ICARE'21 PROCEEDING

International Conference on Advancing and Redesigning Education

2021 International Conference on Advancing and Redesigning Education

Thriving in Times of Global Change

UniKL, Kuala Lumpur, Malaysia, November 22-24, 2021

Editor

Mohd Farid Shamsudin • Veeradasan Perumal
Adzly Anuar • Leow Meng Chew

UniKL UNIVERSITI KUALA LUMPUR · UTP UNIVERSITI TEKNOLOGI PETRONAS · UNIVERSITI TENAGA NASIONAL The Energy University · MMU MULTIMEDIA UNIVERSITY

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UTP Press
Seri Iskandar. 2021

ICARE'21 Proceedings

Published by
UTP Press
Universiti Teknologi PETRONAS,
Owned by Institute of Technology PETRONAS Sdn. Bhd.
32610 Seri Iskandar, Perak Darul Ridzuan, Malaysia

Typeset by
Universiti Teknologi PETRONAS,
Owned by Institute of Technology PETRONAS Sdn. Bhd.
32610 Seri Iskandar, Perak Darul Ridzuan, Malaysia

e ISBN 978-967-2880-05-9

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ICARE'21

International Conference on Advancing and Redesigning Education

The 2021 International Conference on Advancing and Redesigning Education (ICARE'21) is an international conference organised by Malaysian Government Linked Universities (GLU), which consist of Multimedia University (MMU), Universiti Kuala Lumpur (UniKL), Universiti Tenaga Nasional (UNITEN), and Universiti Teknologi PETRONAS (UTP). This conference is virtually hosted by UniKL from 22nd to 24th November 2021.

In response to the ongoing COVID-19 global pandemic, ICARE'21 carries the theme of Thriving in Times of Global Change to address how education and teaching & learning (T&L) activities adapt to these unprecedented and changing times. The objectives of ICARE'21 are,

1. to establish collaboration between GLUs and build relationships between academia and industry,
2. to strengthen research culture among GLU educators and researchers specifically in T&L areas; and,
3. to establish a platform to realign and redesign education to make it accessible and sustainable.

ICARE'21 has four unique tracks that represent niche areas of respective GLUs, namely: skill-based education, soft skills in T&L, industry-driven curriculum, and emerging technologies in the classroom. The variety of tracks and sub-themes offered in ICARE'21 allows educators, researchers, scholars and policymakers to get together and showcase or debate their myriad findings in their respective fields.

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TRACK

SKILL-BASED EDUCATION (UNiKL)

Skill-based education is centered on the development of different skill sets and strengthening the learning process by putting knowledge into practice. While academic-oriented education helps learners to understand theoretical concepts, this educational approach encourages learners to become independent thinkers and workers who can create innovative solutions and products and solve problems creatively. As education evolves to become more global but also more specialised, skill-based learning is becoming increasingly crucial as it develops practical expertise in specific areas and nurtures hands-on learners who are adaptable to changes and challenges in the industry.

INDUSTRY-DRIVEN CURRICULUM (UTP)

The proliferation of industry 4.0, big data, artificial intelligence and machine learning within the higher education sector is evidence of the growing need for our graduates to be skilled in these areas and to be able to function effectively in an increasingly competitive job market. To be at par with key shifts within the industry, industry-academia partnership is therefore crucial. The Industry Driven Curriculum track thus focuses on exploring the myriad of possibilities and advantages that lie in industry-academia collaboration to future proof our graduates, so they remain competitive and industry ready.

SOFT SKILLS IN TEACHING & LEARNING (UNITEN)

Producing individuals who are well-balanced intellectually, spiritually, physically and emotionally has always been the aspiration of every education system. Instead of focusing solely on academic matters, it is also important to integrate character-building elements in the curriculum comprising skills in communication, leadership, teamwork, ethics and spiritual intelligence within the students to enhance their learning experience. This would be one of the crucial elements in producing resilient graduates that would be highly sought after by employers and, at the same time, contributing to the betterment of the society

EMERGING TECHNOLOGIES IN THE CLASSROOM (MMU)

The National Agenda is driving Malaysian educators to create more ICT-based learning environments to engage students' critical and creative thinking processes tasks educators to look at ways to enhance their classroom teaching methodologies with effective pedagogies and innovations. On a global scale, with the onset of Industry 4.0, there is a need for digital education innovations that support flexible education through blended learning approaches, providing students with authentic learning experiences and seamless connections between the physical classroom and the online learning environment, cultivates 21st-century skills, and captures students' academic journeys.

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UniKL UNIVERSITI KUALA LUMPUR

TRACK I

SKILL-BASED EDUCATION

FLIPPED CLASSROOM TECHNIQUE IN IMPROVING STUDENTS' UNDERSTANDING ON ALKYL HALIDE REACTION MECHANISMS

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Introduction

Organic chemistry has historically been considered a difficult subject as organic chemistry, particularly reaction mechanism, has its 'own language'. Students have difficulties with reaction mechanisms whereby they have a limited understanding of curved-arrow formalism and how to draw curved-arrow in writing reaction mechanisms.

Alkyl halides are traditionally the first functional group that is introduced in the Organic Chemistry I course syllabus for the Applied Chemistry degree program in Universiti Teknologi PETRONAS (UTP). An alkyl halide is traditionally the first functional group that is introduced in the Organic Chemistry I course syllabus for the Applied Chemistry degree program in Universiti Teknologi PETRONAS (UTP). Thus, by establishing a good understanding of the concepts of alkyl halide reaction mechanisms, it would be beneficial for the students to understand and write reaction mechanisms of other functional groups in organic chemistry courses. Therefore, the main aim of this study is to increase students' understanding of alkyl halide reactions mechanisms.

In this study, an approach of the flipped classroom has been proposed to increase students' understanding of the reaction mechanisms of alkyl halides. A flipped classroom can be defined as a class content, which traditionally delivered by a lecturer, will be replaced with activities by the students whereby the lecture materials are provided to the students before commencement of the class.

Method

The flipped classrooms comprised of three stages, (a) Pre-Class, (b) In-Class and (c) Post-Class.

a. Pre-Class: The students will be provided with lecture materials (such as slides presentation of lecture notes, assigned readings, and selected videos from YouTube) on reaction mechanisms of alkyl halide. Students are expected to study the lecture materials two weeks before attending the class organic chemistry.
b. In-Class: In this stage, the time allocation will be used to conduct the collaborative activities as follows,
    i. Group activities – Students are divided into groups. Each group comprises 3-4 students. Each member in the group is advised to actively discuss the content provided in a pre-class mode. Students will be assigned problems of pre-class mode to discuss and solve the problems in the group. These activities will be video recorded so that the students can revise the class from the recorded activities.
    ii. Face-to-face (F2F) activities – To solve the problems of pre-class mode, a group will be selected randomly to avoid the delay due to restricted mobility in the classroom. Each member of the group will be asked to report

the answers by writing them on the whiteboard as well as explaining the answers verbally to the class using correct terminology. A video recording will be conducted for each group discussion. Evaluation will be made for each member of the group.

iii. Attendance – Students will be earned participation points by coming to class on time and actively participating in the problem-solving activities.

c. Post-Class: In this stage, the students will be given the questionnaire survey to obtain their feedback on the effectiveness of flipped classrooms. Both students and lecturers will also require writing their reflections on the activity to determine whether the teaching and learning materials and the activities conducted will help and improve students' understanding of the reaction mechanisms of alkyl halide.

Results and Discussion

In this 21st century, the traditional method of delivering a lecture seems to become obsolete as students found many platforms for self-study such as the Internet as a main source of knowledge. As such, in this piece of work, flipped classrooms will be used as an alternative platform to engage students more effectively during the teaching and learning process. It is believed that the flipped classroom will increase students' satisfaction and understanding of reaction mechanisms of alkyl halide as the current generation of students (born after 1980) require learning and engagement to be reactionary and immediate which would be offered by approaches used in a flipped classroom.

In three stages of flipped classroom implementation in this study, the lecture will ensure that activities and discussions will be interactive, and the students will be facilitated by the lecturer to further strengthen students' understanding of the alkyl halide reaction mechanism and to ensure missed concepts are addressed appropriately. Qualitative feedback obtained from student evaluations will be analysed for improvement in terms of developing communication skills and preferences to work in teams for the students. This feedbacks also will be used to increase the effectiveness of lecturer engagement with the students during the learning and teaching process as compared to the traditional method.

Conclusion

We believe, with the implementation of the flipped classroom, the students would practically have more time in the classroom to discuss and engage with the lecturer for a deep understanding of the reaction mechanisms of alkyl halides. By combining collaborative activities and the face-to-face (F2F) approach (during the class) would enhance student learning and finally become independent learners which are one of the main attributes of student graduates nowadays.

Acknowledgement

All authors gratefully acknowledge the financial support by Scholarship of Teaching and Learning (SoTL) Grant (015LF0-044) from Universiti Teknologi PETRONAS.

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TOWARDS GOOD ONLINE LECTURES TO PREVENT CHEATING

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Introduction

Because of COVID-19 pandemic that occurred in 2020, online lectures were adopted at many schools all over the world. A large number of colleges and universities across Malaysia are also transitioning traditional face-to-face classes into fully online courses. Educators usually face some problems with online teaching. One of the serious problems is student academic dishonesty in examinations. King, Guyete, and Piotrowski (2009) defined cheating as "a transgression against academic integrity which entails taking an unfair advantage that results in a misrepresentation of a student's ability and grasp of knowledge". The autonomy of the students and the separation from the teacher in online lectures easily enable students to communicate with their friends, to use a calculator, and search for information via the Internet. In such a situation, it seems that students are more likely to engage in academic dishonesty. It was reported that some students did not consider any actions to be cheating unless the dishonest behaviour in terms of cheating unless they were caught (Reine et al., 2011). In this article, we examine the contents of the paper, James et al. (2013)" together with the author's teaching experience on online lectures.

Method

The author of this article engaged in the Malaysia Japan Higher Education Program (MJHEP for short) from September 2016 to March 2021. MJHEP was a twinning education program between Malaysia and Japan. It consisted of two subprograms. At first, the students studied in Malaysia as a three years diploma program called Diploma in Electrical & Electronic Engineering and Diploma in Mechanical Engineering. After successful completion of this subprogram, students were eligible to continue their studies in selected Japanese universities directly into the third-year bachelor's engineering degree programs.

The author teaches university-level mathematics in Malaysia. The lectures in all years except 2020-2021 were given in face-to-face style. On the other hand, the lectures in 2020-2021 were given as full online lectures. Comparing the results of Examinations, the average in the years 2020-2021 was unnaturally high. There was a suspicion that fraud was committed. The word "e-cheating" was coined by Styron & Styron (2010), It describes dishonest behaviour in an online lecture. We search for solutions for e-cheating with some references.

Results and Discussion

We adopted multiple-choice examinations for the subjects mathematics 3 and 4 in 2020-2021. According to James, et al. (2013), such kinds of examinations provide more opportunities for students to be academically dishonest. It is doubtful whether this type of exam was able to properly measure the student's ability. First of all, in online math lectures, it is better not to create multiple-choice examinations. In the same paper, the following possible e-cheating methods were listed.

1. Waiting for answer
2. Fraudulent error Message
3. Collusion
4. Essay Plagiarism
5. Purchase answers

It seems that the third method matches our case. As counter measures for them, the following are listed in the same paper.

1. Policy dissemination
2. Strict Test Taking Time-Line
3. Cheating Trap
4. Surveillance
5. Class Mole
6. Randomised Exam Questions and responses
7. Statistical Analysis to Detect Common Errors
8. Proctoring

The first countermeasure "Policy dissemination" is a basic method, but I think it's effective. If possible, Surveillance also looks effective. Because we were unable to monitor students during the examinations. But it may be difficult to require a student to purchase a webcam.

Conclusion

In the present article, we discussed possible countermeasures to prevent e-cheating methods. From a new semester, I would like to practice the methods examined this time. However, new techniques must be developed in an attempt to mitigate dishonest behaviour. Teachers must anticipate cheating in advance and prevent it. That is an important teacher's duty.

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PROSPECT, ISSUES, AND CHALLENGES IN MALAYSIA TVET-BASED EDUCATION

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Introduction

Human capital development is critical for Malaysia to maintain a dynamic and globally competitive labor force (Omar et al., 2020). Because educated human resources are at the heart of innovation and high productivity, investing in their growth should be a country's most significant investment (Yaakob et al., 2020). No economy can succeed without highly qualified workforces capable of reacting creatively to unexpected economic developments (Hamid et al., 2016). In the future, emerging technologies and globalisation will impact the worldwide demand for skills and expertise. Malaysia must have a workforce capable of adapting to the changing needs of technology improvements in the knowledge-based economy if it wishes to compete globally (Yusoff, Harun, & Zakaria, 2020). Indeed, human resource development aims to educate and train the labor force to tackle the demands of a knowledge-driven economy to boost the country's efficiency and performance (Okoye & Arimonu, 2013).

By 2020, the Prime Minister's 11th Malaysia Plan anticipates that 1.3 million extra jobs in Malaysia need TVET-related skills (Nik Mood, 2019). As a result, TVET will appear to be the most critical channel for developing Malaysia's skilled labor force. Malaysia's Ministry of Higher Education established the Malaysian Education Blueprint 2015-2025 (Higher Education) to equip young Malaysians to seize new opportunities created by the 11MP (Hassan, Shamsudin, & Mustapha, 2019). One of the blueprint's primary goals for TVET is to be on equal footing with traditional academic pathways. Young individuals must recognise the value of TVET and enroll in TVET programs in tertiary education (Nooruddin, 2017).

Under UNESCO, technical and vocational education and training (TVET) encompasses all facets of the educational system, including the study of technology and allied fields and vocation insight and understanding in different economic and social sectors (Hollander & Mar, 2009). Workforce Education (WE), Workplace Education (WE), Professional and Vocational Education (PVE), Vocational Education and Training (VET), Career and Technical Education (CTE), Technical-Vocational Education (TVE), Occupational Education (OE), Technical Education and Apprenticeship Training are just a few of the terms used in some countries to describe TVET. Regardless of the terminology, it ultimately signifies the same thing.

In recent decades, the term "vocational education" refers to educational programs that focus on specific job-related skills. There is a perception that only lower-level skills, rather than intellectual skills, are required, which can be taught more effectively through concentrated training instead of more widespread participation in education (Moodie, 2002). However, TVET's focus has developed due to the recent advances in employment and the labor market. TVET is not limited to preparing workers for low-wage jobs; it is now widely recognised as a critical component of long-term development. Indeed, TVET fosters human capital development in preparation for industrialisation. A country can develop the high-skilled workers necessary to drive economic growth through programs like TVET.

Figure 1 shows Malaysia's TVET education system across different ministries and agencies from primary school to postgraduate levels. This includes the Ministry of Education (MOE), which has the highest enrollment in formal TVET programs. In Malaysia, the Ministry of Education is the central government authority for technical and vocational education and training, even though several ministries are responsible for it. The TVET policies over the four universities in the Malaysian Technical University Network (MTUN), 102 community colleges, 81 vocational colleges, and 36 polytechnics are directed and coordinated by the Ministry of Education (MOE) Malaysia.

Apart from TVET's programs and curricula in colleges and universities, the MOE also oversees formal TVET programs in high schools. The Ministry of Rural Development provides TVET programs through Kolej Kemahiran Tinggi MARA (KKTM), MARA Japan Industrial Institute (MJII), Institute Kemahiran MARA (IKM), GIATMARA, and German-Malaysian Institute (GMI) by conducting certificates and diploma level programs. Additionally, the Ministry of Human Resources, the Ministry of Youth and Sports, the Ministry of Higher Education, the Ministry of Agriculture, and the Ministry of Defence are all responsible for administering TVET in Malaysia.

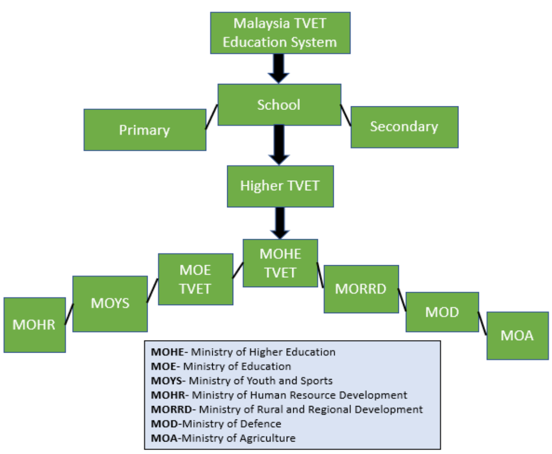

Figure 1 Malaysia TVET education system

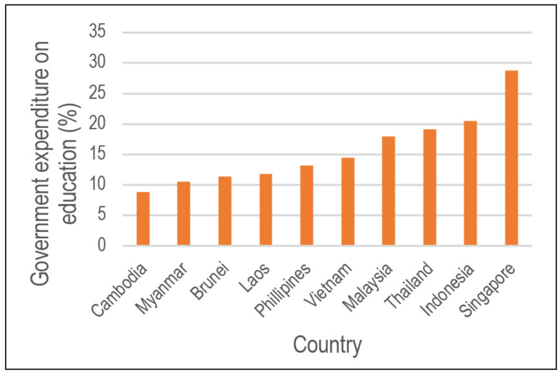

Figure 2 ASEAN Government expenditure on education for the year 2019. Data were taken from UNESCO-UNEVOC International Centre (UNEVOC, 2019)

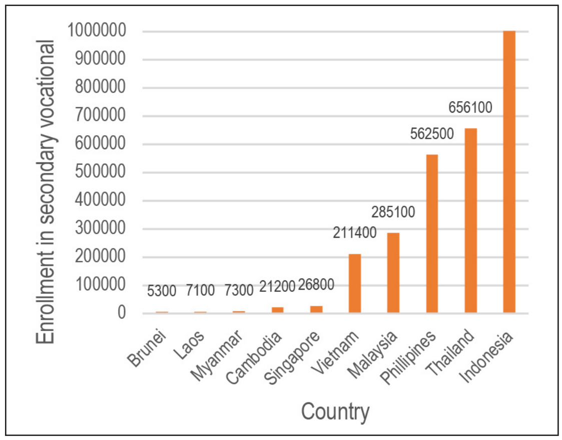

Figure 3 Enrollment in secondary vocational for the year 2019. Data were taken from UNESCO-UNEVOC International Centre (UNEVOC, 2019)

Figure 2 below shows government expenditure on education for 2019. It can be observed that Cambodia recorded the lowest expenditure with just 8.8%. Singapore, on the other hand, spent 28.8% of its budget on education. They spent $12.8 billion in 2019 on their education system because their economy relies on a skilled and educated workforce. Singapore's educational system emphasises STEM disciplines, and its students consistently perform well in PISA science and mathematics assessments.

Figure 3 shows secondary vocational enrollment for 2019. Brunei recorded the lowest enrollment with only 5,300 students. It is expected as the population is 433,300, and the population aged between 15-24 years is 15.8%. Indonesia's secondary vocational school enrollment is 49 million. Indonesia has stated that it wants to add another 200 vocational training centers to the current 500 to be in place by 2024. Only 20% of the higher education facilities are accounted for in this figure. Setting up a vocational training center is expensive, and on the low end, this goal will be challenging to meet. Despite these challenges, Indonesia offers opportunities for TVET programs like curriculum design, institutional refurbishment, and train-the-trainer programs. Malaysia was ranked 4th, where the TVET enrollment of students was 285,100 in 2019.

Prospect of TVET-Based Education

The employment of technology is unavoidable to cope with the country's rapid shift in industrial orientation from labor-intensive to capital-intensive. As a result, the operation will require more experienced, scientifically trained, and technically knowledgeable personnel. Meanwhile, since 2013, TVET has fully realised the transformation of vocational education, making it no longer deemed inferior. Rather than that, it is now widely recognised as a viable educational option and has increased admissions year after year. As part of the 11th Malaysian Plan (RMK-11), which aims to ensure Malaysia's ability to become a wealthy nation, the government continues to pay close attention to TVET. The Malaysian Education Plan 2015-2025 (higher education) also supports this agenda, emphasising the creation of TVET to create long-term industrial employment and increase the country's economy.

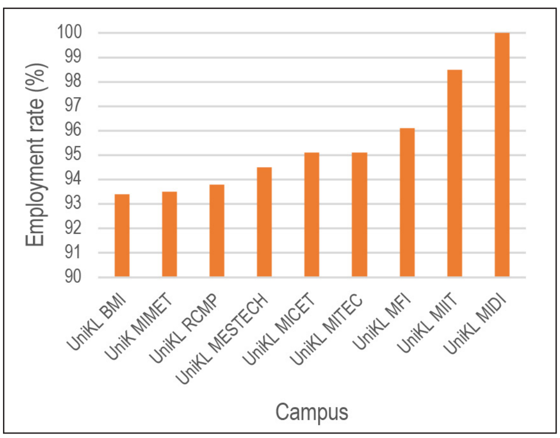

Figure 4 The employment rate of Universiti Kuala Lumpur TVET graduates (UNEVOC, 2019)

Figure 4 shows the employment rate of TVET graduates for Universiti Kuala Lumpur in 2019 for nine campuses. UniKL MIDI recorded a 100% employment rate, followed by UniKL MIIT with an employment rate of 98.5%. However, in the TVET sector, the employment rate of graduates from community colleges and polytechnics has remained consistently high, at 98% each year. The graduates have become the choice of employers and industries. They have the potential to further their studies at a higher level and be accepted into universities. Most TVET colleges offer practical-oriented technical courses, which are incredibly important in any country's industrial and economic growth. Aside from that, many TVET graduates establish their businesses, utilising the entrepreneurial skills they acquired in technical training institutions.

Issues and Challenges

TVET instructors must be proficient in all areas of expertise since they are responsible for developing not only their pedagogical knowledge and skills, but also their professionalism, attitudes, and personalities. Thereby, the components of their competency align with student achievement or competence (Arifin et al., 2017). Inevitably, instructors who teach technical subjects are crucial to ensuring the TVET system's continued relevance in the educational paradigm. If TVET is maintained, instructors will improve the country's ability to impart technical and vocational knowledge to future generations. Before being conveyed to students, the pragmatic approach of TVET education is influenced by the experience of instructors. The majority of TVET instructors have extensive industry experience and have developed valuable assets to the TVET system.

Besides, TVET instructors strive to improve academic achievements to contribute to the nation's outstanding human capital. However, the glaring problem of teacher dropouts is apparent in various nations, and the findings indicate that instructors who leave the teaching profession exhibit a variety of predictable reasons. In particular, academia is currently conducting extensive research on instructor retention and satisfaction to improve instructors' quality in schools. Undoubtedly, ensuring the efficacy of learning and teaching, including academic achievement and student's academic success, pushes instructors to adhere to high standards and confront accountability issues. In this respect, instructors are burdened with a slew of administrative responsibilities that obstruct their ability to do their job, which is to teach. Hence, many educators have changed careers or, in the worst-case scenario, have chosen to leave the workforce completely due to the stress of excessive tasks and workloads (Omar et al., 2019).

Furthermore, Mertler (Mertler, 2016) also highlighted the school's contentious climate by referencing certain external variables like a less appealing remuneration package of the teaching plan and the teaching incentive provided. Surprisingly, the influence of socioeconomic class and instructors' localities are among the various factors for attrition. According to Gomba (Gomba, 2015), five elements encourage instructors to continue teaching: employment security, the necessity to support their families, support from peers and management, principals' self-sacrifice leadership, and unsaleable. The outcomes of this study indicate that instructors are subjected to extreme stress because of financial gain and internally or externally motivations. As a result, this worrisome issue prevents educators from reaching their full potential as educators.

On top of that, workplace environments significantly impact job satisfaction (Omar et al, 2018). Employees will be satisfied if their workstation is well-equipped with the necessary equipment and tools and acceptable quality, noise, humidity, and temperature. Inevitably, a hostile work atmosphere is a significant contributor to low productivity. Employees will require enough equipment, space, warmth, lighting, and ventilation to deal with this situation, as each of these aspects could affect the workplace environment. Restrooms and lockers should be maintained clean, secure, and functional. Even when their staff underperforms, managers must trust and comfort them. In this situation, managers must devise a strategy to aid employees in regaining their composure and achieving future success.

According to the researchers, administrators should motivate educators to participate in career development events to foster a sociocultural learning context. Action research is a critical component of educators' professional growth during their tenure. It enables educators to examine and analyse their teaching techniques and make connections between theory, observation, classroom practice, and ponder their efforts. In addition to this, administrator support and time are critical elements in improving teachers' career growth and performance (Arifin et al., 2017).

Technical and vocational education and training (TVET) graduates should not be underestimated as they will play an essential role in the country's future. Technical skills are valuable assets to have and should not be considered inappropriate compared to more academic qualifications. For instance, Germany is a country where vocational workers are seen as peers. They recognised that an engineer with a university degree could not perform the role of a highly-skilled worker.

Many countries, both developed and developing economies, have an unfavorable perception of TVET education. As a result of this negative reputation, youth and parents consider TVET a viable educational option, considering enrollment to be a last resort at best. Furthermore, a negative reputation might result in less government, industry, and enterprise funding and support for TVET. It is also said to be unappealing to young folks due to its bad reputation. However, the benefits and values of TVET are often misaligned with the decision-making process.

Vocational technical education has had a tremendous impact on society, notably on graduates who contribute to the country's economic development and growth through various industrial facilities. Inadequate funding of vocational institutions has resulted in underqualified graduates due to no funds to sustain workshops, labs, or even get modern equipment (Okoli et al., 2016). In some nations, staffing levels in vocational-technical education are often insufficient due to low remuneration; thus, experienced and skilled instructors may not be hired (Ismail & Hassan, 2013). Instructors who are underpaid quit the field to pursue more lucrative opportunities, particularly in the industry and abroad. As a result, untrained and less qualified technical instructors are hired, decreasing academic standards and resulting in educational waste. Inadequate funding of Vocational-Technical Institutions has historically hampered worker pay.

Additionally, it has led to the diminution of instructors or the early retirement of instructors. Academic staff training is a never-ending process for continuous quality improvement. Training might be less expensive, but it may also be more difficult due to inadequate writing, facilities, and distractions from meeting demand (Tran & Nyland, 2013). Overseas training costs a lot of money, but the conditions are in place to achieve achievement in a short amount of time.

The OBE system is employed in Vocational Colleges to ensure that any program conducted to fulfill the stated requirements is recognised by the Malaysian Qualifications Agency (MQA) (Damit, Omar & Puad, 2021). The execution of outcome-based education (OBE) in vocational colleges appears to require that all programs meet the set learning outcomes. By and large, instructors who do not comprehend the Course Learning Outcome (CLO) and its relation to the Learning Outcome Program (PLO) continue to have low OBE practices. The assessment method relies on coursework and student grade performance instead of the course's CLO.

The level of knowledge and comprehension among program leaders and instructors regarding the OBE-based curriculum is moderate and needs self-improvement. The process of Continuous Quality Improvement (CQI) is still in its infancy. At the moment, no mechanism exists to facilitate CQI assessment. It simply proves that the OBE system's implementation in vocational colleges is still incomplete Nasir eta al., 2020). This is due to the challenges associated with implementing the OBE approach, which includes curriculum changes as well as comprehensive changes to the work system. There are also difficulties in implementing OBEs in the educational system. The issue arises when the implementers are instructors who are unfamiliar with the OBE system. Furthermore, some senior instructors are opposed to changes in how OBE is implemented in the educational system.

Institutional administrators are responsible for ensuring efficiency and effectiveness within and outside the institution, not just in the procurement or acquisition of resources, but also in their control, maintenance, organisation, and coordination (Nik Mood, 2019; Omar et al., 2018). The school head's primary responsibilities include policy interpretation, curriculum implementation, students' welfare, equipment and facility maintenance, staff recruitment and training, and fostering an effective school-community relationship. When a given level of resources is used efficiently, more services are provided through balanced usage and proper maintenance of the existing facilities instead of when inefficiency, on-utilisation, under usage, and overuse are prevalent.

Last but not least, it is well accepted that politics and education are inextricably linked and have a very close relationship (Tompkins-Stange, 2020). Political leaders who give adequate attention to their countries' educational systems have brought transformation, modernisation and have cushioned unemployment and all kinds of vices that bedevil societies where leaders neglect education. A political leader's primary responsibility is to create and sustain the necessary conditions that allow the educational system to function (Hüther & Krücken, 2018). It is unsurprising that in a country as diverse as Malaysia, education policy frequently intersects with nationality, religious belief, and linguistic politics (Sirat, 2010). The nature of these contacts has changed over the years as governments, citizens, and legislators have grappled with the difficulties of globalisation, economic growth, and changing labor market needs.

Recommendation

The first suggestion is to improve the TVET image by raising community awareness of TVET education value. As a result of this perception, TVET competes with pathways to university education as soon as it is implemented in upper secondary school. However, as a post-secondary educational provision, it competes unequally with higher education. Next, policies and practices can also contribute to the enhancement of the image of TVET education. International organisations such as UNESCO, as well as national governments, businesses, local interest groups or societies, and educational systems, enacted policies and procedures to improve TVET's image, as evidenced by the views expressed in previous posts. At the same time, there are common issues associated with the concept of TVET. There are differences in institutional practices (i.e., the application of TVET), TVET provision (i.e., scope, level, and quality), and societal sentiments (i.e., parental or youth aspirations), which have resulted in distinct viewpoints of TVET. The following question prompts suggestions for what stakeholders could do to improve this image. Then, the teacher must have sufficient knowledge and skills to deliver a quality curriculum. They also must review previous lessons with absent students and complete the syllabus on time.

Conclusions

In Malaysia, TVET education encounters difficulties that affect its long-term viability and future direction. Therefore, future and current challenges must be adequately addressed. Besides that, given the global rate of technological advancement, the trajectory of TVET is far from straight and smooth. At this point, a large number of recommendations are being proposed. On the plus side, TVET has aided developing countries in being among the leading skilled and semi-skilled labor producers. It is essential to maintain and improve the curriculum and teaching methods. The public's perception of TVET will improve as students' interest in TVET gets bigger. Impressive developments in the workplace should be continuously integrated into the TVET curriculum to achieve additional skill acquisition and efficient job performance. Additionally, professional and social learning can be integrated into the school-based curriculum through training and traineeship. A TVET students' career counseling program also suggested that the entrepreneurial mindset should be emphasised.

Acknowledgement

The authors would like to thank the Centre of Research and Innovation (CoRI) Universiti Kuala Lumpur for the research cluster grant awarded to CSC UniKL MIDI.

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MEASURING THE QUALITY OF THE OSCE IN THE PART 2 CONJOINT MAFP/FRACGP EXAMINATION (A MALAYSIAN POSTGRADUATE FAMILY MEDICINE EXAMINATION) USING THE BORDERLINE GROUP VERSUS THE BORDERLINE REGRESSION METHODS

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Introduction

The Conjoint MAFP/FRACGP (Member of the Academy of Family Physicians of Malaysia / Fellow of the Royal Australian College of General Practitioners) examinations is a high-stakes postgraduate Family Medicine examination in Malaysia. Successful graduates are eligible for registration in the Malaysian National Specialist Register as Family Medicine specialists after undergoing a credentialing period.

The Conjoint MAFP/FRACGP examinations are in two parts: Part 1 is the written component and Part 2 is in the form of an Objective Structured Clinical Examination (OSCE) consisting of 15 stations. Standard-setting was introduced into Part 1 in 2013 and Part 2 in 2015. For Part 2, the borderline group method (BGM) was used. In BGM, examiners assessed the candidates using a key features checklist in the OSCE station and also gave their global impression of the candidate's performance. The rating form had six options for global assessment, ranging from serious deficiency, competence not demonstrated, competence unclear, minimally competent, clearly competent, and highly competent. In BGM all the scores of candidates who were marked as minimally competent (borderline pass) in the global assessment section were compiled and the average mark was taken as the cut score or pass mark for the station. The sum of all the borderline marks for all the stations became the passing mark for the OSCE.

In BGM, the cut scores were easy to compute but were dependent on examiners marking the candidate as borderline (minimally competent). The number of candidates taking the annual Part 2 Conjoint MAFP/FRACGP examinations was usually small (less than 100). In some stations, only a few candidates were marked as borderline. There was one year when only two candidates were marked as borderline in one station. The concern was if no candidates were marked as borderline in a station, then BGM could not be used. In that instance, there would be a need to use another method, the modified Angoff method to standard set and get the cut score or pass mark. It was also noted that some OSCE metrics to measure its quality could only be done using the borderline regression method (BRM) and not BGM as mentioned in the AMEE guide no 49 on "How to measure the quality of the OSCE: A review of metrics" (Reference 1)

As such a study was done in July-August 2020 to compare using BGM and BRM in measuring the quality of the OSCE in the 2018 and 2019 Part 2 Conjoint MAFP/FRACGP examinations. The specific objectives were i) to obtain and compare the cut scores using BGM versus BRM in the 2018 and 2019 Part 2 Conjoint MAFP/FRACGP examinations to see if there was any significant difference between the cut scores obtained by the two methods ii) to measure the quality of OSCE comparing quality assurance metrics derived from BGM and BRM as recommended by AMEE guide no 49 (Reference 1).

Methods

Approval to conduct the study was obtained from the Board of Senior Examiners, Academy of Family Physicians of Malaysia (AFPM). As the standard setting for the 2018 and 2019 Part 2 Conjoint MAFP/FRACGP examinations were conducted using BGM, the cut scores obtained from BGM were available. All the 2018 and 2019 Part 2 examination marks obtained by candidates in each OSCE station and their global assessment grades were compiled and entered into SPSS version 23. To calculate the cut scores using BRM, linear regression graphs were plotted using candidates' total marks against their global assessment grade in each station. The station cut score was calculated from the formula generated. The BGM and BRM cut scores were then compared to see if there were any significant differences (p value<0.5).

Following the AMEE guide, several OSCE quality assurance metrics were calculated including Cronbach's alpha, R2 coefficient, intergrade discrimination, number of failures, and between-group variation percentage, for each OSCE station. The results were analysed to see if they were in the acceptable range.

Results and Discussion

There was no significant difference between the cut scores obtained for each station using both methods for both the 2018 and 2019 examinations. Cronbach's alpha measuring internal consistency was acceptable: 0.768 (2018), and 0.910 (2019); R2 coefficient (squared linear correlation between the global rating score and checklist score) showed good correlation (>0.5). Intergrade discrimination (measuring the average increase in scores of the checklist for each grade increase on the global rating) showed adequate discrimination in 11 out of 15 stations in 2018 and all 15 stations in 2019 examinations. Between-group variation percentages were acceptable (<30% in 2018 and in 13 stations in 2019). Two 2019 stations had group variation percentages of 30.8% and 33.6%. (unacceptable range was >40%). In 2018, six stations and in 2019, four stations had >50% failures respectively.

Conclusion

There was no significant difference between the cut scores obtained by BGM and BRM. Although BRM required more work to compute, it had the advantage of producing more quality assurance metrics in measuring the quality of the OSCE. BRM had the additional advantage of calculating cut scores even if there were no candidates assessed as borderline in a particular station and therefore suitable for small-scale OSCEs with fewer candidates. As such AFPM decided to switch to using BRM in the standard-setting for its Part 2 Conjoint MAFP/FRACGP examination from the year 2020.

Acknowledgement

The authors would like to thank the Academy of Family Physicians of Malaysia for permission/support in doing this study and to publish it.

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HEAT TRANSFER SIMULATION PROJECT: CLASS ASSIGNMENT AS AN ALTERNATIVE TO PHYSICAL PRACTICAL LAB

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Introduction

As a technical institution of higher learning, Universiti Kuala Lumpur aimed at producing technical graduates who are equipped with the required knowledge and technical skills to serve the industry. With the advent of the industrial revolution (IR 4.0), the technical curriculum and classes' syllabus must be amended to expose and create awareness of the students on IR 4.0 [1], [2]

SCB 47703 Heat Exchanger Design, an elective course for the degree students of Mechanical Engineering Technologist, Manufacturing Engineering Technologist as well as Mechanical Design Technologist, consists of two-hour per week practical sessions for 8 academic weeks. Due to the COVID-19 pandemic and the Malaysian's government Movement Control Order [3]-[5] the operation of the institute of higher learning has been confined to digital learning with limited or restricted practical sessions allowed. Along with the uncertain and sudden changes in movement control, the practical lab sessions for the course have been reduced to two weeks.

To expose the students to the technical skills required in heat transfer analysis and to incorporate the IR4.0 element in the course, classroom assignments on heat transfer simulation were designed, developed, and implemented. The assignments would be guided and conducted via an online teaching platform (Microsoft TEAMS in UniKL). This paper describes the simulation assignments and their implementation.

Methodology

The classroom assignments were designed such that they should satisfy the prescribed course learning outcomes. At the end of the completion of the assignments, the students should be able to:

1. Analyse heat transfer by conduction, convection, and radiation
2. Design the heat exchanger system for an automotive application.

The Assignments

There were two simulation assignments to be completed by the students using SOLIDWORKS software that is readily available on the campus and can be accessed out-of-campus by the Team Viewer program. The assignments are discussed in the next section. The students were given one month to complete each of the assignments.

The students worked in a group of 4 and each group was assigned different study objectives from the same assignment. This is to ensure the originality of their work.

The Delivery of Instructions

The instructions, the expected deliverables, and the assessment rubrics were distributed to the students via UniKL virtual learning environment, Moodle.

The Guide

All of the students are very well-versed in designing components and parts in CAD software, either SOLIDWORKS or CATIA. However, they have no exposure or knowledge in heat transfer simulation and analysis using SOLIDWORKS. Therefore, video tutorials were prepared by the author to guide the students in using SOLIDWORKS for their assignments. The videos were recorded using OBS Studio and edited using FILMORA. A total of 4 videos were prepared for the assignments (Table 1). The videos were then shared with the students and any queries or clarifications required were addressed in consultation sessions.

Table 1 Videos to guide the students

	Content
Video 1	Creating the simulation model for Assignment 1
Video 2	Creating the simulation model for Assignment 2
Video 3	Steady-state Thermal Analysis using SOLIDWORKS (Assignment 1)
Video 4	Steady-state Flow Simulation using SOLIDWORKS (Assignment 2)

Consultation Sessions

These sessions were being held during the lecture slots as well as when it is required by the students. During this session, the students require further clarification on the problems, troubleshooting errors that they had encountered while using SOLIDWORKS, confirmation on their designs as well as checking their preliminary results.

Deliverables

At the end of the assignment, the students were required to submit technical reports and engineering drawings to the author. The technical report must contain an executive summary, introduction, methodology or approaches taken, results, discussion, and conclusion. The engineering drawings must illustrate the design with complete dimension and title.

Assignment 1: Steady-State Thermal Analysis of Engine Cylinder Block

In this assignment, the students were required to conduct parametric studies on the design of fins for a motorcycle engine cylinder (see Figure 1) using SOLIDWORKS. The material for the engine cylinder block is aluminium alloy TS-6061 with an inner surface average temperature of 500 K. Under typical operating conditions, the outer surface of the cylinder is exposed to ambient air at 300 K with a convection coefficient of 50 W/m²°C. Different groups were assigned to different study objectives, as shown in Table 2.

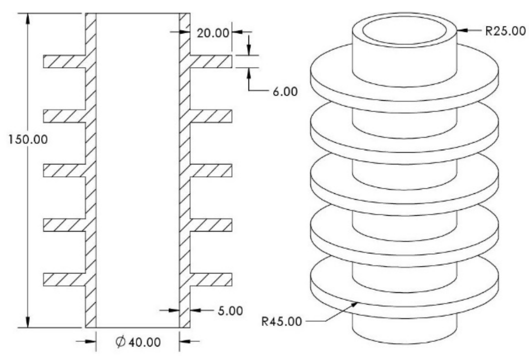

Figure 1 Engine cylinder block with annular fins

Table 2 Different study objectives in Assignment 1

Study	Objective
A	To determine the effect of using different materials for engine cylinder and fins
B	To determine the effect of the number of fins
C	To determine the effect of fin thickness
D	To determine the effect of different fin shapes
E	To determine the effect of fin length
F	To determine the effect of convection coefficient of h
G	To determine the effect of different operating temperature

Assignment 2: Steady-State Flow Simulation for an Automotive Radiator

In this assignment, each group is required to design fins of different shapes for the automotive radiator and to conduct heat transfer analysis for the radiator. They were also required to benchmark their design with an automotive radiator without any fins, to demonstrate the heat transfer enhancement caused by the fins. The effect of the coolant's flow rate and the external heat transfer convection coefficient were also investigated. Each group was assigned to different shapes of fins, as indicated in Table 3.

Table 3 Different fin shapes for Assignment 2

Study	Fin Design
A	Rectangular
B	Triangular
C	Wavy
D	Offset strip fin
E	Perforated triangular
F	Louvered triangular
G	Perforated rectangular

Results & Discussion

Assignment 1

The students were able to complete the assignments and achieve the study objectives within the deadline. The simulation result in the form of a temperature contour plot for the base case is shown in Figure 2.

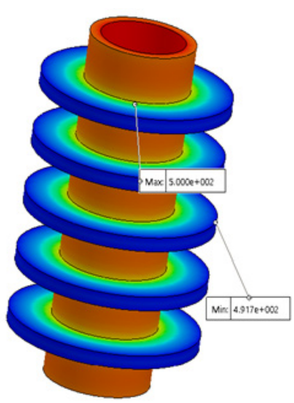

Figure 2 Temperature contour plot for the base case of Assignment 1

Assignment 2

The majority of the students in this course are pursuing their Final Year Project 2 and their time is very constrained. Hence the deadline for this assignment has been extended by two weeks. Consultation hours were also greater for this assignment compared to Assignment 1.

The temperature contour plot for study A of Assignment 2 is shown in Figure 3. Based on the technical reports submitted by the students, it is demonstrated that the students were able to complete the simulation assignment and have learned the required technical skill in using SOLIDWORK to conduct heat transfer analysis.

Conclusion

This paper discussed the preparation and the implementation of simulation assignments to teach degree students technical skills as an alternative to physical practical lab sessions due to the COVID-19 pandemic and the restriction of face-to-face learning. The students, working in a group of four, were assigned to conduct heat transfer simulations to solve specific problems and to achieve different objectives. It has been shown that the students were able to complete the assignments and learn the technical skill of heat transfer simulation via an online learning platform.

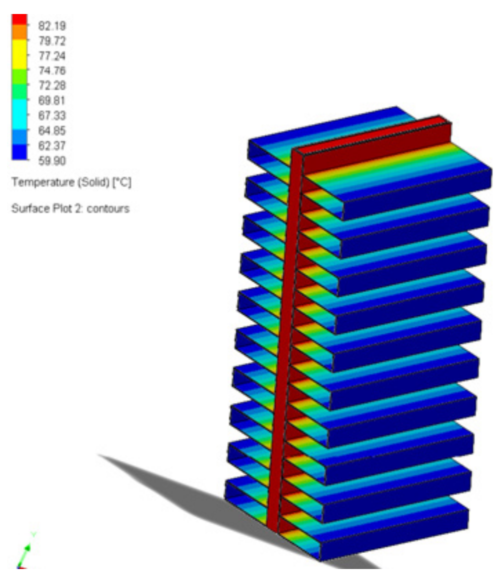

Figure 3 Temperature contour plot for study A of Assignment 2

Acknowledgement

The author would like to acknowledge the support of UniKL MSI in facilitating the teaching and learning process of the course SCB 47703 Heat Exchanger Design.

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TEACHING COMMUNICATION SKILLS THROUGH AN ONLINE PLATFORM

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Introduction

Communication skill is one of the most important skills in medical education. It has always been taught face-to-face as that is deemed the most effective method. However with the implementation of physical distancing to reduce disease transmission, online delivery has become an essential alternative teaching method.

This paper will describe the implementation of an innovative solution to teach communication skills in particular talking to real patients through a video conferencing platform. It will explore the barriers as well as suggestions to improve such sessions which will revolutionise training of medical students to keep up with the future trend of medical practice.

Methods

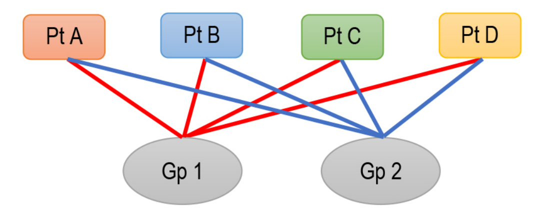
Communication skills teaching is incorporated throughout the five years medical curriculum in UniKL RCMP. Students in year three have to practice talking to patients in person, under the guidance of a tutor in a controlled environment. However, with the implementation of movement control order and physical distancing, patients and students were unable to be present in the classroom for the scheduled face-to-face patient interview session.

Thus an innovative solution was introduced to allow students to practice talking to patients through the video conferencing feature in Microsoft Teams, an application that all UniKL students and tutors have access to. Other video conferencing platforms that were more suitable for virtual patient interviews were considered but the patients enlisted had difficulty using those platforms because of a lack of experience, skills, digital devices, and poor Internet connection.

Only patients staying nearby the college (less than 10 km) and have consented were briefed and enlisted to participate. Four patients per session were scheduled to be present at the college's computer room equipped with high-speed Internet, desktop with webcam cum earphone, and assisted by a technical team. Each patient was assigned to a specific desktop that was connected to a specific channel in Microsoft Teams. Patients have seated far apart (at least 2 metres) from each other to avoid voice interference during the interview session with the students.

Both students and tutors were also briefed and trained to use Microsoft Teams before the sessions. They were connected using their own devices within the comforts of their home. Students were divided into 2 groups of 4 people per session. A tutor was assigned to each group to guide them through the key steps and provide feedback to improve the students' performance. Two students with the tutor would leave the group to join the selected patient's channel – one student to perform and one student to observe the interview. After the interview is over, the students and tutor would leave the patient's channel to rejoin the rest of the group for feedback and discussion.

Students would take turns to join another patient's channel to interview until all have completed the session as illustrated in Figure 1. Students from both groups were scheduled according to Table 1.



Pt = Patient, Gp = Students' group

Figure 1 Layout of channels in Microsoft Teams

Table 1 Rotation of students

Group 1		Group 2
1st Student	Patient A	3rd Student
2nd Student	Patient B	4th Student
3rd Student	Patient C	1st Student
4th Student	Patient D	2nd Student

A follow-up survey was conducted after the session (communication skills – one-to-one interview) to evaluate the students' experience. Comparisons were drawn to the earlier patient interview sessions (communication skills – talking to the patient) that were conducted face-to-face, before the movement control order in seven domains, namely: i. overall experience, ii. demonstrating listening skills, iii. demonstrating non-verbal communication skills, iv. demonstrating verbal communication skills, v. showing empathy towards the patient, vi. responding to patient's cue and following patient's agenda, vii. building rapport with patients.

Scores were assigned to the responses of the Likert scale survey questions, ranging from 1(very dissatisfied) – 4 (very satisfied) and 1(very challenging) – 5 (very easy).

Data analysis was conducted using IBM SPSS Statistics Subscription Version 2020. Paired sample t-test was used to compare the means for each domain. P < 0.05 was set as the level of significance.

Results and Discussion

A total of 94 out of 144 (65%) third-year medical students who underwent both the earlier face-to-face patient interview session and the later online patient interview session, responded to the survey.

Overall, more than 90% of the students were satisfied or very satisfied with their experience of both sessions with no significant difference, P= 0.345 (Table 2). However, the students found the online session was significantly more challenging than the face-to-face sessions in the other six domains surveyed, with P values ranging from <0.001 to 0.035. This was expected as the students, tutors, and patients involved had very little prior experience or training in online communication skills sessions.

Table 2 Comparison of students' experience during face-to-face and online patient interview sessions

Domain	Face-to-face		Online		P
	n (%)	Mean score (SD)	n (%)	Mean score (SD)	
Overall experience Very dissatisfied Dissatisfied Satisfied Very satisfied	2 (2.1) 2 (2.1) 65 (69.1) 25 (26.6)	3.20 (0.58)	0 6 (6.4) 69 (73.4) 19 (20.2)	3.14 (0.50)	0.345
Demonstrating listening skills Very challenging Challenging Average Easy Very easy	2 (2.1) 9 (9.6) 40 (42.6) 32 (34.0) 11 (11.7)	3.44 (0.90)	3 (3.2) 20 (21.3) 37 (39.4) 28 (29.8) 6 (6.4)	3.15 (0.94)	0.002
Demonstrating non-verbal CS skills Very challenging Challenging Average Easy Very easy	3 (3.2) 13 (13.8) 27 (28.7) 38 (40.4) 13 (13.8)	3.48 (0.90)	9 (9.6) 31 (33.0) 37 (39.4) 13 (13.8) 4 (4.3)	2.70 (0.97)	< 0.001
Demonstrating verbal CS skills Very challenging Challenging Average Easy Very easy	3 (3.2) 12 (12.8) 38 (40.4) 37 (39.4) 4 (4.3)	3.29 (0.86)	7 (7.4) 16 (17.0) 42 (44.7) 26 (27.7) 3 (3.2)	3.02 (0.94)	0.003

cont... **Table 2**

Domain	Face-to-face		Online		P
	n (%)	Mean score (SD)	n (%)	Mean score (SD)	
Showing empathy towards the patient					
Very challenging	15 (16.0)	2.81	13 (13.8)	2.57	0.002
Challenging	25 (16.6)	(1.18)	34 (36.2)	(0.98)	
Average	23 (24.5)		27 (28.7)		
Easy	25 (26.6)		20 (21.3)		
Very easy	6 (6.4)		0		
Responding to patient's cues & following patient's agenda					
Very challenging	5 (5.3)	3.06	7 (7.4)	2.89	0.035
Challenging	21 (22.3)	(0.96)	21 (22.3)	(0.90)	
Average	35 (37.2)		42 (44.7)		
Easy	29 (30.9)		23 (24.5)		
Very easy	4 (4.3)		1 (1.1)		
Building rapport with patients					
Very challenging					
Challenging	7 (7.4)	3.06	7 (7.4)	2.90	0.006
Average	19 (20.2)	(1.00)	31 (33.0)	(0.90)	
Easy	33 (35.1)		31 (33.0)		
Very easy	31 (33.0)		23 (24.5)		
	4 (4,3)		2 (2.1)		

In particular, the mean scores were below the average mark of three for the online session in four domains i.e. in demonstrating non-verbal communication skills, showing empathy, responding to patients, and building rapport. Students found it more difficult to express non-verbal communication online (P= < 0.001). This could be due to inferior visual resolution and only the face of the patient or student could be visualised, as the choice of camera and the bandwidth used would significantly affect the accuracy in identification facial expressions.[1] Other factor such as the hands, body posture, eye contact which are important components of non-verbal communication could not be effectively demonstrated during the online session. As the students and patients would be looking at the computer screen instead of the webcam that is placed at a different position, the typical eye contact could be difficult to determine.

Showing empathy is another challenge in a virtual patent encounter, as face-to-face teaching sessions were shown to be superior to online modules in the expression of verbal empathy[2] Thus, online communications demands extra focus to express concern and empathy effectively[3] Challenges mentioned above will affect rapport building and may lead to a poorer ability to respond to the patient's agenda.

Internet stability, English proficiency, and level of IT skills did not significantly affect the domains surveyed.

After experiencing both modes of training, slightly more than half (55.3%) of the students preferred face-to-face patient interviews (Table 3). Only two (2.1%) chose online sessions while 42.6 % thought both modes of training are fine. Among the students who preferred face-to-face sessions, 63.5% found it easier to communicate with patients face to face. They also thought that face-to-face sessions were more personal and realistic (15.4%), more effective, and had no technical or Internet problems.

Table 3 Students' preferred mode of patient interviews

Students' preferred mode of patient interviews	Number (n)	Percentage (%)
Face-to-face	52	55.3
Online	2	2.1
Both are fine	40	42.6
Reasons given		
Face-to-face		
No reason given	2	3.8
No technical problems	5	9.6
Easier to communicate with patients	33	63.5
Makes learning more effective	4	7.7
More personal and realistic	8	15.4
Online		
Less nervous	1	50
In view of pandemic	1	50
Both are fine		
No reason given	8	20
No problems either way	4	10
Pros & cons both ways	6	15
Both are the same	5	12.5
Good experience for students	3	7.5
Mode not important	1	2.5
Depending on the situation	10	25
Provided there is a good Internet	3	7.5

Table 4 demonstrated that the main difficulties for the online patient interview were technical problems which were faced by half (53.2%) of the students with 41.5% of students having Internet connectivity problems.

Table 4 Online patient interview sessions-problems encountered & reasons given

Problems encountered & reasons given	n (%)
None	30 (31.9)
Technical problems	
Internet connection	39 (41.5)
Audio/Visual	11 (11.7)
Student related factors	
Communication skills related (difficulty expressing non-verbal skills, demonstrating empathy, following patients' cues & agenda)	8 (8.5)
Language	1 (1.1)
Others (awkward /not personal/ineffective)	5 (5.3)

Although the results favoured the face-to-face method for the teaching of communication skills, our experience demonstrated that online teaching was possible as e-learning (standalone or blended with traditional learning) could be equally effective as face-to-face learning in communication skills training.4

The main barrier seems to be technical issues like Internet connectivity which could also be affected by the devices used and lack of video conferencing skills by the students, patients, and tutors. There could be perception and attitude that face-to-face training is superior to online teaching which might have affected some of the students' responses to survey questions. Other research identified the key barriers in the development of online medical education include lack of support and negative attitude of all concerned.5

To overcome these barriers, one of the major steps will be a collaboration of key agencies like the education ministry, the higher learning institutions, and industries like the telecommunication and computer companies. The industries can contribute significantly in terms of making affordable good Internet connections and suitable devices widely accessible to the students and teachers. A change of negative attitude against conversion to online teaching mode, more training of the students and teachers in computer skills, and development of curriculums with contents suitable for online delivery would be beneficial. Adequately set-up online patient interviews might be an invaluable platform to train medical students not only in communication skills but also in telemedicine which is gaining popularity worldwide due to the COVID-19 pandemic. Telemedicine is foreseen to become a norm in the future with expected demand in rural areas with low access to medical care.6

Conclusion

COVID-19 pandemic has forced unprecedented teaching of communication skills among medical students through online patient interviews using video conferencing platforms. The students faced more difficulties during the online session compared to the usual face-to-face session. The key barriers were poor Internet connectivity, unsuitable devices, and lack of skills for video conferencing. Collaborations between government, educational institutions, and industries to provide good Internet connectivity and suitable devices for online learning are essential to improve the outcome of online medical education. The experience and skills learned from these sessions could contribute to the future practice of medicine through telemedicine.

Acknowledgement

The authors would like to acknowledge all the patients and tutors who were involved in the teaching sessions, clerical staff for keeping track of the schedule, and the technical support team for preparing the technical facilities.

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CHALLENGES EXPERIENCED BY STUDENTS IN OPEN-ENDED LABORATORY USING COMPUTER SIMULATION FOR HEAT AND MASS TRANSFER COURSE

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Introduction

This paper presents a case study on challenges faced by students when shifting from physical lab sessions to computational simulation for an open-ended lab due to the CoVID-19 pandemic. An open-ended lab gives freedom to students to construct their experiment procedure to test a given hypothesis. Students must formulate the objective based on the hypothesis. Then, students must search-relevant literature to develop fundamental knowledge on the topic. This enables students to determine a suitable configuration and instrumentation for the experiment. The procedure and data analysis technique are also constructed based on this literature search. This paper presents a qualitative survey on difficulties faced by students to shift from physical experiment to computer simulation experiment.

Laboratory activities could be a dull session if students just follow a specific procedure without being able to innovate in their experiment. This practice limits the potential for students to enhance their experiential learning (Colburn, 1997). To produce a more interactive session and create an opportunity for students to exercise their critical and innovative thinking ability, the open-ended laboratory can be included as part of the curriculum. The open-ended laboratory is not only implemented in university, but it is also applicable to high school students (Szott, 2014). Although some difficulties were faced, the rewards justified the implementation of the open-ended laboratory. Implementation of an open-ended laboratory is more interesting for biological science experiments since students can bring the compound or organism from their home as a specimen (Marshall, 2007). This means that an open-ended laboratory can utilise numerous sources of specimens or materials for investigation. Due to differences in those specimens and materials, the results and findings will be different. Indirectly, new knowledge is created from open-ended laboratory activities.

In engineering education, attainment of major competencies can be assessed through open-ended laboratory (Kulkarni, et al., 2017). Since the results obtained by students in an open-ended laboratory are unlikely to be similar, evaluation of their competencies is more reliable because no elements of lack of integrity need to be considered. Another advantage of an open-ended laboratory is it helps students in their preparation for Final Year Project (Haron, Mohammad, & Sam, 2013). Intensive training during open-ended laboratory gives experience to students in designing their experiment, which is relevant to a portion of their final year project activities. An open-ended laboratory also helps in fostering critical thinking among students (Poor & Miller, 2016). Critical thinking skills are essential to engineering students because they will face new and unprecedented problems throughout their careers. Soft skills such as student engagement, participation in discussion, and execution of open-ended laboratory and their perception on personal competency are also improved (Cullin et al., 2017). These skills are required to execute engineering activities. To date, reported activities in the open-ended laboratory are mainly on the physical experiment, where students are dealing with hardware. From the literature survey, implementation of the open-ended laboratory using software is not yet reported.

The case study presented in this paper concerns the challenges and difficulties experienced by the student during the implementation of the open-ended laboratory using computer simulation through the online session. A qualitative study on difficulties faced by the student was conducted by collecting information throughout the execution of open-ended lab activities.

Method

Sample

This qualitative study involved fifth semester Bachelor of Mechanical Engineering with Honours students in one of the universities in Malaysia. These students enrolled in the Heat and Mass Transfer course. The pre-requisite to Heat and Mass Transfer is Thermodynamics 2. In Thermodynamics 2, students must produce lab reports for guided experiments.

Stimulant given to students

Online sessions were conducted to introduce the concept of the open-ended laboratory. During these sessions, the requirement of lab reports was explained in detail. Techniques to construct the methodology were discussed in detail. A hypothesis was given to students to be tested. The hypothesis given to students for this study was:

> 'Fins made from higher thermal conductivity materials increase the rate of heat dissipation.'

Based on this hypothesis, students were required to prepare a complete lab report with the structure below:

1. Title of experiment
2. Introduction
3. Hypothesis
4. Literature review
5. Problem statement
6. Objective
7. Methodology
8. Results and discussion
9. Conclusion
10. References

Software

Energy2D software was used in this open-ended laboratory. Energy2D is a multiphysics software that can simulate heat conduction, heat convection, and heat radiation in two-dimensional analysis. There is no requirement for computational fluid dynamics knowledge before the use of this software. Figure 1 shows the user interface of Energy2D software.

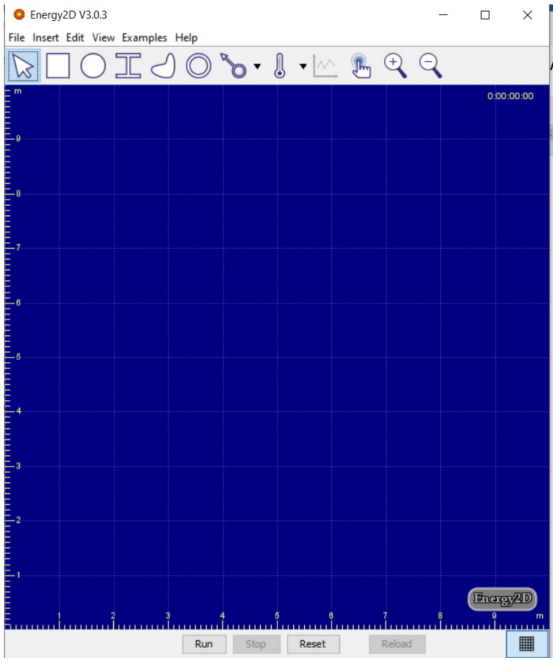

Figure 1 User interface of Energy 2D software where the geometry of fins are constructed and simulated

Students must construct the geometry of the fin and set the properties of the fin and fluids around the fin. Then, students must decide the locations for temperature and heat flux sensors. Initial conditions are required for all objects constructed in the simulation domain.

Students must decide the length of time for the execution of the simulation. In this open-ended laboratory, flexibility was given to students to choose steady-state or transient heat transfer for the analysis of their results.

Methods to collect data on difficulties experienced by students

The data on difficulties experienced by students were collected by two methods which are:

1. Questions asked by students during an online session

All questions asked by students during online face-to-face sessions were recorded and classified into a few categories.

2. Observation on submitted lab reports
   The analysis was divided into three main parts which are objectives, methodology, and results.

Results and Discussion

Conversion from physical to virtual system

Simulation of heat transfer in Energy 2D required students to convert physical to a virtual system. Students had difficulties in ensuring the virtual system has similar properties to physical systems. Since the step of assigning materials properties is missing in the physical experiment, most of the students experienced difficulties setting those parameters in the Energy2D software. They have the perception that the default parameters set in the software are correct for their simulation.

For instance, the fin is surrounded by air. Students tend to forget to set the properties of fin and air. Students also have difficulties choosing the appropriate average temperature since the properties of substances are a function of their temperature. In the physical experiment, they do not need to set the properties of air since real air is involved and the properties of air will be changing according to its temperature. In the simulation, students must assign properties of all objects involved according to their estimated average temperature.

Students also found it was difficult to relate the change from one fin specimen made from Material A to another fin specimen made from Material B. In the physical experiment, students must change the fin with another set of fins with different thermal properties. In the simulation, students have a little bit of difficulty in imagining how to imitate this physical step, which is done by changing the thermal properties of fins in the parameter setting option. Temperature and heat flux sensors are required in this computational heat transfer simulation. Students have difficulty placing the sensor at appropriate locations. In the physical experiment, the sensors are usually located at fixed locations. So, there is no issue with the selection of the appropriate location of sensors. However, flexibility does exist in computational simulation for students to install many sensors to get the measured value of parameters at appropriate locations.

Verification of experiment procedure

In the physical experiment, students can refer to manufacturer specifications on the equipment to partially assist them in constructing their procedure. If there is an anomaly in their measurement, students can immediately modify the procedure. In contrast, in the simulation, there is no specific procedure or specification given by the software developer on how to test the given hypothesis. Students must construct the procedure purely based on the hypothesis. The configuration of the system that can be simulated almost has no limitation but there is no indicator if any procedure was not properly chosen.

Data analysis

The volume of data recorded from the virtual simulation is huge. Since the simulation involves computational fluid dynamics, some fluctuations in values of data can be observed although it has reached a steady-state condition. It is a challenge for students to decide the appropriate endpoint in their simulation. For instance, heat flux sensors will measure fluctuated heat flow at the root of a fin. Students need guidance on data analysis techniques, such as taking average measured heat flux at several periods to ensure the variation in measured values is not significant. Students tend to pick a single data point rather than taking an average measured data for a specific period.

Flexibility of computer simulation for open-ended laboratory

In the physical experiment, the configuration of apparatus to test the hypothesis is limited due to the availability and suitability of equipment. In contrast, the simulated experiment in software almost has no limit unless the configuration has complex shapes which lead to instability in the numerical solution. For instance, various configurations of the fin with complex geometry can be modeled in an experiment using computational fluid dynamics (Haider, Freko, Acher, Rehfeldt, & Klein, 2020).

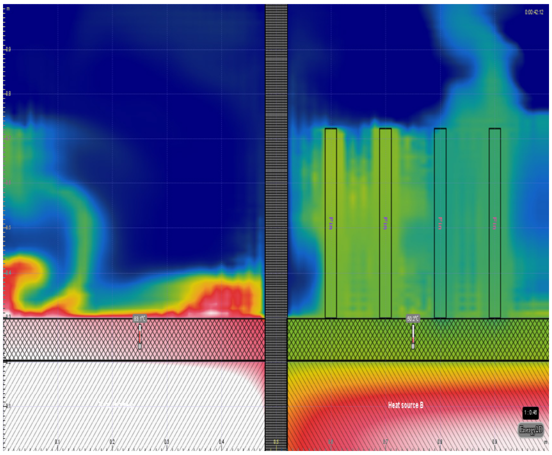

Figure 2 Temperature distribution of fluid around the fins

Figure 2 shows the screenshot from Energy 2D software which illustrates the temperature of the fluid at the surrounding fins. In the simulation, students have an opportunity to understand a complete picture of the heat transfer process. Instead of measuring temperatures at specific points, the students can visualise temperature distribution in the form of a filled temperature contour. This compliment discussion during lecture and tutorial on heat transfer where computational simulation is commonly not a topic of discussion.

Conclusion

An open-ended laboratory is a good learning activity to get more engagement and participation from students. Some challenges are apparent when computer simulation is used in open-ended laboratories. The challenges experienced by students are difficulties in converting physical to virtual experiment setup, verification of procedure, and difficulties in the analysis of the large volume of data. However, exposure to the open-ended laboratory using computational simulation is beneficial for their future. They may encounter a situation where the use of the software is relied on to enable quick verification of a system at a lower cost.

Acknowledgement

The authors would like to acknowledge financial assistance by Universiti Kuala Lumpur for the publication of this case study.

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MOBILE APPLICATION DESIGN PROCESS TO BALANCE THE BODY, MIND & SOUL AMONG STUDENTS: A GUIDELINES AND FRAMEWORK

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Introduction

This research aims to create a mobile application about the importance of a healthy lifestyle for the Nutrition club by Tuisyen Kurus Online (TKO). The mobile application name is B.M.S (Body, Mind, Soul) Balance. This application will suggest to them which meal is suitable for their body. It will teach them an adequately balanced nutrition meal using some recipes from the nutrition club by TKO and learn about taking Herbalife products benefits for other meal replacements. The mobile application has features that will provide information about the calories in the meal and the benefits of Herbalife products for their daily intake dosage for meal replacements. The most important feature of the app is to help consumers to control their daily food intake and have a healthy body with a proper meal that won't make their body overweight during the lockdown.

1. *Target audience for B.M.S. Balance mobile application*

   The main target audiences are adults with obesity. This project provides a mobile application of B.M.S. Balance as interactivity for the audience's daily routine. The audience today is looking for an easy way with everything they are doing for their daily routine.

   Users who used this application learned about properly balanced nutrition meals with recipes given in the application and knowledge about the benefits of consuming Herbalife products. Besides learning about properly balanced nutrition meals, users will also get a notification on their timing meal and a reminder to do basic exercises. This application will boost the Herbalife products and train the users in balanced nutrition for their body, mind, and soul.

2. *Designing the suitable navigation*

   Although the design is essential for every mobile application, it is also crucial to have suitable navigation to ensure how well the application interacts with the users. If the users only think it is beautiful but quite hard to navigate through, it should just be a waste of time to use the application.

   Therefore, to create the most excellent navigation is by practicing the best mobile application navigation. According to Hoober (2011), research on designing mobile interfaces found that 49% of users use their thumb to scroll on their smartphone screen. Thus, the thumb rule is essential to place frequently used actions at the bottom of the screen. On the other hand, the users will reach the navigation button when holding the phone with one hand or two hands.

a. Bottom Bar Tab
The bottom tab bar navigation frequently used by social media like Instagram makes it their core functionally features that can easily access the bottom tab bar. As a result, it allows the switching between features fast. Furthermore, the bottom tab bar only shows the most important and the more frequently used navigation. On the contrary, avoid using scrollable icons in the tab bar and avoid using different colours icons in the bottom tab bar.

b. Card-Style Design
Card-style design navigation is a great thing to use in mobile application interface design. They can display applicable content and allow content to reveal itself naturally. It gives the user this feeling of fun while swiping to another one. For example, using card-style design navigation would be the Google Primer app. The application can tap on each card and then wipe away the cards inside whenever done with the reading (Inapptics, 2018).

c. Full-Screen Navigation Full-screen navigation can save some space
However, it can be the best navigation design option for some mobile applications. The full-screen navigation is a home page that lists all the navigation elements and beneficent navigation for coherence and simplification. Therefore, adding a search box in the navigation bar is the best practice to design, and if, without the search box, it will make the user feel like they are locked in a dark room without escape. Adding a search box gives the users the freedom to search for whatever they wanted to avoid uncomfortable feelings.

3. *Rules designing User Interface (UI) Button*

According to the research of (Justin, 2018), when designing a UI button, the most important thing is the principle of UI button designing and the button's purpose. On the contrary, the UI button design course, from the Three-Dimensional rage and Skeuomorphism to the Flat design revolution and Floating Action Button fever. Besides, accessibility is for the user's priorities. However, to design the button, it must look like a button based on size, shape, and padding. The size and shape of a button can break the likelihood of user interaction.

a. Size
Before starting the UI button design, the button needs to be user-friendly for the users. So, when 'tap' is the primary input method for the mobile application, the basic Android principles of Material design recommend that the button's touch target should be at least 48 x 48dp along with at least 8dp or more between them. It will ensure that the design will be balanced information density and usability.

b. Shape
The term for shape in the UI buttons depends on how it has been designed because there is plenty of shape for the button, for example, rectangle and circle. However, most of the designers used a rectangle for the UI button to look clean and elegant without hurting the user's eyes when 'tapping' the button. For instance, in Android, UI design used a flat and raised design button. The button material should have been 36dp high, minimum width of 88dp, and a 2dp corner radius for flat but for raised, it has a default elevation of 2dp.

c. Padding, colour, and contrast
It is a virtual white space around the content or component, and it will give the UI button breathing and avoid overwhelming when the users interact with the button. Thus, to make the button look actionable, the UI button's design will use colour and contrast that can guide the users towards taking the meaning of the UI button content.

Therefore, the UI design colours will help the users navigate buttons and figure the action behind each click. Also, contrast will be needed for the users to choose between different buttons. Suppose there is no contrast between the buttons. In that case, it will cause difficulty for the user to decipher between actions of each button. It can slow down the user journey and make the user experience a low-quality application.

Balance Healthy Lifestyle

Since the pandemic, people are living stress-ridden and hectic lives. They tried to balance careers, families, social lives, and till they drained themselves with stress life. According to the research (Sophia, 2020), to balance a healthy lifestyle, they need to change to a new environment and try new things to live a balanced lifestyle. The balance of a healthy lifestyle, the researcher has some tips and ways to balance the mind, body, and soul.

Tips for balancing the body and mind are through a good diet food that most people do not know much how big the effect is according to the research (Sophia, 2020). Regularly consuming clean food will boost the body, like consuming a coffee every hour to boost the energy and what the body has consumed is very important to have a good mental during hectic works. Besides, the benefit of consuming clean food will improve the whole physical healthiness.

Nowadays, people are continually pushing on their work and responsible non-stop until they drained their mental and emotional which they need adequate rest. In the research by Sophia (2020), the first step that the body needs after draining the mental and emotional is by spending time outdoors to take a breath from the hectic work. During free time, go on a walk and do some exercise that will boost the mind and soul. Based on Deepak (2020), most people carry their emotional toxicity through a form of unprocessed anger, hurt, and the feeling of disappointment in themselves.

Spending time writing a journal about daily life will change how the body has been living. They need to acknowledge what they have been holding on to and just let it go without feeling regretful. Besides that, nurturing, having a supportive environment, and the mind will fill the new space for the body to accept love and self-nurturing.

The Purpose of Development

The purpose to create the B.M.S. Balance mobile application is to helps the users to choose which meal suitable for their body. It will teach them an adequately balanced nutrition meal using some recipes from the nutrition club by TKO and learn about taking Herbalife products benefits for other meal replacements.

The research objectives will solve three problems as below:

1. Increasing Obesity rates since lockdown
   Obesity rates have increased since the lockdown because of a lack of physical movement and unbalanced nutrition from stress eating. Also, it made people have a complicated relationship between a healthy lifestyle and food.

2. Working from home
   Nowadays, because of the lockdown majority have been working from home and it also has altered their eating habits and emotional well-being, making them less physical movement while stressed with their work and the environment around them.

3. Lack of knowledge about Herbalife product's benefits
   Besides daily solid food, most people don't know much about Herbalife products which may help obese and overweight people. Also, they have known for the benefits of their products as food replacement and extra supplements. It has been used for sports figures because of the complete nutrition in the products and used as backed by medical practitioners.

Methodology

This section illustrates the techniques used to complete the project. The B.M.S. Balance framework outlines the steps and methods required to achieve the project's goal. The first approach uses the analysis, design, development, implementation, and evaluation (ADDIE) model which represents the entire project in this methodology.

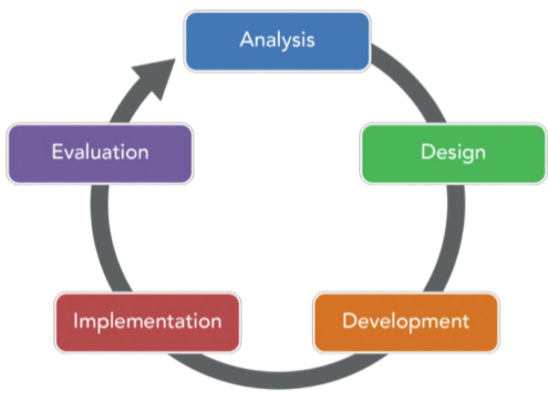

Figure 1 Phase of ADDIE Model

According to Figure 1, The ADDIE model is an iterative instructional design process. The formative evaluation results of each phase can lead the instructional designer back to any preceding phase, which is the starting product of the next phase (Kurt, 2018).

The ADDIE model is an instructional design methodology used to help in organising the production of the research and project content. It was a widely recognised instructional design model commonly used today, which is the most traditional ADDIE model consisting of five stages.

ADDIE model has its stages where each stage has its process done in the given order but with a focus on reflection and iteration. ADDIE is an acronym for the stages of a development process which stands for Analysis, Design, Development, Implementation, and Evaluation. Figure 2 shows the framework of B.M.S. Balance as a guideline for mobile application development based on the ADDIE model.

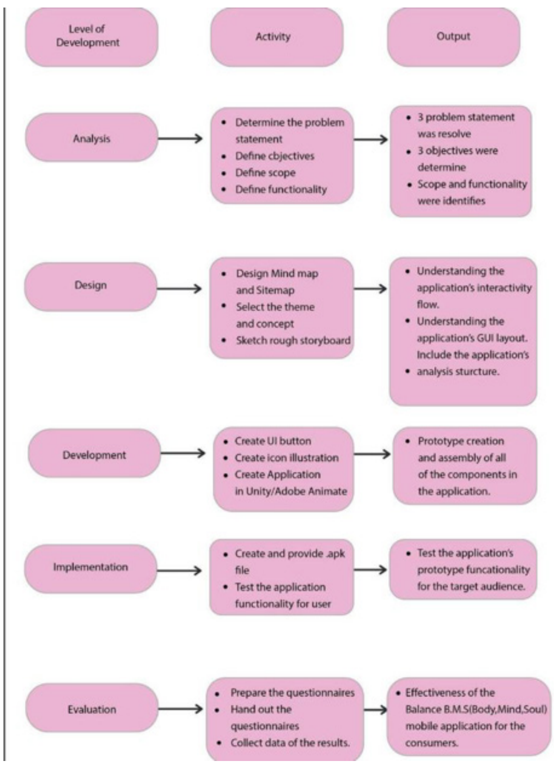

Figure 2 B.M.S Balance framework

A. Phase 1: Analysis

Through the analysis phase, several outcomes will be identified during the analysis phase, including the project's goals, problem statement, target audience, and project's content. Meanwhile, several important aspects are discussed in this phase, including determining the role of mobile apps in assisting users with skincare.

According to Dute (2016), promoting a Healthy Lifestyle among adolescents and students Using a Mobile Application to assess dietary intake and the benefits of meal replacement. Next, the researcher identifies the effectiveness of mobile applications in terms of user training proper meal replacement with Herbalife products. As for the BMI category classification, this application created a calculator BMI for the user to get their BMI category and the suggestion for their daily calorie intake together with Herbalife products.

B. Phase 2: Design

During the design phase, researchers will go over all the data from the analysis and make specific and rational decisions on structuring the content and building the project to meet the goal by sketching the sitemap for the content and a rough storyboard for the instructional design.

The design process aids the developer in establishing clear learning objectives and content structure. It must adhere to a strict set of standards, and every aspect of the instructional design plan must be thoroughly carried out. When it comes to the design stage, it is critical to be a perfectionist. This systematic approach implies that it is part of a well-planned plan, or set of plans, with the overall goal of achieving the project's objectives. Figure 3 shows the site map of B.M.S. Balance mobile application.

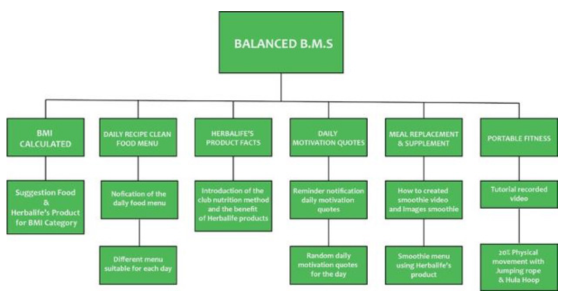

Figure 3 Sitemap of B.M.S. Balance C. Phase 3: Development

The development stage begins the production and testing of the project methodology. In this stage, designers use the data gathered in the previous two stages to create a program that will relay what needs to be taught to participants. Testers carry out the debugging procedures and review and revise in response to any feedback received.

Figure 4 B.M.S. balance mobile application user interface design

In this phase, developers start to design a prototype of the user interface and user experience for the mobile application Figure 4 shows the user interface design for B.M.S. balance mobile application. The user interface was designed by using Adobe Animate to make it function as planned. For video editing, the software used is Adobe premiere pro, and the developer uses Adobe Illustration. The programming language being used is ActionScript3.

C. Phase 4: Implementation

The implementation stage reflects the program's ongoing modification to ensure maximum efficiency and positive results. In other words, developers play an active role in this stage, which is critical to the project's success. To ensure adequate product delivery, developers should constantly analyse, redesign and improve the product. Also, proper evaluation of the product, course, or program, with necessary and timely revisions, is done in this phase (Kurt, 2018).

D. Phase 5: Evaluation

Evaluation is the final stage of the ADDIE method when the project is subject to meticulous final testing regarding what, how, why, and the things accomplished (or not accomplished). It consists of two-part: formative and summative. Each stage of the ADDIE process includes formative evaluation. It is a multifaceted and necessary component of the ADDIE process. Summative evaluation consists of a test designed for domain-specific criterion-related referenced items and opportunities for user feedback.

Conclusion

In summary, the researcher has defined the objective, problem statements, scope, and functionality of the mobile application during the review of the study. The writing of this review article will contribute to the guidelines and framework for mobile application's development process based on B.M.S. balance mobile application design process.

The study will continue with phase 4 - implementation and phase 5 - evaluation. The writing of the following article will report each of the findings from the two phases, especially the results of data collection analysis on the effectiveness level evaluation of the mobile applications that have been developed. The main target audiences are adults with obesity.

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LOAMS – A WEB-BASED SYSTEM TO MEASURE LEARNING OUTCOMES – UNIKL EXPERIENCE

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Introduction

Outcome-based *education* or outcomes-based *education* (*OBE*) is an *educational* theory that bases each part of an *educational* system around goals (outcomes). Outcome-based Education means focusing and organising a school's entire programs and instructional efforts around the clearly defined outcomes we want all students to demonstrate when they leave school (Spady, 1995). OBE is a powerful education strategy that should be used as a focus for curriculum planning, as a means of making informed discussions about the approaches to teaching and learning be adopted, and as a basis for the assessment of students/trainees and of the education programme itself (Mohd Ghazali et al. 2008). OBE empowers students to choose what they would like to study and how they would like to study it. Not only does it adapt to a learner's strengths and weaknesses, but it also provides sufficient time to attain proficiency and fluency in the subject matter.

Learning OBE is enhancing every teacher/student to think critically, and perform due to their capacity (Mamary, 1991). OBE enhances the curriculum it serves as the guide to every teacher, it is an education that is anchored and focuses on outcomes. The challenge in implementing the OBE approach in education is that every single component such Programmme Educational Objectives (PEO), Programme Learning Outcomes (PLO) and Course Learning Outcomes (CLO) need to be measured. This paper presents how UniKL developed a web-based system called LOAMS to measure the outcomes of some items such as PLO and CLO. The system also can generate some reports based on demand from the stakeholders.

Mechanism of Measurement for Programme and Course Learning Outcomes

Program learning outcomes are a description of the knowledge, competencies, and values a student displays at the end/conclusion of the program. Program learning outcomes help students understand why this knowledge and these competencies will be useful to them. Effective learning outcomes highlight expected student behaviour as well as the specific conditions and standards of performance by which students will be measured. Learning outcomes should be specific and target one expectation or aspect of understanding and highlight the conditions under which the student is expected to perform the task. The conditions of the outcome should communicate the situation, tools, references, or aids that will be provided for the student.

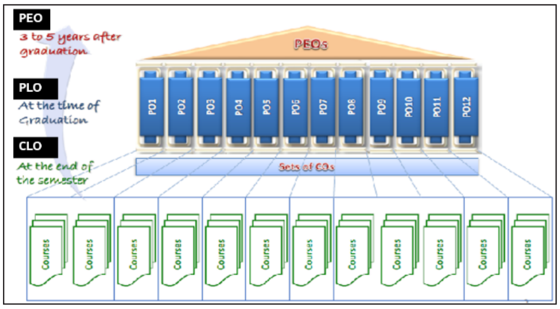

Figure 1 Different levels of Learning Outcomes in A Programme

Each Learning Outcome (LO) should be measurable and include the criteria for evaluating student performance. Generally, standards provide information to clarify to what extent a student must perform to be judged adequate; thus effective learning outcomes indicate a degree of accuracy, several correct responses, or some other type of measurable information. Standards serve the dual purpose of informing students of performance expectations and providing insight as to how achievement of these expectations will be measured.

Course Learning Outcomes are specific and measurable statements that define the knowledge, skills, and attitudes learners will demonstrate by the completion of a course. LO are written with a verb phrase and declare a demonstrable action within a given time frame, such as by the end of the course. At both the course and program level, student learning outcomes should be clear, observable and measurable, and reflect what will be included in the course or program requirements (assignments, exams, projects, etc.).

To answer the issue of measuring learning outcomes at the programme and course level, UniKL had developed a web-based application called LOAMS (*Learning Outcomes Attainment Measurement System*) in 2014. To facilitate the understanding of this system, UniKL has come out with the following documents,

1. The circular announces the implementation of UniKL LOAMS Policy was approved in Senate meeting (30th April 2014) – (Senate meeting no. 54)
2. Proposal on UniKL SOP for LOAMS – was proposed and approved by UAC members in September 2014 (UAC No. 103)
3. Proposal on UniKL SOP – was proposed and approved by Senate members in October 2014 (Senate meeting no. 57)
4. The UniKL Standard Operating Procedure on LOAMS (Doc. Ref. : UniKL/CITC/SOPLOAMS/05)

LOAMS (*Learning Outcome Attainment Measurement System*) is an online web-based system that is systematic and efficient to process and facilitate the attainment of learning outcomes at the PLO and CLO levels.

In the Outcome-Based Education (OBE) framework, measuring the LO attainment for each course of each program is a requirement. Previously, the data need to be keyed in manually into the provided templates. A lot of time and energy was spent completing the task.

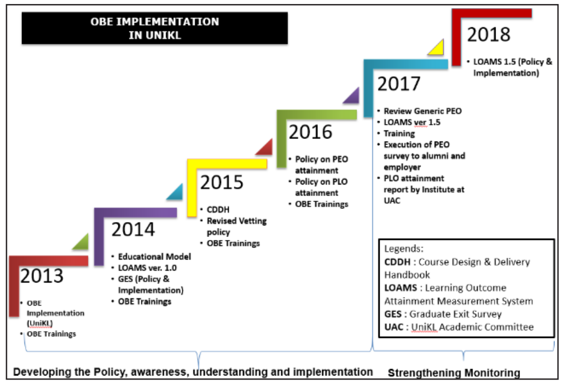

Figure 2 Implementation of OBE In UniKL

UniKL curriculum and pedagogic strategies aim to prepare our students for a world that is increasingly diverse and unpredictable. Offering a variety of academic programmes aligned to industry requirements, UniKL closely observes educational best practices and the needs of the market by continually reviewing our curriculum to cater to Industrial Revolution 4.0 and beyond. The Outcome-Based Education (OBE) approach implemented in UniKL further demonstrates our commitment to academic excellence through the amount of knowledge, skills, and learning opportunities offered in our academic programmes (CDDH, 2019).

Methodology

LOAMS are used in all programmes offered in UniKL. The standard set for CLO attainment is at 50% which is based on individual students' attainment on its related CLO.

The setting up of mapping assessment to CLO (CLO Distribution) is at week 0 to week 3 of the academic calendar. PLO and CLO need to be tagged with their version number as well as their effective date to keep track of any changes in the future. Reports of CLO analysis to be attached in Course Portfolio.

The implementation of LOAMS will involve several parties as followed such as Head of Section, Programme

Coordinator, Course Leader, and Course lecturer. Each level has its roles and responsibilities.

Heads of Institute (Campus), Academic Management Division (AcMD), Center for Quality Assurance (CQA), and Center for Instructional Technology and Curriculum Development (CITC) are responsible and accountable in making sure LOAMS is implemented according to this policy and its procedure.

The roles and responsibilities of the centre, sections, and units are as follows,

1. Academic Services (AcSS)-at Institute or campus level will update the lecturer's subjects in the academic system (e-CITIE).
2. Human Capital Unit at Institute or campus level will update HOS in the E-CITIE – Human Resource system.
3. Head of Section (HOS) will set up the programme coordinators in the system, to verify CLO aligned to its specific cohort/intake, and to verify PLO and CLO aligned to its specific cohort/intake.

The programme Coordinator (PC) will setup PLO and PLO Matrix (one-time setup) and to update if there are any changes, the Course Leader will setup CLO and CLO-PLO mapping (one-time setup) and update if there are any changes, and the lecturer will set up the mapping between CLO and assessment.

According to Linn & Miller (2005), the learning outcomes are actually what we are expected our students to achieve at the end of their learning process.

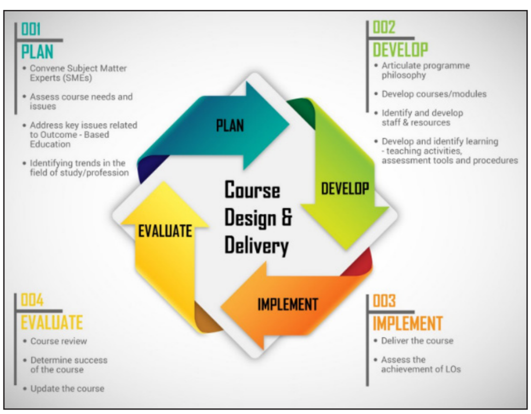

Figure 3 Curriculum and design delivery (adapted from MQA, 2008)

Results and Findings

Overall process and attainment of PLO and CLO are as follows,

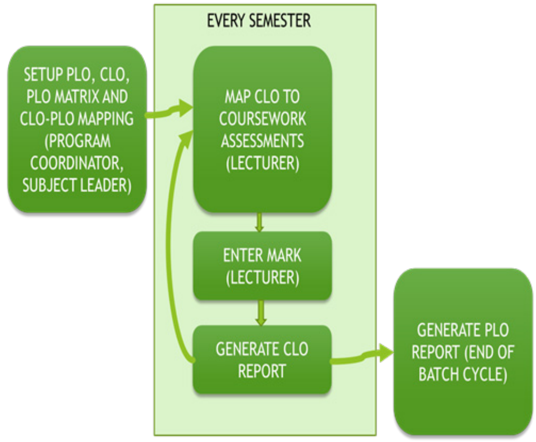

Figure 4 Details of LOAMS process flow

As explained from the beginning, this process flow will involve four-level; Head of Section, PC, Course leader, and Course lecturer.

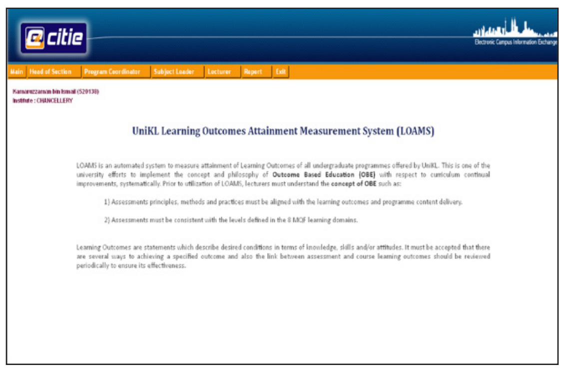

Figure 5 Home screen of LOAMS

The setup of LOAMS will involve four groups of people:
1. Head of Section/Department
2. Programme Coordinator
3. Course leader and
4. Lecturer

The role of Head of Section/Department is just to assign the right Programme coordinator for a particular programme.

The programme coordinator will set up the programme's outcomes and PLO matric. Figure 6 shows the interface of setting up PLO and PLO Matrix (one-time set-up) by using the blueprint for each programme and updating if there are some changes.

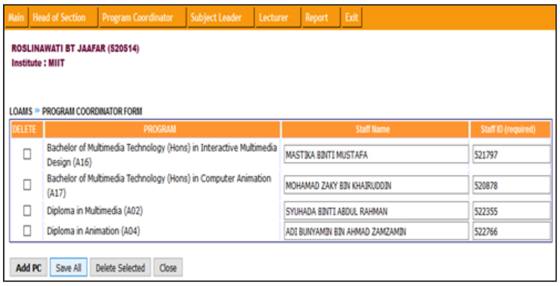

Figure 6 Interface setup by Programme Coordinator

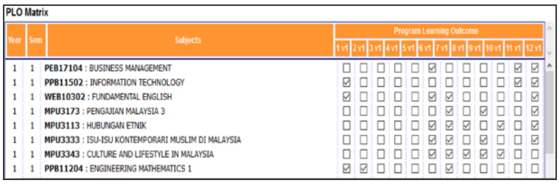

Figure 7 Interface setup of PLO Matrix by PC

In the next step, the Subject Leader will set up a CLO and the course lecturer will do the mapping between CLO and assessment.

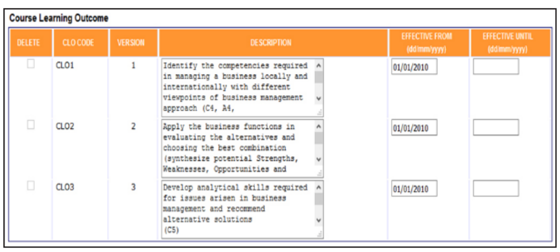

Figure 8 Interface of Setting Up CLO by Course Leader

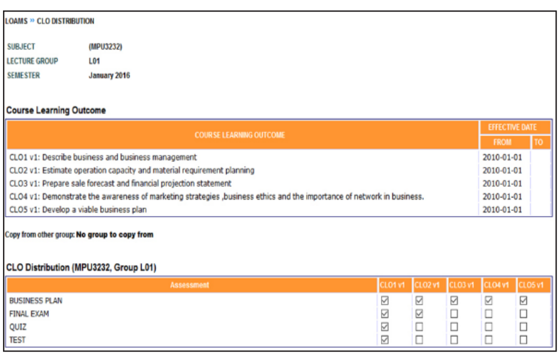

Figure 9 Interface of mapping CLO vs assessment by course lecturer

Based on the demand of specific requirements by Professional bodies and accreditation bodies, this system manages to generate thirteen reports as follows,

1. OBR201_L: CLO Report
2. OBR202_L: Course Analysis Report (by Headcount)
3. OBR202_CL: Course Analysis Report (by Headcount)
4. OBR203_L: Student CLO-PLO Report
5. OBR203_CL: Student CLO-PLO Report
6. OBR204_L: Student Subject-PLO Report
7. OBR204_CL: Student Subject-PLO Report
8. OBR205_PC: PLO Monitoring Report
9. OBR206_PC: Program Analysis Monitoring Report
10. OBR207_PC: Student's PLO Monitoring Report
11. OBR208_PC: PLO Attainment Report
12. OBR209_PC: Program Attainment Analysis Report
13. OBR210_PC: Student's PLO Attainment Report

The generating of reports is based on a different level and requirement. For a programme level, PC has more authority to generate more reports compared to course leaders and course lecturers. Of course, by request or special need, the admin can authorise anyone to access the reports if during the audit visit they are requesting to do so. The admin of the system can at any time remove and add the person in charge at a different level based on the request of the top management of the institute or campus.

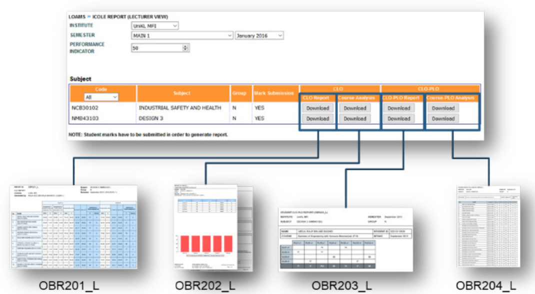

Figure 10 Reports generated by course lecturer

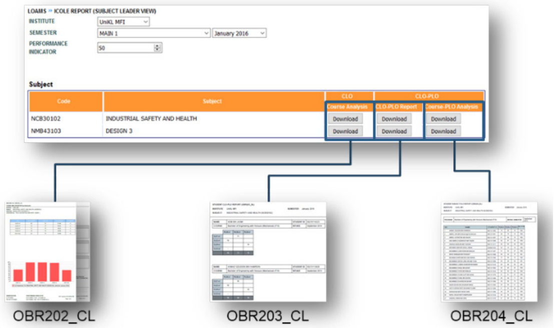

Figure 11 Reports Generated by Course Leader

The significance and benefits of the OBE system in the 21st century should be understood in its philosophy, premises, principles, and instructional planning process.

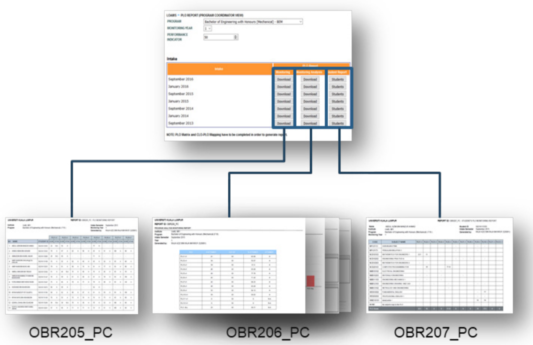

Figure 12 Reports generated by Programme Coordinator

OBE can be viewed in three different ways – as a theory of education, or as a systemic structure for education, or as classroom practice (Killen, 2000; 2006). Ultimately, the systemic structure and the classroom practice with the theory are aligned to produce genuine outcomes-based education. As a theory (or philosophy) of education, OBE embodies a certain set of beliefs and assumptions about learning, teaching, and the systemic structures within which the activities take place. The most detailed articulation of OBE theory can be found in Spady (1994a, 1994b). Spady is one of those authors who have made significant contributions to OBE.

In the OBE system, there are three learning domains, namely, cognitive, psychomotor, and affective determined by the MQA. Furthermore, eight domains of learning outcomes are provided: knowledge; practical skills; social skills and responsibilities; values, attitudes, and professionalism; communication, leadership, and team skills; problem-solving and scientific skills; information management and lifelong learning skills; and managerial and entrepreneurial skills. All these domains are essential to the quality and standards of the higher education system in Malaysia.

	Cluster		Learning Domain
i	Knowledge and Understanding		Cognitive
ii	Cognitive skills		Cognitive
iii	Functional work skills	a. Practical skills	Psychomotor
		b. Interpersonal skills	Affective
		c. Communication skills	Affective
		d. Digital skills	Affective
		e. Numeracy skills	Cognitive
		f. Leadership, autonomy and responsibility	Affective
iv	Personal & Entrepreneurial Skills	a. Personal skills	Affective
		b. Entrepreneurial skills	Affective
v	Ethics and professionalism		Affective

Figure 13 MQF Learning Outcomes Clusters and Learning Domains (MQA 2018)

In short, the OBE approach should have a clear definition of the outcomes that students are to achieve, and the efforts that must be made to indicate the priority of each of the outcomes (Adedoyin & Shangodoyin, 2010). The teacher must then describe the knowledge, skills, and dispositions in detail, which students must develop to achieve the outcomes. Having done that, prerequisites for students should be made explicit before they attempt to develop their new knowledge, skills, and attitudes.

Calculation of PLO and CLO Attainment

This process will show how the system calculates the attainment of PLO and CLO based on the pre-requisite set by different levels at the beginning of the semester (CDDH 2018)

Using curriculum mapping is one way to ensure that learning outcomes align with the curriculum. A curriculum map is a the matrix in which learning outcomes are plotted against specific program courses. Learning outcomes are listed in the rows and courses in the columns. This matrix will help clarify the relationship between what you are assessing at the program level and what you are teaching in our courses.

The attainment of PLO and CLO is also reflected in the marks filled up by the course lecturer and also all the mapping processes that need to be done by different levels (MQA, 2019). A notice to a specific person will be issued if before the generating of reports can be done or not. Every single individual has his/her responsibility in ensuring the smooth running of the system.

These are samples of how the system generates the reports.

1. CLO Attainment Calculation
2. PLO Attainment Calculation
3. PLO-CLO Mapping

Learning outcomes are the statements on what a learner should know, understand, and can do upon the completion of a period of study (MQA, 2014). So, in the OBE approach, the attainment should be measured at topic, course, programme, and program educational levels.

	CLO			
Assessment	CLO 1	CLO 2	CLO 3	CLO 4
Assign_CLO1	A1/8			
Assign_CLO3			A2/12	
Test _CLO2		T1/10		
Test _CLO4				T2/10
Lab_CLO1	L1/9			
Lab_CLO3			L2/11	
Final Q1	F1/10			
Final Q2		F2/10		
Final Q3			F3/10	
Final Q4				F4/10
	∑CLO 1/27	∑CLO 2/20	∑CLO 3/33	∑CLO 4/20
	24/27	16/20	27/33	9/20

Figure 14 CLO attainment calculation

CLO Mark

	Mark
CLO1	89
CLO2	80
CLO3	82
CLO4	45

CLO - PLO Mapping

	PLO1	PLO2	PLO3
CLO1	X		
CLO2		X	X
CLO3	X		X
CLO4		X	

Figure 15 PLO attainment calculation

CLO Mark

	Mark
CLO1	89
CLO2	80
CLO3	82
CLO4	45

CLO - PLO Mapping

	PLO1	PLO2	PLO3
CLO1	89		
CLO2		80	80
CLO3	82		82
CLO4		45	

Figure 16 PLO-CLO Mapping

In this system, the Course – PLO mark would be the average of CLO mark (only CLOs that has a mapping to the PLO). Course – PLO >= 50 is attained, while subject – PLO < 50 is not attained. The performance indicator is passing.

The score is set by the university to consider the attainment level at the programme or course level.

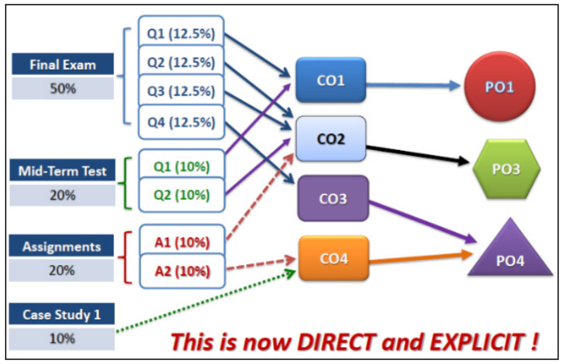

Figure 17 LOAMS calculation – (CDDH, 2019)

Conclusion

Learning outcomes is one important descriptor of national qualifications frameworks (NQFs). As of 2015, 140 countries have developed NQFs, with 6 regional frameworks (UNESCO, 2015). Some countries have comprehensive frameworks – basic education, technical vocational education and training, labour-based and higher education), whilst others are limited in scope and/ or with diverse ownership.

Some countries have sectorial or institutional learning outcomes such as Canada, China, Germany, Russia, United State of America and Malaysia; graduate attributes in Australia. Diverse practices in higher education compared to schools where more autonomy with different types of ownership, disciplines, modes of delivery, accountability to a wider group of stakeholders. Several key issues concerning learning outcomes are to be addressed, driven either by long-term trends or emerging concerns (Burns & Squires 1987).

LOAMS as a web-based system has helped a lot in calculating and generating reports for PLO and CLO levels. The system has facilitated the academic staff that used to use the conventional method in calculating the attainment of PLO and CLO before. The system has won several awards at the ministry and agency levels.

In general, learning outcomes are being benefited when they influence all components of the curriculum. The outcomes cover the scope and structure of the course content through which students will develop the knowledge, skills, and values; focus the instructional methods so that each learning activity has its specific purpose; determine how student placement and advancement (that is based on demonstrated learning rather than age) will be organised; determine how student learning (that emphasises on what learning students can demonstrate, rather than when they are required to demonstrate their learning) will be assessed, and focus attention on the learning environment to achieve the outcomes.

Based on the reports generated by our LOAMs, the continual improvement of instructional approaches through better clarity of the learning outcomes can be achieved, better alignment with the curriculum and assessment methods used (Chandra et al., 2008), a greater and greater sense of engagement due to the need to work with colleagues across disciplines as well as their own, continuous monitoring and assisting students to become more competitive in their achievements and lastly assessment of prospective students' capabilities.

Acknowledgement

Heartfelt gratitude to those who have been involved in developing the system mainly UniKL IT Division and CITC. A huge thank you also goes to UniKL Centre for Instructional Technology and Curriculum Development (CITC) staff who are directly and indirectly involved in the process. May this count as a contribution that benefits the organisation and the whole nation.

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A PRELIMINARY STUDY FOR E-LEARNING AS AN ALTERNATIVE TEACHING & LEARNING APPROACH FOR SKILL-BASED COURSES AT UNIVERSITI KUALA LUMPUR

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Introduction

The COVID–19 pandemic that has hit for more than a year has shifted on how T&L is normally conducted. Due to this pandemic, typical face-to-face classes had to be suspended to ensure the safety of students and lecturers. And to minimise the impact of Movement Control Order (MCO) towards T&L, online learning has been enabled as an approach to the conventional method. Online learning has been taken seriously due to MCO since it becomes the solution to ensure less disruption in T&L processes.

Thankfully, the concept and the idea of online learning that has been practiced by all Universiti Kuala Lumpur (UniKL) academics are well adapted and become a norm each year. Through the implementation of blended learning that has been established since 2017, all courses need to have a minimum of 30% of online components either through synchronous or asynchronous activities. The exclusion, however, applies to selected courses such as Final Year Projects, Industrial Training, and Co-curriculum activities.

This paper presents the summary of e-learning implementation at nine institutes under Universiti Kuala Lumpur (UniKL) which offer engineering and/or engineering technology programmes. Overall, UniKL has 171 academic programmes include all levels. Out of that figures, 66 academic programmes are categorised as engineering technology programmes and engineering programmes. Being the higher TVET institution, UniKL emphasises skill-based T&L in its every programme. The quality and effectiveness of the alternatives T&L deliveries compared to conventional (F2F) T&L delivery are also studied in this paper.

Method of Study for E-learning Implementation at UniKL

Nine UniKL institutes involved in this study are:

1. Universiti Kuala Lumpur Malaysian Institute of Information Technology (UniKL MIIT)
2. Universiti Kuala Lumpur British Malaysian Institute (UniKL BMI)
3. Universiti Kuala Lumpur Malaysia Italy Design Institute (UniKL MIDI)
4. Universiti Kuala Lumpur Malaysia France Institute (UniKL MFI)
5. Universiti Kuala Lumpur Malaysian Institute of Aviation Technology (UniKL MIAT)
6. Universiti Kuala Lumpur Malaysian Institute of Chemical and Bio-Engineering Technology (UniKL MICET)
7. Universiti Kuala Lumpur Malaysian Institute of Industrial Technology (UniKL MITEC)
8. Universiti Kuala Lumpur Malaysian Institute of Marine Engineering Technology (UniKL MIMET)
9. Universiti Kuala Lumpur Malaysian Spanish Institute (UniKL MSI)

In general, based on Course Design and Delivery, the courses at UniKL can be classified into three categories as follows:

1. Course Type 1 (with Lecture/Tutorial)
2. Course Type 2 (with Lecture & Practical)
3. Course Type 3 (with mostly Practical work)

Therefore, for this purpose of study, for every course type, the inputs on the following concerns are gathered from the institutes:

1. Replacement of F2F contents with alternative online activity
2. The platform/medium used for online lecture/tutorial
3. Level of Bloom's Taxonomy assessed in online lecture/tutorial/practical and differences with F2F assessments (if any)
4. Issues/challenges in the implementation of e-learning such as:
   a. Average of time spent to cover for online lecture/tutorial/practical
   b. Students' reaction/performance in adapting to the online learning mode

Results and Findings

The findings for e-learning implementation at UniKL are summarised according to the course type and the concerns outlined in the previous paragraph.

Replacement of F2F contents with alternative online activity for courses at UniKL

Table 1 Findings of F2F Contents with Alternative Activity According to Type of Course

Course Type	Findings
Type 1 (with Lecture/ Tutorial) Type 2 (with Lecture & Practical)	Lectures and tutorials are conducted via synchronous activities i.e through MS TEAMS meetings that happen as per the academic timetable. This allows two-way real-time communication to happen where students can get feedback immediately from their lecturers. To create better engagement, students are encouraged to turn on the camera to replicate physical-in-class scenarios.

cont... **Table 1**

Course Type	Findings
	All UniKL academic staff are highly encouraged to combine the online T&L with activities and assessments for effective and engaging learning sessions. Therefore, to support the effectiveness of the online class, relevant content such as videos from YouTube or MOOC videos are shared during the online class which later will be related to the course contents. At the same time, lecturers prepared online activities and assessments (summative or formative) using multi Web 2.0 tools such as Kahoot!, Mentimeter, etc. The courses are pre-equipped with such tools and it's proven to create an engaging and participative session. The course materials such as the presentation slides or any additional handouts are available on UniKL VLE before class commencement. Hence, students can easily do pre-study before joining the classes to enhance their understanding. Tutorial sessions are also supported via the usage of modern apps such as WhiteBoard that also allows collaborative activities between students and lecturers. The usage of external devices such as Wacom eases the lecturers to perform live scribbles to explain details of problem-solving. This is highly used for Mathematics or calculation based courses. Apart from that, the tutorial sessions are also divided into smaller groups for better monitoring. MS Teams with the feature of 'Breakout Rooms' allows the lecturers to auto or manually divide the students into smaller groups where these groups are assigned specific tasks or questions to be discussed. Lecturers will 'visit' the groups to run further checking on students' understanding

cont... **Table 1**

Course Type	Findings
	All T&L sessions conducted online are recorded, using MS Teams or other recording tools and made available online. The recordings are for ease of students' reference and viewing throughout the course duration. Soft skills are assessed by observing students' abilities, works, or participation in online activities using UniKL VLE or MS Teams. Rubrics are used to measure the skills. Asynchronous activities such as communication via instant messaging platforms or discussion via forums on UniKL VLE also happen collaboratively as additional support to the students.
Type 3 (with mostly Practical work)	Apart from the same implementation with Type 1 and Type 2 courses, for Type 3 courses it is found very unlikely the practical components to be substituted with simulation tools or software. For example, the competency for the welding may not be replaced with any simulation tools. It shall require the technology of AR/VR to ensure students are getting appropriate skills similar to F2F. Part of the practical components that able to be substituted is going through assessments during the ongoing demonstration and after report submission. The assessments will be based on the prepared rubrics. That shall include an online oral presentation or viva. Soft skills are assessed by observing students' abilities, works, or participation in online activities using UniKL VLE or MS Teams. Asynchronous activities such as communication via instant messaging platforms or discussion via forums on UniKL VLE also happen collaboratively as additional support to the students.

Platform/medium used for Online Lecture/tutorial for Courses at UniKL

Table 2 Findings of Platform/Medium Used for Online Lecture/Tutorial According to Type of Course

Course Type	Findings
Type 1 (with Lecture/Tutorial) Type 2 (with Lecture & Practical) Type 3 (with mostly Practical work	The main platforms are UniKL VLE and MS Teams. It is also supported via communication through emails and instant messaging channels

Level of Bloom's Taxonomy Assessed in Online T&L for Courses at UniKL

Table 3 Findings of Level Bloom's Taxonomy Assessed in Online T&L According to Type of Course

Course Type	Findings
Type 1 (with Lecture/Tutorial) Type 2 (with Lecture & Practical) Type 3 (with mostly Practical work	Levels of Bloom's Taxonomy covered via online assessments are ensured to be similar to F2F assessments as stated in the course syllabus All SLT and topics as described in the course syllabus are constructively aligned to the CLO(s) mapped to the original assessments

Issues/challenges in the implementation of e-learning for Courses at UniKL

Table 4 Findings on Issues/Challenges in Implementation of E-learning According to Type of Course

Course Type	Findings
Type 1 (with Lecture/Tutorial)	Significant additional time is required at the beginning of e-learning implementation. That is mainly due to familiarisation with the apps and settings. Lecturers agreed that the skills are mastered once the familiarisation period is over and it assists to administer the classes and groups.

cont... **Table 4**

Course Type	Findings
	On average, 1.5 hours are taken to complete two subunits/topics. That's however, depending on the depth and breadth for respective units/topics. The suggested SLT for online learning is available for lecturers' reference The main challenges in implementing online learning are the internet connection and stability of both lecturers and students. As an initiative, UniKL collaborates with Celcom Axiata to provide eligible students with sim cards for online learning purposes.
Type 2 (with Lecture & Practical) Type 3 (with mostly Practical work	Apart from the challenges detailed out for the Type 1 course, another main challenge for Type 2 and Type courses is to find the appropriate substitutions for simulation tools and software that can measure learning outcomes similar to F2F. The software identified is also limited to the trial/ demo version. Another challenge is to get the students to familiar with the software. This can be a burden if they need to learn a few software in the same semester.

Conclusion

The implementation of e-learning at UniKL has surely evolved. Type 1 courses can efficiently be conducted online. Multiple resources and apps have enabled the communications between the lecturers and students to be more effective. Type 2 and Type 3 courses with practical components should be evaluated on a case-by-case basis as the requirements are different. With the advances of technology, Type 1 and Type 2 courses are possible to be effectively conducted as virtual mode. Nevertheless, in either conventional or virtual mode, the fulfilment towards learning outcomes is the priority in ensuring good education and knowledge is applied. With all the details presented, UniKL would like to propose e-learning to be accepted as an alternative approach in delivering the engineering or engineering technology courses.

Acknowledgement

Heartfelt gratitude to those who have been involved in participating in the survey; mainly the nine UniKL institutes that have contributed to the data collection. A thank you also goes to UniKL Centre for Instructional Technology and Curriculum Development (CITC) staff who are directly and indirectly involved in the process. May this count as a contribution that benefits the organisation and the whole nation.

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READINESS TOWARDS ONLINE LEARNING DURING COVID-19 PANDEMIC: A PERCEPTION FROM ACADEMIC STAFF AND STUDENTS OF UNIVERSITI KUALA LUMPUR

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Introduction

The COVID–19 pandemic has disrupted teaching in a variety of institutions including UniKL. Due to COVID-19, typical face-to-face classes had to be suspended to ensure the safety of students and lecturers. However, to minimise the impact of Movement Control Order (MCO) towards teaching and learning, online learning has been enabled as an approach to the conventional method. This sudden transition from a face-to-face class to online learning that has started beginning March 2020 created a new 'prototype' for teaching and learning for academic staff and students.

Universiti Kuala Lumpur (UniKL) as one of the higher educational institutes (HEI) is also adapting to this transition. During the COVID–19 pandemic, online learning conducted via multiple channels such as UniKL VLE, MS TEAMS, etc are becoming the core medium of curriculum delivery. The medium is being used for all T&L activities including delivering skill-based or hands-on content, which is the key strength of UniKL higher TVET programmes.

This paper presents the findings of satisfaction level on online teaching and learning from the perception of academic staff and students. The effectiveness of online teaching and learning implementation and respondents' perception of online learning are also reported.

Mechanism of Measurement for Online Learning Satisfaction Level

For the online teaching & learning satisfaction survey, two different surveys are conducted for academic staff and students respectively and it is accessible via Microsoft Forms. The survey is for online learning that has been ongoing from March 2020 till December 2020. The surveys are intended for all levels of staff and students; from the foundation to the postgraduate programme.

Each survey consisted of nine questions. In the first question, the respondents need to classify their level of the programme to know which group is benefiting the online learning more than another.

In this survey also, both academic staff and students need to evaluate their online class experience by identifying the advantages and challenges of online learning. The effectiveness of online classes is also determined in this survey using a Likert Scale from 1 to 5 with details as follows:

1. Extremely effective
2. Very effective
3. Moderately effective
4. Slightly effective
5. Not at all effective

Considering mental health issue has become a spotlight during MCO, the respondents also need to rate the stress level of online learning during the pandemic.

Results and Findings

Overall Statistical Analysis of UniKL Online Learning Satisfaction Survey

Out of 1407 UniKL lecturers, 231 (22.1%) responded to the survey while for students, 1019 (4.32%) from a total of 23,595 responded as following details:

No	Level of Programme	Academic staff		Students	
		Number	%	Number	%
1	Postgraduate programme	20	8.7	99	9.7
2	Undergraduate programme	227	98.3	862	84.6
3	Foundation programme	16	6.9	58	5.7
4	Short course	8	3.5	[redacted]	[redacted]
	Total	**271***	**100**	**1019**	**100**

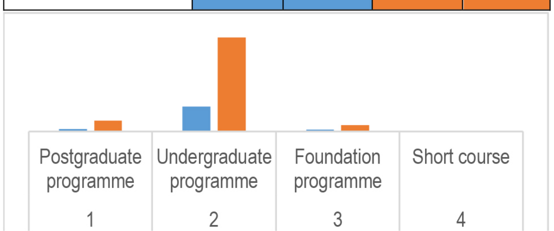

Figure 1 Details of respondents for the survey

Detailed Findings for UniKL Online Learning Satisfaction Survey

1. The preference of class format by the academic staff:

No	Class format	Academic staff		Students	
		Number	%	Number	%
1	Meeting regularly in a classroom setting	50	21.6	282	27.7
2	Delivering all course content online	20	8.7	172	16.9
3	Combination of face-to-face and online learning	161	69.7	565	55.4

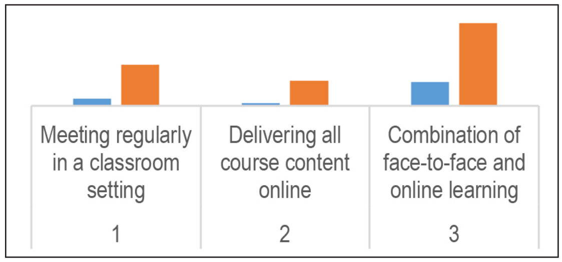

Figure 2 Findings on class format preferences

2. Rating of online class experience

No	Level of Class Experience	Academic staff		Students	
		Number	%	Number	%
1	Excellent	14	6.1	81	7.9
2	Good	119	51.5	313	30.7
3	Average	87	37.7	433	42.5
4	Below Average	10	4.3	129	12.7
5	Poor	1	0.4	63	6.2

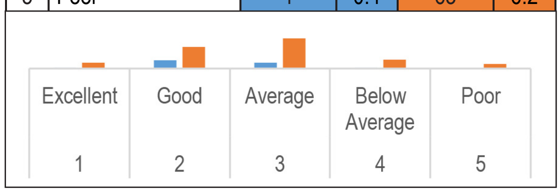

Figure 3 Findings on class experience

3. Effectiveness of online learning as a comparison to inline (face-to-face) class

No	Level of Effectiveness	Academic staff		Students	
		Number	%	Number	%
1	Extremely effective	5	2.2	44	4.3
2	Very effective	19	8.2	124	12.2
3	Moderately effective	135	58.4	493	48.4
4	Effective	60	26.0	284	27.9
5	Not at all effective	12	5.2	74	7.3

Figure 4 Findings on online learning effectiveness

4. Stress level of online teaching

No	Level of Stress	Academic staff		Students	
		Number	%	Number	%
1	Not at all stressful	28	12.1	101	9.9
2	Slightly stressful	93	40.3	263	25.8
3	Moderately stressful	80	34.6	376	36.9
4	Very stressful	23	10.0	192	18.8
5	Extremely Stressful	7	3.0	87	8.5

Figure 5 Findings on online learning stress level

5. Cooperation/assistance given by the students/ lecturers during online learning

No	Level of Cooperation	Academic staff		Students	
		Number	%	Number	%
1	Very cooperative	22	9.5	412	40.4
2	Somewhat cooperative	126	54.5	417	40.9
3	Neither cooperative nor non-cooperative	55	23.8	169	16.6
4	Somewhat non-cooperative	25	10.8	20	2.0
5	Very non cooperative	3	1.3	1	0.1

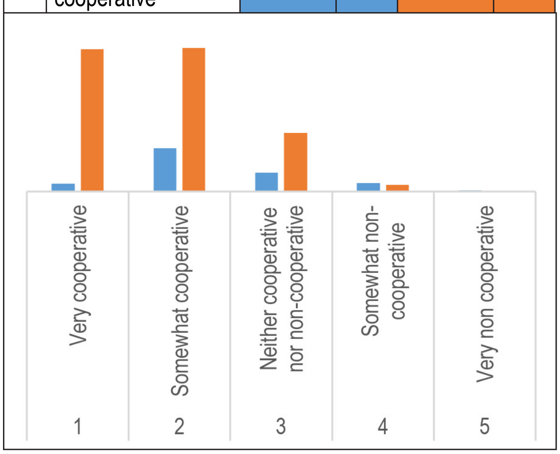

Figure 6 Findings on cooperation from academic staff/ students

6. Added values gained from online teaching/learning

No	Added Value	Academic staff		Students	
		No.	%	No.	%
1	More time and space flexibility	125	54.1	596	58.5
2	More creative in teaching and completing tasks	99	42.9	597	58.6
3	Give encouragement to explore new technologies and tool	157	68.0	408	40.0
4	Better understanding of various teaching/learning methods/ techniques	118	51.1	231	22.7
5	Give awareness of what is available/not available around me	90	39.0	287	28.2
6	Other	6	2.6	28	2.7

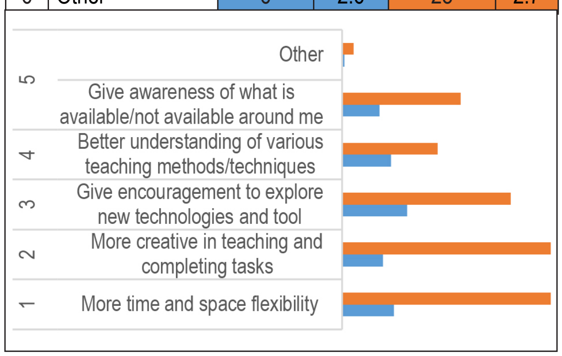

Figure 7 Added values from online learning

7. Challenges faced during online teaching/learning

No	Challenges	Academic staff		Students	
		No.	%	No.	%
1	Unavailable/ Unstable Internet connection	156	67.5	743	72.9
2	Difficult to discuss with other SMEs/ group members	48	20.8	647	63.5

No	Added Value	Academic staff No.	Academic staff %	Students No.	Students %
3	Limited facility to teach or do tasks at home	113	48.9	406	39.8
4	Limited knowledge on how to search for information	10	4.3	247	24.2
5	Limited knowledge on how to use the technologies and tools	53	22.9	229	22.5
6	Difficult to manage time	28	12.1	342	33.6
7	Other	57	24.7	54	5.3

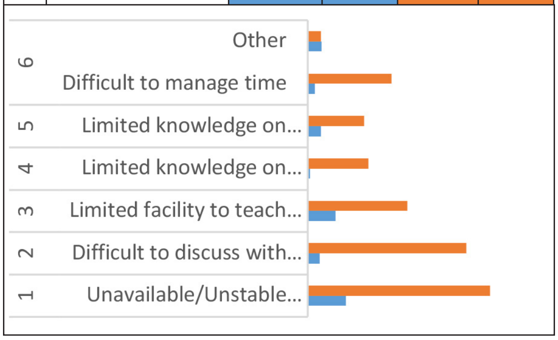

Figure 8 Challenges in online learning

Conclusion

From the survey conducted, a few perceptions from academic staff and students can be evaluated and concluded:

Given options, both lecturers and students vote to have a combination of face-to-face and online learning as the class format. This was voted by 161 (69.7%) academic staff and 565 (55.4%) students. Only 20 (8.7%) lecturers and 172 (16.9%) opted for fully online learning.

As for the online learning experience, academic staff experiences it better with 220 (95.2%) rated excellent, good, and average. However, on the student's side, it tends to be lower with 827 (81.2%) rated the same. Almost half of that particular group felt they only had an average online learning experience. Despite that, the online learning experience was not coherent with the perception of the effectiveness of online learning. 159 (68.8%) academic staff and 661 (64.9%) students felt online learning was effective.

As expected, very least respondents agreed the online learning is not stressful at all. This is supported by only 28 (12.1%) and 101 (9.9%) voted so. The rest of the respondents agreed that online learning is stressful. There was also a small group of academic staff and students who claimed the online learning was extremely stressful. These figures are consistent with the cooperation received by the students or the assistance received from the lecturers as support towards online learning. Only 22 (9.5%) academic staff rated their students are very cooperative during online learning. On the other hand, 412 (40.4%) students are very satisfied with the assistance given by their lecturers.

The flexibility to study from home or any location is shown as one of the strongest advantages in online learning and it was agreed by both academic staff and students. It was voted by 125 (54.1%) lecturers and 596 (58.5%) respectively. This is probably due to the contents can be delivered to students using two different approaches: self-directed and lecturer-directed learning. Self-directed e-learning allows the learner to manage his activity independently. This eventually contributes to another agreed advantage of online learning which opportunity to explore new technology and tools. 118 (51.1%) academic staff also agreed that online learning contributes to a better understanding of various teaching methods/techniques. This is especially for technical academic staff that needs to convert their hands-on experiment to simulation or remote labs. On the students' side, 597 (58.6%) students found out the lecturers are more creative to ensure students are engaged with the online class. This, at the same time, allows creativity in completing the tasks as well.

Online learning is not without its disadvantages. The main challenge faced by the respondents in the survey was an unavailable or unstable Internet connection. This factor was agreed upon by 156 (67.5%) lecturers and 743 (72.9%) students. Another major disadvantage agreed by both respondents; 113 (48.9%) academic staff and 406 (38.8%) students are limited facilities to do tasks at home. This is most probably due to unexpected extensions of MCO. The students, for example, left their laptops in the hostel and limited the online learning. 53 (22.9%) lecturers thought they had limited knowledge on how to use the technologies and tools while 647 (63.5) students found out it was difficult to discuss with group mates. The online platform is always ready for discussion however it needs to be supported with a good/stable Internet connection.

Overall, online teaching and learning are widely accepted by both academic staff and students as the new norm, even for courses that previously relied heavily on skill-based or hands-on learning processes, which made up most of UniKL programme contents. With the assistance of technologies like a virtual classroom, AR/

VR, simulation tools, video and audioconferencing, and MOOCs, delivery of theory and practical content are possible despite the differences in access platform, venue, or time. UniKL is currently taking several initiatives to reduce the digital gaps between students so that everyone can enjoy online teaching and learning.

Acknowledgement

Heartfelt gratitude to those who have been involved in participating in the survey; mainly UniKL academic staff and students. A thank you also goes to UniKL Centre for Instructional Technology and Curriculum Development (CITC) staff who are directly and indirectly involved in the process. May this count as a contribution that benefits the organisation and the whole nation.

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EASIFRENCH: HOLISTIC MODEL LANGUAGE SOFTWARE BASED ON CONTENT MANAGEMENT SYSTEM (CMS) AT A HIGHER TVET EDUCATION PROVIDER

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Introduction

Current and future educational trends are focused on Information and Communication Technology (ICT). The use of the Internet has become a catalyst and opens up new dimensions in the approach of teaching and learning (T&L) because of its capabilities in supplying various sources of information using effective search engines and directory engines (Sonnenrich 1998). The development of ICT has also given an impact on the world of a good education at the pre-school level nor the level of higher education. The advent of the Internet and websites, in addition to computing facilities which are sophisticated and fast providing a lot of convenience to students and instructors it will be one important thing in the field of education today (Anderson & Elloumi, 2004; Hall, 2000a; Kramer, 2000).

Most nations have strived for producing graduate students who can master multiple languages in the face of the globalised world of the time. Malaysia is no exception in this matter of where the emphasis has been given in producing human resources who can master a foreign language in driving the economy knowledge-based (k-economy) and also competitive at the national or international level. In this world, the current globalisation of foreign language mastery is no longer seen as added value but becomes a necessity in competing in the arenas of politics, security, trade international, and education. This is also in line with the goal National Key Success Areas (NKRA), National IT Council (NITC), and the National Information Technology Agenda (as contained in the Malaysian Smart School Roadmap 2005-2020: An Education Odyssey, 2005: 23). According to The Smart School Milestones (4 waves), on the 4th wave (2010-2020), technology will be a key enabler in teaching and learning. Educational trends current and future are application-focused Information and Communication Technology (ICT) or Information and Communication Technology (ICT) in education as one of the main focus in Education Development of the National Vision Age 2001-2010 (KPM 2001; 2006).

Research Background

Web-based learning or also known as e-learning can change the way a person or organisation acquires the skills and knowledge that is new. According to Jeurissen (2004), e-learning is defined as the use of innovative technologies and models of learning that can be used without being limited to place or time factors. Dalgarno in Sidek et al. (2007) also stated that students can develop knowledge by accessing a variety of learning resources that are abundant in the Internet space. According to Sufyan (2001), with the advent of the Internet, students can now access many language resources online such as notes, documentary items, essays, online quizzes, announcements, reference materials, and more. Some studies on e-learning show use of the Internet has left a huge and positive impact on those who are learning the language.

According to Olivier (2000), the use of Internet technology or the web in language learning is a new medium in language P&P. Sufyan (2001) states Learning Computer-Based Language (CALL) or Computer Assisted Language Learning (CALL) is not a new thing in the world of education. Most use of PBBK is still not widespread in Malaysia and not yet integrated into the national education system.

The changes and development of ICT have changed the national education scenario. In T&L scenario is also not exempted from accepting the impact of this development. Olivier (2000) said that the use of Internet or web technology in language T&L is a new medium. Supyan & Zaini (2005) said that web-based T&L allows students to interact with other peers without physical and time boundaries. Web-based T&L is also seen as relevant to lectures, assignments, course management, assessment, and providing a new platform or environment in language T&L. Supyan (2006, 2006a, 2006b and 2007) found through his experiences and highlights of past researches, web-based language T&L is also able to improve language and communication skills as well as open space for students to master (acquire) language proficiency and extend the process of T&L from the conventional environment to the online environment.

Therefore, this study will develop an interactive and innovative web-based Basic French language software specially developed to meet the level and needs of today's students. According to Sufyan & Roziana (2001), featuring interactive features such as repetition, drills, corrections, and spontaneous rewards, language learning will become more meaningful and leave a positive impact on educators and students.

Problem Statements

The problems of this study are highlighted through a preliminary study conducted against the teaching staff who teach the language in France in addition to the experience and observations of the researcher against low achieving students in French and reports on student academic performance against the subject. A needs analysis study needs analysis) was conducted among instructors and students to find current constraints in R&D French in a Technical IPTS here. Findings preliminary studies conducted indicate several problems or constraints have been identified, such as i) Relatively low student interest and motivation in learning French, ii) Lack of use audio-video equipment in French language R&D, iii) Relatively limited time allocation, iv) A learning style different, v) Application of limited cultural aspects, vi) Relatively less Internet usage or online access satisfactory, vii) Infrastructure facilities or infrastructure, viii) Use of text, ix) Concerns about handling the latest teaching equipment, x) Teaching non -student examination -based, and xi) Lack local software.

For French language T&L in Southeast Asia, Dadang (2008) meanwhile says only a few countries like Vietnam, Cambodia, and Laos were once occupied by the French nation. Most other Asian countries remain have limited connections, both geographically nor the influence of the francophone. In addition to the issue of geography, it should be noted also the existence of differences in linguistic character which separates French from the other languages that exist in Southeast Asia. This difference translates to various levels such as aspects of grammar, syntax, and phonetics. That is, the difference doesn't just show up on the level of geographical limitations, in fact, it also covers logic language, and culture. It is therefore important in the process the development of a local factor or value software local is taken into account and more importantly the character of the nation applied in such development.

Basic French language software was developed for allowing T&L to be carried out regardless of time and place limits either through the Internet (on-line) and not (off-line). This development is very important because it gives students the freedom to follow the learning process according to their level of ability as well as the freedom to repeat any part of the subject that they do not understand according to their respective needs and levels of understanding.

Research Objectives

This study was carried out to develop a web-based Basic French Software prototype (multimedia software) for French-language subjects' basic level. It will also involve a web application that offers a variety of facilities in providing an interactive, effective and innovative learning environment. This study will also evaluate the prototype features of language software Basic French from several aspects such as approach pedagogy, learning strategies, learning theories, aspects of usability, and testing the effectiveness of use through the achievement of the use of

Language Software French Basic web-based technology compared to conventional teaching and learning (T&L) processes.

Research objective

To achieve the stated objectives of the study, two main objectives of the study have been established, namely:

1. Develop Basic French Software (multimedia software) web-based for the subject Basic French for students of a diploma level at a Private Institution of Higher Learning (IPTS) Technical as a case study. These sub-objectives involve the following aspects:
    a. Identify and design methodologies web-based Basic French software development or Basic French subjects for students' semester one diploma level.
    b. Design and develop an ID model (design instructional form) for Basic French Language Software for Science & Engineering Technology National Conference 2015 semester one student of diploma level at an IPTS Technical.
2. Developing prototypes of Basics French language software for French-language subjects Basics for students' semester one diploma level at a Technical IPTS.

The study also evaluated Basic French software from several aspects such as pedagogical approaches, learning strategies, learning theories, and interactive multimedia elements as well as effectiveness aspects through pre and post-evaluation for a group of students who follow the T&L of this Basic French software.

Research questions

To achieve those objectives, a few questions the main has been constructed as follows:

1. What is the methodology of language software development Appropriate Basic French is used in the teaching process and learning for diploma-level semester one student in IPTS Technical?
2. What is the instructional design model) - the appropriate ID model for the Language Software Basic French in the process of teaching and learning for diploma level semester students at IPTS Technical?

Conceptual Framework of the Study

In this study, instructional design (instructional design) is adapted from the ADDIE design model. Model ADDIE has five main levels namely stages of analysis, design, development, implementation, and assessment. According to Ismail (2002), teaching is based on the web serves not only as an added value but as a key requirement towards smart learning. Sufyan (2000), states that PBBK is multimedia capable of integrating various forms of media and theory learning that also supports the use of pictures, graphics, video, and sound to help students understand and remember anything learned better (Kemp & Smelle 1989). Romiszowski (in Sufyan 2000) states that students can remember about 20% from what is seen, about 30% of nothing that is heard, and about 60% of such that made. Because Computer-based T&L multimedia software is capable of integrating various forms of media, learning processes language will become more interesting, meaningful, and productive.

EASIFRENCH software has successfully incorporated multimedia elements in its development. The software has incorporated elements such as text, graphics, audio, video, animation, hyperlinks, and so on to attract students to use this software. Alessi & Trollip (2001) say that the use of text, video, and audio can help students as well as suitable for language learning for listening, speaking, and reading skills. Ismail (2002) said that these multimedia elements allow for interactivity and help students in understanding the presentation of information presented. This finding is supported by Jamaluddin & Zaidatun (2003) who stated that the use of text and other multimedia elements can maintain students' interest in following online learning. Afendy & Mohamed Amin (2009) stated that each software to be developed must combine several things such as audio, visual, animation, and graphics so that the delivery of information can be done by involving the various senses of the user.

The presentation of information through text is less effective when compared to text and graphics. Multimedia-assisted learning can provide consistent and guaranteed learning. A study by Mayer (2001) and Reed (2008) found that there was a difference in the increase in scores after students used multimedia-assisted learning software. The increase in scores may be due to software design that has been able to improve learning effectiveness. Their findings also show that the use of learning can be used effectively to meet the needs of different students in terms of ability, intellect, and learning style.

In this study, the instructional design model was adapted from the ADDIE model and the Multisensory model. ADDIE Model has five main stages namely analysis stage, design, development, implementation, and evaluation. As we well know, the ADDIE model is an instructional design that is often referred to as the basis for other models. Models such as Dick & Carey's (1990) ID model and the ASSURE model (Heinech et al. 1996) can be inferred in the ADDIE model.

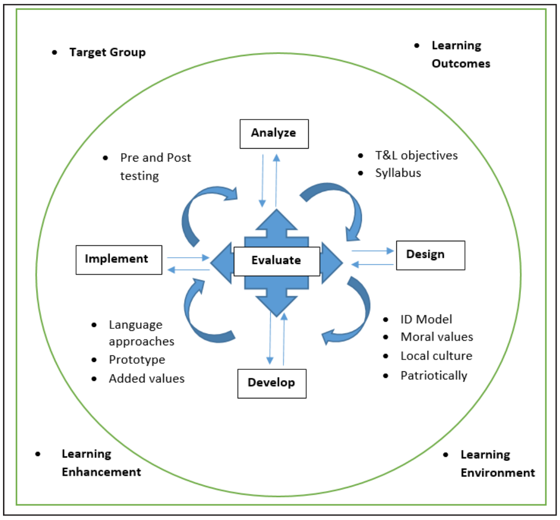

Figure 1 The Holistic Life Cycle Model of Basic French Software

Research Methodology

The study method used a quasi-experimental design pre-posttest type for groups not balanced. The subjects or respondents of the study consisted of three French lecturers and a total of 56-semester students one for the Diploma in Engineering Technology major in an IPTS Technical in Hulu Langat district. In this research, students will be divided into two study groups separately, i.e. a total of 28 people will follow the points Basic French lessons using prototypes software to be developed (treatment group) while 28 more students from different classes will learn Basic French conventionally (control group). In this study, a total of seven instruments will be used for problem assessment purposes, needs analysis (identifying problems in R&D current), formative and summative evaluation of Computer-Aided T&L software. The findings of the study will be analysed using SPSS software version 11.5 and descriptive and inferential statistics will be used to answer research questions.

1. Study population and sample
   The subjects or respondents of the study consisted of 3 lecturers French, 4 experts (2 experts for the assessment of language aspects and 2 experts for technical aspect assessment), and a total of 56 first semester students majoring in Diploma in Technology Engineering at a Technical IPTS in Hulu Langat district. In this study, students will be divided into two separate study groups, i.e. a total of 28 people will follow Basic French subjects using a prototype of the developed software (group treatment) while another 28 students from different classes will learn Basic French conventionally (control group).

2. Procedure and implementation of the study
   In the process of developing Basic French language software (EASIFRENCH), several phases according to the function have been in following that is:
   1. Software requirements analysis process
   2. The process of designing a software prototype model
   3. Software development process
   4. Software execution process
   5. The process of testing and evaluation of software from several aspects of use.

   The development of EASIFRENCH was based on using ADDIE Model that involves five stages; (Analysis, Design, Development, Implementation, and Evaluation).

3. A pilot study
   A pilot study was conducted on 15 students to determine the acceptability and validity of all items in questionnaires used in this study. Though some constructs were adapted from some reviewers then, but it is tested again to test the reliability of the data items available in the list reviews or questionnaires. The internal consistency method used in this pilot study was the Cronbach Alpha method which this

Table 1 Cronbach Alpha Values

Dimension / Constructs	Items No	Cronbach Alpha Value
1.Presentation Design aspects	7	0.6053
2. Interactivity aspects	7	0.6096
3. Content organisation aspects	6	0.6455
4. Language aspects	32	0.8635
5. Learning approaches aspects	13	0.8676
6. Learning theories aspects	22	0.6144
7. Learning strategies aspects	19	0.6290
TOTAL	**122**	**0.7662**

method can be used for all data types (Norazah, 2002). Here are the index values reliability of the results of the pilot study conducted.

4. Study Instruments
According to Mohd. Majid Konting (2004), research instruments are important for achieving the objectives of a study and it is also a measuring tool used to measure the variables studied. According to him again, A good measuring tool will accurately measure something variables to be measured. In running this study several research instruments were used. Among them is the direct observation of the researcher to students who use this software, unstructured interviews with lecturers, and several sets of a questionnaire that included questions about respondent's background, teaching objectives and learning, ease of use of software, multimedia features, issues instructional design, screen design (user interface) and so on. These sets of questionnaires are assessments continuously used for the evaluation of prototypes which is developed.

Study Findings and Discussion

Q1: What is the methodology of language software development Appropriate Basic French is used in the teaching process and learning for diploma-level semester one student in IPTS Technical?

From the results of the study, researchers have found Basic French language software development has been applied trader approaches, theories, strategies appropriate development in P&P for first semester students. Findings of the study from the aspect of presentation design, aspects interactivity, the content organisation as well as integration multimedia elements further strengthen the development of this software.

Q2: What is an instructional design model) - the appropriate ID model for the Language Software

Basic French in the process of teaching and learning for diploma-level semester students at IPTS Technical?

From the results of a study on instructional design (conceptual model) and the resulting modules, the development of this software was developed based on the following aspects,

1. Basic French language teaching approach
2. Teaching Sequence
3. Holistic development of students
4. Designed modules
5. T&L process that integrates the elements
6. Interactive multimedia

The findings of the study have shown that this Basic French software has successfully applied the pedagogical approach of tutorials, drills, and educational games. This pedagogical approach is found to be appropriate and meet the needs of users with different backgrounds and learning styles. The pedagogical approach used as the basis in this development has succeeded in improving student achievement in the topics taught and the content included is appropriate to the basic level of learning French. The findings of this study are supported by Juriah et al. (2001) and Sya Azmeela (2003) who stated that tutorial and drill & practice approaches allow students to select and access information without sequence as well as assist weaker students in correcting their weaknesses.

Conclusion

Computer capabilities and their role in helping teachers and students in T can no longer be denied. Computers and the Internet as tools in learning, shaping towards critical and creative thinking as well self -motivation (Jonassen 1996). The purpose of this study done is to develop a software education for Basic French subject web-based technology. Prototype development for this software is expected to make a new contribution in the world of education in particular and in learning a language in general. This study is also important for giving information to certain parties in drafting and formulating strategies to increase the use of technology while in an ever-changing educational process. This coincides with the aspirations and vision of the country emphasising the use of the latest technology in the era of information and communication technology.

From the findings of the study, this research found that a high level of agreement has been given by experts and students in terms of pedagogical approaches, learning theories included, learning strategies applied as well as interactive multimedia elements and system usability in improving student achievement.

This study is also expected to contribute to enriching the collection of teaching materials, especially in the T&L of Basic French as well as assist the relevant parties (stakeholders) in planning and managing the form of teaching in the future. The findings of this study are also in line with the Malaysian Smart School Road Map 2005-2020: An Educational Odyssey-which expects the fourth wave (2010-2020) will focus on strengthening teaching materials and making technology an enabler in the teaching and learning process.

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UNIKL HIGHER TVET EDUCATIONAL MODEL: PRODUCING QUALITY GRADUATES STUDENT

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Introduction

TVET is defined as a comprehensive term referring to those aspects of the educational process involving, in addition to general education. TVET is also a combination of the study of technologies and related sciences, as well as the acquisition of practical skills, attitudes, understanding, knowledge relating to occupations in various sectors of economic and social life (UNESCO, 2011).

TVET should evolve in line with technological and economic development to ensure the relevancy of the products produced by the system. The future requires not only a technically-sound workforce In Malaysia, the quality and skills of human resources are very crucial to the success of economic transformation as well as realising Malaysia's vision 2020 of becoming a developed nation. According to the Economic Planning Unit (EPU), the demand for labor especially for the TVET sector is expected to increase with the introduction of National Key Economic Areas (NKEA). NKEA will require a workforce of up to 3.3 million by 2020 of which 1.3 million are to be TVET graduates. It is predicted by 2030, the global workforce will increase to 3.5 billion people with 40 million highly skilled workers. but also an independent, innovative, and enterprising talent (Kamaruzzaman 2015).

NKEA is defined as an important driver of economic activities that potentially and directly contributes towards the Malaysian Economic Growth measurable by the National Gross Income (GNI) indicator (Pang 2011). Malaysia will leverage its competitive advantages by prioritising investment and policy support behind a limited number of key growth engines. Hence, the Economic Transformation Programme focuses on 12 National Key Economic Areas (NKEAs) as announced in the Tenth Malaysia Plan (Department Prime Minister, 2011). These NKEAs will receive prioritised government support including funding, top talent, and Prime Ministerial attention.

Technical and Vocational Education and Training (TVET) includes formal, non-formal, and informal learning that prepares young people with the knowledge and skills required in the world of work. According to the United Nations Organisation for Education, Science and Culture (UNESCO), TVET has been called many names over the years – apprenticeship training, vocational education, technical education, technical-vocational education, occupational education, vocational education and training, professional and vocational education, career and technical education, workforce education, workplace education, and others.

Scenario TVET

Chronology of TVET in Malaysia Context

Maznah (2001) said that TVET programmes in Malaysia are offered at certificate, diploma, and degree levels by seven ministries that include the Ministry of Higher Education (MOHE), which offers the most TVET programmes to the highest number of students. In Malaysia, the establishment of initial public TVET institutions had started in 1964, which started with only two public TVET institutions at that time and is now almost over 500 public TVET institutions. These institutions offer a variety of training and skills of TVET that developed for realising the Government's intention. For that, year after year TVET constantly updated and improved to meet the demands of the industry in producing graduates' skills and further enhance the employability of graduates.

According to the national development plan for the period 2016 - 2020 as presented, there will be an increase in demand for an additional 1.3 million TVET workers by 2020 in the 12 National Key Economic Areas (NKEA) identified under the government's Economic Transformation Programme (ETP). In 2013, out of the 429,000 students who sat for the SPM examination, 321,000 students enrolled in higher education and training programmes, with more than 50% enrolling at TVET institutions (Department of Prime Minister, 2012).

Among the measures seen as vital to increase the quality of development and the strengthening of technical and vocational education is through education. Malaysia's TVET standards continued to reach new heights, as proven through the country's strong showing at the ASEAN Skills Competition – in which Malaysia placed second behind Vietnam – and the country's involvement in developing Vietnam's National Occupation Skill Standards (NOSS, 2011).

The Government will continue to elevate the Education NKEA to ensure our education offerings meet the needs of a high-income and globally competitive economy. It is also crucial for private sector players to continue supporting our goals towards 2020 and help to drive our transformation process. Having world-class education in Malaysia will also enable local students to pursue quality education at a lower cost compared to going abroad. Our Education NKEA will continue driving the growth of our education industry and also act as an enabler by feeding in talent into the rest of the NKEAs to ensure that we have sufficient human capital in place to sustain the growth and development of our Malaysian economy.

TVET Providers In Malaysia

According to Pang (2011), there are seven ministries involved in providing TVET training and education. They are as follows:

1. Ministry of Education
2. Ministry of Higher Education
3. Ministry of Human Resource and Development
4. Ministry of Youth and Sports
5. Ministry of Works
6. Ministry of Rural Development
7. Ministry of Defence
8. Ministry of Agriculture

Private providers – for example under MARA, there are the *Institut Kemahiran MARA*, and *Pusat Giat MARA*, among others. There is also the Universiti Kuala Lumpur (UniKL), under which the German-Malaysia Institute, British-Malaysia Institute, etc, are placed. In addition, there are institutions such as the YWCA that offer vocational training to the public.

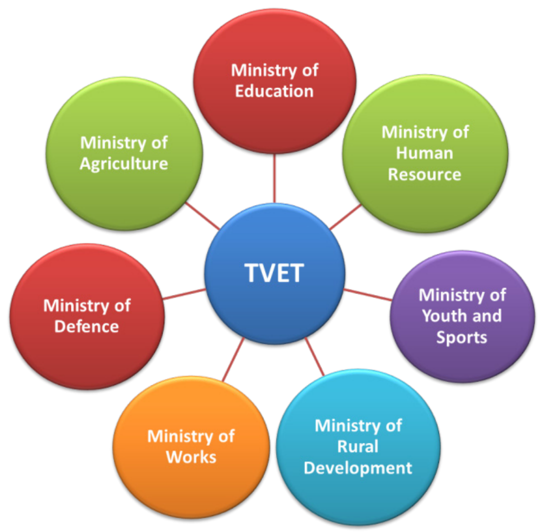

Figure 1 TVET Providers In Malaysia

Challenges and Issues in TVET

Kamaruzzaman et al. (2015) underlined five main challenges in TVET that is;

1. Strengthening the collaboration between Industry and TVET providers throughout the value chain from student intake, curriculum design, delivery, and employability or job placement.

2. Poor perception and recognition of TVET
3. The multiplicity of provision, certification, standards, and curricula
4. Weak monitoring and evaluation
5. Lacking in efficiency and quality

Pang (2011) said that among main issues in TVET are,

1. TVET governance that is inconsistent
2. TVET delivery are not integrated
3. Less Recognition for technologist
4. Defragmentation of TVET provision
5. Students TVET enrolment
6. Quality in TVET curriculum

Zuraidah (2008) said among the challenges in TVET are:

1. Demand-Supply Mismatch
   Despite the many TVET providers in the country, TVET is not without issues and challenges. For starters, there are many reports of a demand-supply mismatch, which in part contribute to unfilled employment vacancies in the industry (for example, as reported in Star Education, 31 August, 08). There is a need to improve links between schools and the industry (EPU, 2008) to minimise this mismatch.

2. Issue of Status
   Some authors claim that too much attention and resources are given to 'academic' rather than vocational education (Chin, 1994). As reported by many authors vocational education in Malaysia suffers the same fate it suffers elsewhere – that it is only for those who do not do well 'academically' (Mustafa, 2003).

3. Non-Homogeneous Participation of Ethnic Groups
   Another issue faced by Malaysia is that of comparative participation of all ethnic groups in TVET. Malaysia being of multi-ethnic composition, every ethnic group must be fairly represented in this arena. Thiruselvam (2006) reported that Indian youths make up less than 3% of the total intake to TVET places offered in the country

UNIKL'S GLOBAL CURRICULUM IN PRODUCING QUALITY TVET GRADUATES

UniKL is proud to carry the torch of Higher TVET and this is core to the mission and vision of lifelong UniKL. In We4 Asia Blueprint, the definition adopted HTVET as follows:

Higher TVET is an innovative educational model that embodies the spirit of the democratisation of knowledge and progress in science, technology, and trade. It is designed to produce graduates who meet the labor market demand at the global level that is formed by the values of a noble character and a high character. Driven by the belief that a sustainable education system needs to be flexible and adapt to the needs of the community, this model emphasises the strong relationship between the organisation and related industries.

1. The symbiotic relationship and dynamic between academia and industry to add value to an application-oriented integrated curriculum that provides a platform to produce graduates who are independent, creative, and innovative and able to contribute and achieve multiple benefits by becoming part of the country where innovation is the main driving force and high income located in the fastest-growing continent in the world for this century.

   UniKL Higher TVET Educational model was developed to ensure the quality and excellence in learning and teaching in UniKL. It emphasises two important components,

   a. Innovative Teaching and Learning
   b. Quality Curriculum

These two important components in the model are supported by UniKL's shared values of Commitment, Integrity, Teamwork, Innovativeness, and Excellence (CITIE) which guide the culture and practices of UniKL academic staff and students.

The UniKL Value-Based HTVET Educational model also supports the 5 Programme Educational Objectives (PEOs) and UniKL educational goals, which are in line with the University's mission and vision.

There are seven features of Innovative Teaching and Learning, which are,

1. Teaching Factory
2. E-Learning
3. E-Assessments

4. Blended Learning
5. Experiential Learning
6. Active learning – such as Problem-based Learning, Project Orient Based Learning and Mastery Learning
7. Industrialmanship ++

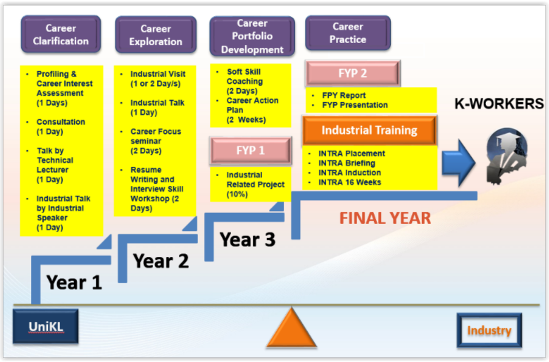

Figure 2 UniKL Industrialmanship Framework

The second component of the UniKL Educational model is Quality Curriculum. UniKL puts great importance on ensuring a quality curriculum is delivered to the students to ensure knowledgeable graduates with high employability potentials. This is done by having,

1. Technical subjects embedded with entrepreneurial elements
2. One programme one professional certificate
3. Academicians with industrial background
4. Research and Innovation

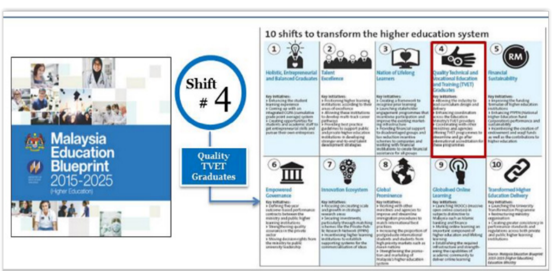

Figure 3 Shift No.4 – Quality TVET Graduates (MEB: 2015 – 2025)

The current trends in Malaysian higher education are based on four factors, 1) Globalisation, 2) Teaching and Learning, 3) Governance and 4) Knowledge-based Society. Based on these trends, the government through The MOE has formulated three education blueprints: The Malaysian Education Blueprint 2013–2025, NHEAP 2007–2010, and NHESP beyond 2020 to pursue the idea of becoming an "education hub" in the region, especially in South East Asia.

UniKL aims and endeavors to produce students who are,

1. Knowledgeable and highly-skilled: Students who are knowledgeable and equipped with industry-ready skills;
2. Deeply spiritual: Students with good values who are honest, courageous, confident, humble, and with a strong sense of integrity and responsibility;
3. Altruistic leaders: Students who are proactive, resilient, visionary, innovative, collaborative, and supportive in their environment;
4. Lifelong learners: Students who are forward-looking and strive for excellence in their working environment as well as in their personal lives;
5. Noble citizens: Students who are law-abiding, loyal, courteous, and compassionate citizens of Malaysia;
6. Entrepreneurial: Students with creative, optimistic, and entrepreneurial mindsets.

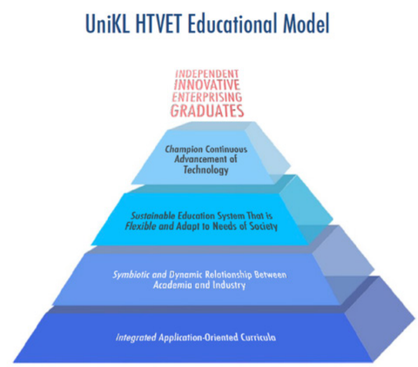

Figure 4 UniKL Higher TVET Educational Model

Discussions

Universiti Kuala Lumpur (UniKL), which is wholly owned by MARA, was established in 2002. The purpose of its establishment is to contribute towards the advancement of science and technology by training individuals to become knowledgeable, highly skilled, and entrepreneur savvy with the capability to become a leader in the technological field Industry-specific facilities provided during the learning process produce capable graduates who are ever ready for the local and international market. UniKL's uniqueness is in offering Engineering Technology courses that emphasise hands-on or experiential learning.

UniKL Educational Model is the outcome of the process, which is to produce a holistic graduate. This is done by combining the concepts of Engage, Explore and Experience with UniKL core values Commitment, Integrity, Teamwork, Innovation, and Excellence to mold UniKL graduates to be Knowledgeable & Highly-Skilled as well as Deeply Spiritual, Altruistic Leaders who are Entrepreneurial and Noble Citizens who have the spirit of being Lifelong Learners.

The curriculum is the pillar of TVET training. Various initiatives have been implemented which include the regular conduct of tracer and employer studies, curriculum reviews, and the setting up of the Industrial Advisory that comprises representatives from major industrial sectors, professional associations, and key government agencies to ensure that the syllabus is parallel with what the industry required.

Conclusion

A holistic human capital can be achieved when individual self-actualisation arises. This can be done by developing technical and cognitive elements in TVET. In UniKL, Higher TVET Educational Model has been introduced as a framework that emphasises knowledge and skill delivery through global curricula and programmes for students during the whole academic value chain, which eventually increases the competitiveness and marketability of as well as a part of its transformation strategy as a globalised higher education provider.

At the National level, TVET in Malaysia focuses on employability issues of its future products (future workforce). UniKL has come out with its model or framework: Higher TVET Educational Model that emphasises two main components; innovation in teaching and learning and quality curriculum. In line with the challenges of globalisation and to meet industry needs and the growing job market, UniKL equips graduates with the knowledge, expertise, technology, entrepreneurial skills, leadership skills, and excellence.

Although the issues relating to TVET are not new in the country, they are nevertheless complex and may require more than just a fundamental approach. A holistic and wide approach needs to be tackled effectively as well as in the planning process and should be put together before any strategic solution can be considered. The impact of globalisation and the uncertainties of the world economy will greatly affect the long-term strategy to initiate any necessary plans that will be made.

Lastly, this study also hopes to share certain measures for effective governance of the TVET sector so that the decisions and actions of multiple stakeholders towards driving the performance and quality of this sector can be harmonized. Since education is considered as the key to effective development strategies, TVET must be the master key that can alleviate poverty, promote peace, conserve the environment, improve the quality of life for all and help achieve sustainable development.

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TRACK III

INDUSTRY DRIVEN CURRICULUM

INTEGRATION OF PROGRAMMING BASED ONLINE TEACHING AND LEARNING RESERVOIR SIMULATION COURSE WITH CONSTRUCTION OF IN-HOUSE SOFTWARE USING PYTHON LANGUAGE

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Introduction

Online learning has been widely proposed as an option due to the recent outbreak of the Covid-19 pandemic, which generally stirs panic and restriction in people's movement. This event has a significant and challenging impact on the education sector where a new future roadmap on education learning and delivery must be designated and improvised to cater to the current circumstances. Based on a study conducted by the Faculty of Mathematics and Natural Sciences of Universitas Negeri Makassar, Indonesia, more than 75% of the students who participated in a survey on perception towards online learning responded positively towards the implementation of the system. The survey was participated by 194 females and 56 males. One of the main issues discussed in the study that governs the students' perception is the students' familiarity in using a computer for study purposes. Students with exposure of more than three years and a maximum of two years responded with contradicting perceptions of online learning. The blatant bias in this study was due to all students who participated in the survey were originally graduated from a vocational school where the exposure to computer-based learning is substantial. The study also concluded that a very different result could be expected if the same set of surveys and questionnaires were to be distributed in engineering faculty instead. This can set a challenging precedence as the implementation of the online learning will be among engineering students in the project to be conducted by Rusli, Rahman & Abdullah (2020).

Online-based learning has a prevalent issue of distraction since studies have shown students spent more time browsing content related to non-academical compared to academical. A study conducted on the use of the internet among students of higher learning institutions for academical purposes in Malaysia indicated that more time is spent non-academical content than academical. In this study, 1,675 students participated in the survey. The students were clustered based on their field of study, namely social science, science, engineering, agriculture, and computer science. Among all the clusters, computer science students spent more time on the internet compared to the rest on average of 5.61 hours per day. The main concern raised in the literature was students spent their time unwisely on the internet and ended up being addicted to the internet. The probability of such an unfortunate occurrence is high when social media was incorporated into online learning such as Facebook group etc. (Ayub, Hamid and Nawawi, 2014). These findings were also supported by authors who conducted similar studies in Hong Kong (Chan & Fong, 2007). However, in China, adolescent teenagers showed only 2.4 % of internet addiction in comparison to the previous study. The main reason behind this might be due to restriction in social media activities imposed by the People Republic of China's government, and Hong Kong had no such restrictions (Cao & Su, 2006). In fact, some parents took actions like disconnecting their internet line for the purpose of avoiding distraction for their children before their tertiary education. This problem can be mildly addressed using in-house software. Most students were pulled into distraction when they were required to do research or procure knowledge kinds of activities. This mundane and less interactive nature of the tasks made them prone to distraction which can be avoided by incorporating the in-house software into the online learning. Rather than watching and listening to series of clock-ticking lectures, students can carry out some interactive works by using the in-house software.

Literature Review

Another difficulty identified from conducting online courses for reservoir modeling and simulation is the lab session. Instructing the lesson will not be a hassle, but when it comes to hands-on sessions where the students must utilize the software on their own, the process can be a bit of troublesome. The students need to be given access to remotely control a software which is not really a recommended practice since this action may impose some security issues. Thus, by introducing the simpler version of the simulator, the need for students to deal with the commercial simulator can be reduced. The in-house software used in this course requires some coding or rather scripting and teaching a programming course has been deemed as a difficult task. Blended learning had been proposed to replace the traditional learning when comes to programming course. This learning approach was considered as an effective method by many researchers but the outcome of the learning approach in programming courses has not much been published (Alammary, 2019).

There are five blended learning models which were proposed to assist entry-level students in introductory to a programming course. The first two modes are face-to-face models with and without instructors where students can collaborate, discuss and interact in the classroom. However, this model is no longer a consideration since the recent pandemic prohibits proximity interaction. The advantage of face to face with instructor pedagogical approach is an instructor has governance of the entire process. This method is proven to be more efficient since a large course content can be well-taught to a large number of students without the predicament of information dissemination and constraint of time. This finding was recorded by a study conducted on the benefit of auditory input in assisting a traditional lecture (Griffin, Thompson, & Mitchell, 2009). This would be proven in the past, where the enrolment of petroleum engineering students was almost more than 80 every semester (prior to crude oil price downfall). The face-to-face collaboration without the presence of an instructor has other benefits, which are conjugate to the method with an instructor. Students will have more critical thinking on the subject which prompts them to have a deeper understanding. This is because instead of being spoon-fed on the contents of the course, the students will improvise in finding the right materials and comprehend the contents by themselves. They shall do the learning at their own pace which may be tailored to their optimum performance (Sarason & Banbury, 2004; Selvi & Perumal, 2012). There are three other methods that are online based, i.e., with instructor and groups or only with groups and individuals. Online learning with the instructor carries the same benefit as face-to-face, except that the method can be made more flexible as there is no classroom requirement. However, the learning performance can be impeded due to no in-person guidance. The online collaboration methods are free of the constraint of time and location. This method removes the barrier of having to meet up for discussion. Finally, the individual online method with no instructor grants freedom to students to conduct their study at any time and location. The usage of in-house built software complements the final learning models where the interactive can be enhanced virtually.

Methods

1. The students were first taught how to code common operations which must or should be utilized collectively and in integration to create the scripting or the software used for the calculation. Thus, the first four weeks of tutorials were dedicated to Python teaching which would be used by the students later for their project. In Week 5 of the academic semester, students sat for their first test, henceforth Test I. However, for Test I, the students were yet to experience the use of the software since the coding or scripting of the software was under the development stage. This was a golden opportunity since Test I was later be used for comparison's sake with the assessment in which students had access to the software i.e., extended assignment.
2. In Week 10 of the academic semester, students presented the software scripted in which evaluation was conducted via online presentation to assess the accuracy and competency of the software developed.

Students submitted the presentation files, Python extension file in terms of .py and. ipynb, which were used to run some cases and to confirm the validity of the project. During the presentation, total evaluation was focused on the understanding of the scripting technicality instead of the course technicality. This step was carried out to further evaluate students' real understanding line by line.

3. The real comparison could be conducted in Week 13 soon after the performance of Extended Assignment, which was formerly knowns as Final Exam. In this assessment, a similar form of the question as in Test I was given to students to compare the performance prior and post utilization of Python coding. However, bear in mind, the Test I question was less complicated because the question was on 2-phase, but the extended assignment was second-phase.
4. Both questions for Test I and Extended Assignment were set in a way where both calculation and analysis assessment of Bloom Taxonomy (C3 and C4) are equally tested. This is to ensure that the grade obtained from Test I was justly comparable with the Extended Assignment.
5. Finally, a survey was done on how the students responded to implementing software-based learning with an online medium soon after the Python Presentation. The outcomes of the survey shall delineate which area to improve for the software-based learning. This was the first intervention plan proposed in the overall project to ensure that the students were benefitting from the software-aided teaching. The survey used Microsoft Form to ensure that only students with UTP domain email could leave feedbacks.

Results and Discussion

Test I for the course was divided into two questions of equivalent marks of 25. The first question required students to manually compute pressure for 5 grid blocks (single phase problem) which was a typical reservoir simulation question commonly given in tests. The second question was a coding question testing on students' capability to perform a potential calculation using Python which was irrelevant in this comparison. There was a total of 38 students taking the Test I. The performance of the students was captured in Figure 1 based on the grade marks tabulation in Table 1 :

Table 1 Grade, mark and percentage for Test I

Grade	Marks	Percentage
A	25.00	55.26%
A-	21.00	10.53%
B+	19.75	10.53%
B	18.50	5.26%
C+	16.00	15.79%
C	13.50	0.00%
D+	12.25	0.00%
D	11.00	0.00%
F	9.75	2.63%

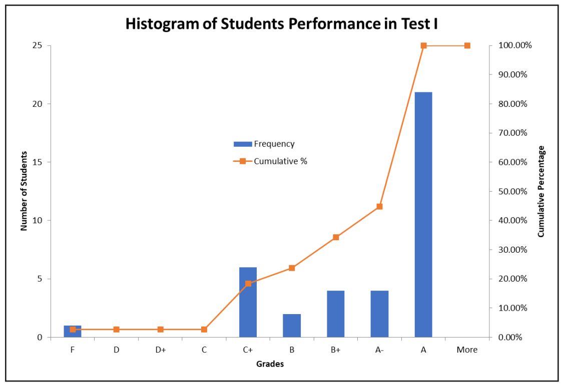

Figure 1 Students performance in Test I

For Test I, the percentage of students who scored an A for Question 1 was more than half of the class, which was considered as a remarkable achievement considering that the nature of the question required long calculation with high accuracy. Almost all the students except 1 managed to at least score 50 % for Test I, which also showed a very minimal number of students categorized as below average. One failure was recorded due to the inability to complete the question until the end which was a scenario hard to resolve even with the aid of the software. The next performance to be portrayed in this paper was Question 2 of Extended Assignment which was a similar nature to Question 1 of Test I but harder due to the computation of multi-phase flow that resulted in calculation twice as long as in a single phase. Students' performance for Extended Assignment Question 2 was shown in Figure 2 based on grade-mark distribution in Table 2. The total mark for Question 2 of Extended Assignment was 40 and the total number of students who attended the assessment was 39, an addition of a student compared to Test I.

Table 2 Grade, marks and percentage for Extended Assignment Q2(a)

Grade	Marks	Percentage
A	15.60	41.03%
A-	17.60	5.13%
B+	19.60	0.00%
B	21.60	33.33%
C+	25.60	15.38%
C	29.60	2.56%
D+	31.60	0.00%
D	33.60	0.00%
F	40.00	2.56%

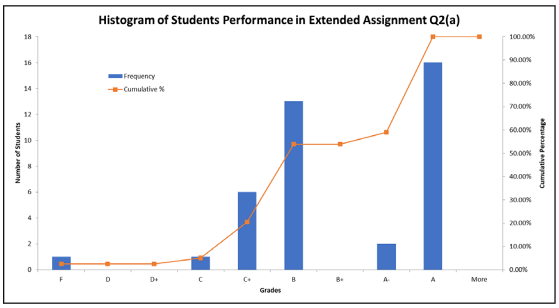

Figure 2 Histogram of Students Performance in Extended Assignment Q2(a)

The percentage of students scoring an A for Extended Assignment Q2(a) was slightly more than 40%, in which 15% drop was recorded in comparison to Test I. The number of students for the next 2 highest grades also dropped from 10 to 5 and 10 to 0 for A- and B+ grades respectively. The second largest group of students scored a solid B in Extended Assignment, which was around 33%. These numbers briefly showed that the utilization of software learning did not bring benefits but caused an adverse impact on the student's performance. However, prior to arriving at such a conclusion, another post-mortem must be conducted to ensure the comparison was truly done on an even ground.

First and foremost, both questions were not similar in nature, whereby Extended Assignment Q2 (a) was very lengthy in nature and required addition of 3 more inputs. The second difference between the assessment was the boundary condition in which Test I question was on Neumann Boundary Conditions whereas for Extended Assignment Q2 (a) was on Dirichlet Boundary Condition in which the latter was considered a more complex problem due to having more than a single pressure value where students often interchange between the boundary and initial pressure. The presence of a constant pressure boundary also caused some confusion among the students, especially after the first time- step wherein the second time step, students should decide on the relative permeability between the boundary and intermediate blocks.

However, this reason was not a prevalent cause found upon post-mortem. The main reason for such a drop in performance was, again, none other than a careless mistake committed. This justification might sound ironical at first since the software function was to avoid students in making a human error which in this case, the purpose was thwarted. However, the careless mistake did not happen along with the calculation on which the software was responsible but during the computation of the input at the very beginning stage. This means the numbers received by the software had errors to begin within which there was no counter measure to prevent the errors from happening. A famous quote in the realm of reservoir simulation, which is believed to have a general application in every other simulation is “garbage in, garbage out”. This means if the inputs incorporated into the software was erroneous to begin with, any output has no more stand inaccuracy.

The question was fashioned in a way where every student must compute their own inputs prior to computing the pressure and saturation. The computation of inputs was made by using their matric ID or commonly known as roll number. This step was taken to avoid plagiarism among the students whereby all students would have unique matric ID, consequently unique input, and unique output. Around 90 percent of the errors happened due to wrong input, and the rest was because the students did not use the software to double-check or further validate their answers. The same predicament should have arisen in Test I, but there was almost minimal to none. The reason why such problems happened only in Extended Assignment was due to the assessment nature. For Test 1, the total time allocated was 3 to 4 hours, in which students attempted the Q1 first and went to Q2. The assessment was conducted from 10 am to 2 pm. This means Q1 for Test I was attempted by them at the early stage of the morning after getting enough sleep.

The Extended Assignment began at 3 pm, which was not as favorable as 10 am as far as assessments are concerned. To make things worse, the calculation question was a second question after Q1 which required students to perform a lengthy coding. This means by the time the students arrived at Question 2(a), of the extended assignment, all the vigor in the beginning was mostly drained out due to Q1. This reasoning was obtained as per discussion with students where many students did well in the previous assessment i.e., Test I flunked in the

Extended Assignment. Many took hours to solve Q1 of the Extended Assignment and by the time reaching Q2(a), their attention span had been compromised resulting in such lowered performance. Some of them who took longer time in dealing with Q1 coding were so fatigued and bulldozed through Q2(a) without any validation using the software. The total time for Extended Assignment was 24 hours.

Another problem as mentioned earlier was the addition of extra time-step for the Extended Assignment Question in which the students needed to repeat the question in its entirety for one more time. For Test 1, the question only required computation for a single time-step i.e., 0 to 10 days, whereas for Extended Assignment, the calculation had to proceeded from 10 to 20 days. This calculation actually in which most students lost their marks due to unfamiliarity with the concept of relative permeability averaging using the upstream concept. Thus, all in all, the usage of the software could not be rendered futile as there were more underlying factors accounted for in the comparison and require another analogical comparison for future study. From a different perspective, the usefulness of the software can be better assessed in the event where students must do all the computation by themselves without any means of validation. In fact, there were 2 reported cases during the Extended Assignment whereby the students were fortunate enough to detect the errors made in the calculation by using the software to counter-check.

The usefulness of the software was captured based on the survey feedback obtained from students after the Python Presentation. There were 11 questions apart from the details of the submitters and submissions. The first question was more on remarks, while the rest were questions to be answered using the Likert Scale. The following are the questions asked in the survey:

1. Please kindly describe your experience and preference between the Python coding to perform the calculation and hand calculation as you had undergone both methods adequately (essay-based answer).
2. The rest of the 10 questions required input based on the Likert Scale as listed below:
   a. Strongly Agree
   b. Agree
   c. Neutral
   d. Disagree

3. Question 2 to 11
   Python coding is better than hand calculation in terms of time consumption.
   a. Python coding is better than hand calculation in terms of the learning process.
   b. You would recommend Python based learning to others taking the same course compared to hand calculation.
   c. You feel there is an added value in you for getting the exposure in Python and being able to do the coding at your current level.
   d. The Python lab session is more interesting and engaging compared to hand on calculation.
   e. A careless mistake can be greatly reduced in Python coding-based calculation compared to hands-on calculation.
   f. Python project is a synergetic combination with online class compared to hands-on calculation.
   g. Your attention in an online class is better captivated using Python based teaching than conventional calculation.
   h. You feel that having Python exposure will make you a more valuable employee in your future company for real job application and internship.
   i. Python based learning is more suitable for online class than physical class.

Response of students to the Questions 2 to 11 are shown in the following histograms:

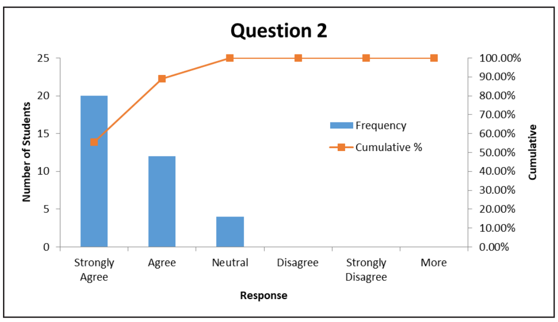

Figure 3 Question 2 response histogram

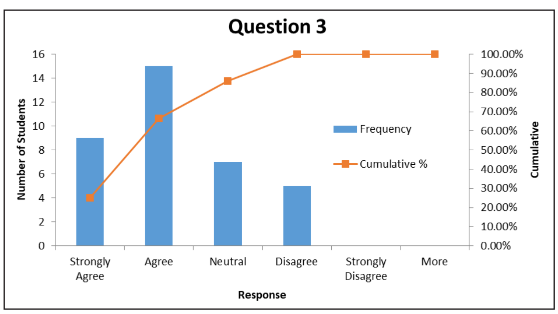

Figure 4 Question 3 response histogram

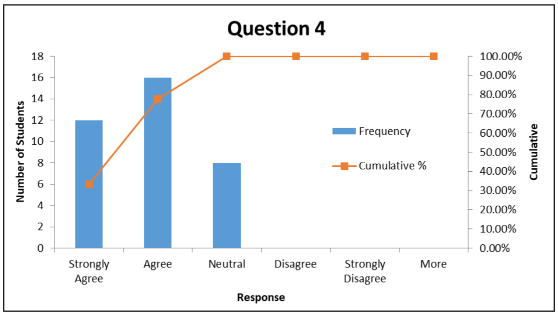

Figure 5 Question 4 response histogram

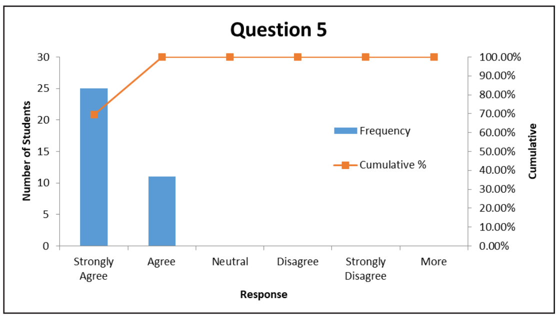

Figure 6 Question 5 response histogram

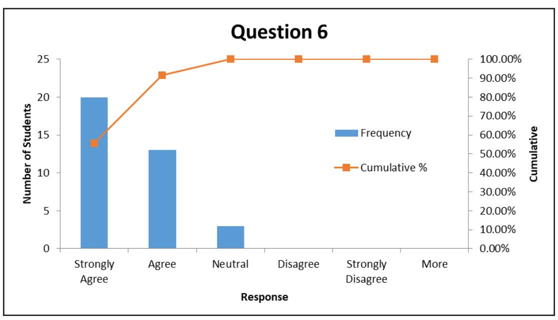

Figure 7 Question 6 response histogram

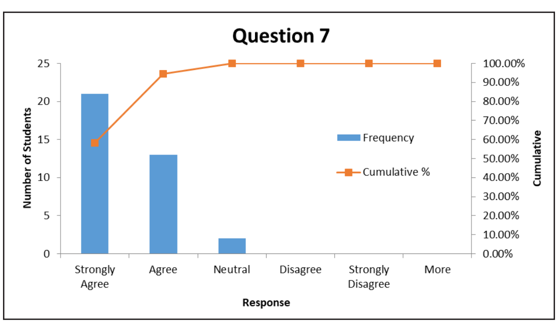

Figure 8 Question 7 response histogram

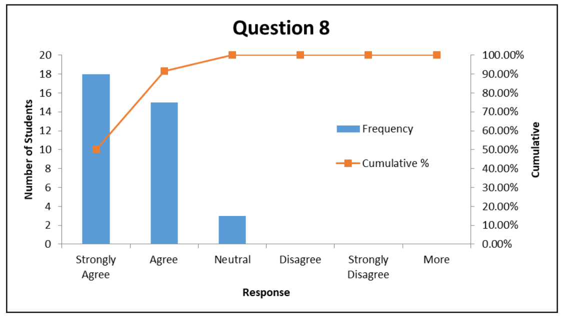

Figure 9 Question 8 response histogram

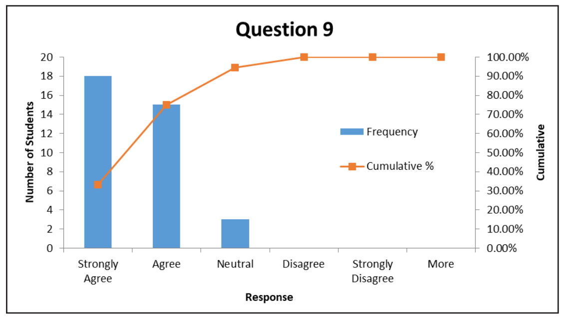

Figure 10 Question 9 response histogram

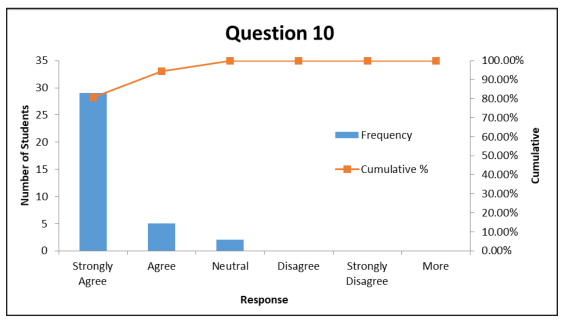

Figure 11 Question 10 response histogram

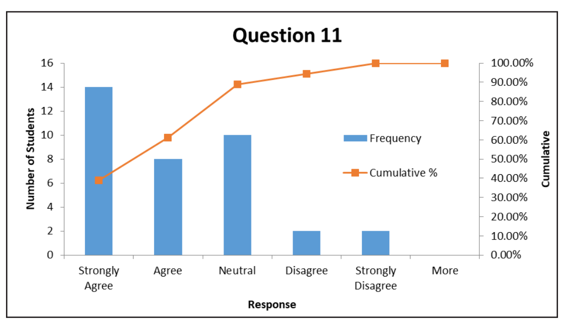

Figure 12 Question 11 response histogram

In terms of time consumption, as shown in Figure 3, most students “Strongly Agree” and “Agree” that Python calculation is better in saving more time. However, a minority still held a neutral opinion on this question which was understandable. Obviously, the computation conducted using the Python Coding would generate results in a quicker time compared to hand or manual computation, but there must be a consideration of first creating a Python Coding to emulate the question. The nature of questions or scenarios for reservoir simulation differ greatly depending on the properties of the reservoir and other considerations such as well placement and the time-step. Thus, in every unique case, the Python Coding must be tailored to meet the criteria or scenario, which again would defeat the purpose of reducing the time. This problem could only be overcome by creating Python Language that covers all aspects of calculation and could cater for a different scenario which were as far-fetched to be assigned as an assessment for undergraduate students as far as expertise and time are concerned. This reason was believed to be the factor for some minority of the students to stand neutral regarding Python being less time-consuming.

Question 3 response had more variation whereby the first response of “Disagree” was recorded, as shown in Figure 4. This question was on the learning process whereby Python was considered as a better medium than hands-on calculation. This question was made rather vague, whereby the learning process should be spelled out more clearly on which stage. If the learning process was referred to as post theory learning whereby students could utilize the coding to study different scenario without having to compute the case by hands one by one, then, undeniably, Python Coding had defeated manual calculation by a long shot. However, if the learning process was referred to the most fundamental level where the first attempt was done to compute the pressure for a single-phase flow. In that case, a strong emphasis should be given in manual calculation. This was because most petroleum engineering students enrolled for the reservoir simulation course must first take a computational method. Computational method or commonly also known as a numerical method is a course or a mathematical discipline that deals greatly with lengthy calculation. This method is often opted for in the event the analytical approach failed to find a solution. Reservoir simulation was the only course as petroleum engineering curriculum structure was concerned, to utilize the techniques learned during the computational method which make the computational method a good pre-requisite for reservoir simulation. Thus, by introducing the calculation using the manual method, the student shall appreciate the knowledge gained from and application of the computational method. Thus, the explanation in entirety could be the reason for disparity in opinion on whether Python Coding is better for the learning process. Another subtle reason for some students to prefer the manual method was because of inability to perform coding due to weak understanding in programming.

Question 4 somehow recorded a similar trend of response like in Question 2 as shown in Figure 5. This question was on whether the students would recommend Python-based learning to others, especially to their junior batch. Most of the students chose “Agree” indicating that there would recommend the course but not with total obligation. This was rather a unique finding because the expected outcome would be a total recommendation with the majority of responses skewing towards “Strongly Agree”. Upon giving some thought on the response trend, this might be due to fear of accountability, which was very dominant among certain classes, especially students. Students often consider themselves as the less authorized people and refer to their instructors or lecturers most of the time prior to reaching a decision. Students are in constant need of guidance and approval for every step taken. Thus, in this kind of survey, in which if the students were to opine strongly agree to implement Python-learning for the consecutive batches, the fear of consequences if the implementation goes south loomed over the respondents. The students would rather not decide on the fate of others and better leave the decision to more authorized personnel i.e., lecturers. This could be one of the reasons on “Agree” being the most popular choice among the Likert Scale option.

Question 5 was a self-reflection question in which the posed question was on whether students felt there was an added value on themselves upon learning Python Coding. Most students opted for the answer of “Strongly Agree” and there were no other choices were made except the previous and “Agree” as shown in Figure 6. This clearly indicated that learning Python is a wholesome benefit felt by all students and reached out a unanimous perception among the students that the Python course indeed benefitted their knowledge and skills level. This response was very much anticipated because all the students did not have much exposure to programming language courses before except for a course taken in foundation studies which on C++ language. A few students who did not do their foundation studies at UTP had completely no previous experience in programming. One of them struggled but managed to perform good and another student did very well in the project despite of the disadvantage. Thus, with no previous exposure, the students felt very grateful to have learned such good knowledge and able to apply the knowledge within a semester.

Question 6 was on whether Python Coding was more interesting and engaging compared to hands-on calculation during an online class in which most responses were skewed towards “Strongly Agree” and “Agree” as shown in Figure 7. The Python Coding was more interesting and engaging because the coding could be made as user-friendly as possible. The hands-on calculation has no variation to the method and did induce no creativity. The Python Coding could be made first to request any other verification prior to performing the calculation or a pop-out message could be coded in to inform the user to perform follow-up action, rectifying error or sign of calculation completion. These features had a real interactive advantage despite of no additional benefit in terms of accuracy or calculation. The analogous to this comparison was reading two storybooks that depicted the same exact story but one with pictures that could attract the reader’s attention more affectively. The engaging part could be further enhanced with the inclusion of a graphical image in the software that portrays the pressure and saturation changes in the reservoir along with time. However, due to lack of expertise, time and manpower, this module was not integrated into the in-house built software.

Question 7 was on the chances of avoiding careless mistakes using Python compared to manual calculation. The response was recorded in Figure 8. Most of the responses skewed towards “Strongly Agree” and “Agree” with a few neutral. The question was believed to be more rhetorical because Python undeniably could avoid careless mistakes indefinitely. This question was mainly posed despite being rhetorical in nature due to the need of knowing to gauge students’ perception on how good the Python coding helps in avoiding careless mistakes. The expected response from the students was to be completely on “Strongly Agree” and “Agree” with no students choosing a lesser option. However, there were a few students who opted for being “Neutral” for this question. As evidently from the outcome of Question 2(a) of Extended Assignment, the only avenue for careless mistake to happen was during the input incorporation. The incorrect incorporation of the input shall result in a very different answer in the end. This might be the reason for the minority of the students to opt for being neutral on Python coding being a useful tool to avoid careless mistakes.

Question 8 requested respondents to identify the synergetic effect between the type of learnings, i.e., Python Coding and hands-on calculation with online classes. The response was shown in Figure 9, where the majority “Strongly Agree” and “Agree” with Python Coding is a better tool to be used during the online class. Although, there were a few students who responded being neutral which the main reason was believed to be lack of competency in Python Coding which pushed the students to stay on the fence. One of the main drawbacks of the online class was lack of avenue to manually intervene with the learning process to provide more aid. For example, a lengthy calculation such as reservoir simulation calculation shall result in higher chances of students making errors. The prone in making error would require the instructors to intervene and assist the students in identifying the errors and rectifying the calculation. This was indeed an advantage of physical class where instructors could easily wander from place to place to do such, but the difficulty increased exponentially during an online lesson. Apart from difficulty such as swapping of screens shared by one student to another, the process could be very time-consuming without factoring in internet connection or any other problems related with the medium as well. However, Python Coding is impermeable to careless mistakes except for the beginning stage which was not a concern during classroom lessons whereby all students usually get the same input. Thus, Python Coding truly assists students learning during an online class by reducing the chances of making errors and the likeliness of the instructor’s intervention to resolve problems related to calculation.

Question 9 posed an inquiry on how good students’ attention span using Python Coding instead of manual calculation during an online class. Online class undeniably has more obstruction and distraction which may prompt students to space out and limit their attention, especially for over the 2-hours period. The main reason behind this predicament was due to the psychological circumstances of online learning where students were not facing their instructors to stay focused on the lesson and being diverted to other activities. In a physical class, in most teacher-student interaction cultures, paying attention is somehow equivalent to paying respect which stops the students from performing other tasks during the learning session which is not the case during an online session. Apart from the nature of the online class, living conditions played a role in determining a student’s focus during the lesson. The practice of students wearing proper attire, registering the attendance, and seating on a designated location are part of the ritual that immersed the students to further indulge and delve into the learning process which was completely nullified during the online class. Thus, garnering and retaining attention during an online class for students is indeed a challenge which in this study, majority of students had opted for “Strongly Agree” and “Agree” as shown in Figure 9. There are 2 reasons why Python Coding possesses the ability to captivate the students’ attention during the lesson better i.e., the chances of being called to demonstrate their works are higher and the user interface interaction of Python Coding is more modern-reckoning.

For hands-on calculation, the instructors would face a huge hassle in going through each and every student's work because the students had to snap a photo of their works and upload the works to be validated by the instructors. Despite with the help from drawing tablets, sharing a screen from one student to another could be another form of hassle, especially for a limited two-hour online class with fundamental theories to be covered and calculations from examples. For Python Coding, the instructor could simply ask for the python extension file and students could simply download their works from Jupyter Notebook (Python Integrated Development Environment – IDE) and share the works using the chat function of the medium i.e., Microsoft Teams. The online class is a modern-stricken element to students' study life in which Python Coding, a modernized tool came in handy. Students or millennials nowadays spend most of their time in the virtual world using their smartphones or laptops with less access to non-digital tools decades back. This prompted convenience and familiarity among them to stick to such tools during learning as well. In a way, for the newer generation, learning via devices is more of a customary than scribbling using writing tools on a piece of paper. Jokingly, students could always switch screens between the Python Coding and scrolling down social media during the class.

Question 10 was not really on the learning process but the prospects in securing a job during the employment stage where again the benefit of mastering Python in providing students some upper hands to land job was questioned. Python is a cutting-edge skill which is very synonymous with industrial revolution 4.0 where graduates are required to be more tech-savvy since most job focuses on optimization than hard work or breakthrough in science. This explains the response where most respondents opted for "Strongly Agree" as shown in Figure 11. This was a positive response where most students realized the importance and strength of possessing Python skills, which shall contribute to their future. Although, disappointingly, some remain neutral in this question despite of blatant benefits of learning Python had been spread around. Historically, in the past era or centuries, mankind strived to gain more knowledge with the hope that the knowledge could provide a better life to human. The trend continued until a decade past year 2000 where the trend of optimization breaks in whereby instead of finding a perfect solution adhering to the science behind every phenomenon, a statistical approach to predict the best performance is more preferred or also known as data science. Many may debate that data science is a mere glorified statistical approach, which is partially true, but this field was rendered essential due to the evolution of knowledge such as machine learning which enables many processes to automate and reduce the necessary manpower. The downside of the knowledge in terms of excessive manpower that eventually led to retrenchment is inevitable consequences but the benefit in advancing the life of every human being somehow supersedes all the shortcomings. The underlying brick of machine learning is data science which is mostly programmed using Python and students imbued with this knowledge definitely stands out in the employer's eyes.

Question 11 was the final question of the survey that asked about the suitability of Python Coding for online class than physical class. This has the most variation of response where all the options in Likert Scale were opted where most students chose "Strongly Agree", followed by "Neutral", then "Agree" and a small number who chose "Disagree" and "Strongly Disagree" as shown in Figure 12. This question was rather a unique comparison because previously most comparison was made between hands-on and Python Coding but in this question, the main comparison was between physical and online class which the previous was very much favorable by all, if not almost all students. Despite of many software capable of conducting classes online such MS Teams, Zoom, Google Meet, and etc., most students still prefer a physical class which in this question the efficiency of Python Learning is being compared to. The setting of online learning is somehow more favorable for Python Learning, where both sessions and activities take place in front of a computer. In a common physical class, students sit and take notes while listening to lectures where often, no laptops or equivalent gadgets/devices are provided. In some cultures, the instructors became uncomfortable with students' using devices during their classes which often creates the image of not paying attention. However, this situation can be effortlessly fixed by conducting the class or the Python lesson in a computer lab instead of doing the lesson in a regular classroom. This can be done in a hybrid class setting whereby the class will be conducted online by sharing the screen using software like MS Teams, but for students who need aid, the instructor can physically approach the students to provide the help.

Question 1 was not based on the Likert Scale but more on remarks from students. The remarks shall not be discussed individually, but the responses were captured in the Appendix Section with some correction performed on the comments in terms of grammar. The question posed in Question 1 was, "Please kindly describe your experience and preference between the Python coding to perform the calculation and hand calculation as you had undergone both methods adequately." Basically, based on the remarks, majority of them found that both methods, and Python must be implemented but at different stages. Hands-on learning must be first introduced so that students understand the concept of the calculation but later for the repetitive calculation. Python is the best. Actually, not a single remark dissed the ability of Python in achieving quicker and accurate results and all response showed a positive remark towards learning Python.

Conclusion

The objective of the project was successfully achieved as all students believed that Python has a vivid advantage in creating an error-free and less time-consuming learning environment which is indeed helpful for online learning. Hands-on calculation shall be maintained in beginning stage where students are learning the fundamental concept on the calculation. This stage is utmost important for a later stage to successfully craft the Python coding emulating the calculation steps done manually.

Acknowledgment

The authors of this paper would like to extend their utmost gratitude to all the parties who made the case study/project a successful one. A heartiest appreciation is extended to Cadex Department of Universiti Teknologi PETRONAS who sponsored the project under the scholarship for Teaching and Learning. A hearties appreciation to petroleum engineering students from Universiti Teknologi PETRONAS who became the prime mover of the project via which the project was concluded successfully.

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Appendix

The students need to understand the hand-written work first before doing python. The coding took a long time, but the result paid off with short time calculation and a deeper understanding of IMPES and python. In terms of every student having a fair share in the project, that is not true. This is observable during the presentation. I enjoy doing both. Really recommend it for future batches. In the coding part the students can learn by themselves, the intricacy is more on the thought process.

Hand calculation is indeed the best method as I am the one who likes to deal with numbers, and I love to learn something that I can visualize. However, this semester when I was introduced to python, I realized that this method was the most convenient way to performing calculations and less time-consuming, especially when involving the complex calculations. To be honest, I would say learning python would give me a heartbreak, a whole new level of tiredness, I spent most of the days figuring out the coding and also the error, which turned out I almost gave up on the project. But, the more I learned python from YouTube, websites, and from this subject, I am really interested in python as this was a new experience for me and great exposure. I am keen to learn more and have a great understanding of python in the future.

It was hard at first. But it was a really good learning experience. Actually, I learned a lot about programming, and it will be very useful in future. Thank you, Sir.

It is great when I am able to learn Phyton coding and can see the difference between manual calculation and Phyton. Somehow, Phyton was greatly used in time-consuming as manual calculation will need more time to be used and can reduce the number of mistakes in doing the calculation.

The experience was fun, and it proved to be challenging to learn due to the lack of exposure to coding prior to this course, however, it all went well, and calculating it through coding proved to be much easier and quicker than manual calculation

I think both methods are okay for me but however if you know how to do python coding, I believe which will make students easier and faster to complete. But for those who never experience coding before, this might be a huge challenge for them but however I prefer to learn new skill.

Advantages: Fast calculations and can apply at diff conditions needed. Disadvantages: time consuming in finding sources of coding, make a person crazy due to python does not want to loop.

Advantage's python: More accurate, easy to use, user friendly, and can get fast answer. Disadvantage's python: Quite hard to get the correct code. Advantages hand calculation: Can easily detect if do wrong, can clearly see the working step. Disadvantages hand calculation takes a long of time to complete, if one wrong, have to redo all over again from the start. I will recommend using python.

In terms of fast calculation, using Python would be the best, but through hand calculation, we really learn and understand how and why the formula is applied. Python is good for fast calculation, but it is harder to understand the concept of the formula. Hand calculation is time-consuming, but it is easier to understand the application of the formula. As a recommendation, it is preferable to learn the calculation through hand calculation but using Python for calculation.

As for me, both methods are very important in determining accurate answers, for instance, you can directly build matrices in python all the way from defining those. List lines followed by looping and nested looping, but knowing whether your Python coding for the matrix is correct or not is through handwritten at the first the beginning. After getting the most accurate answer by hand, continue to code until the value is the same as by hand.

Using Python is preferable, but to make the code is not easy

From my point of view, both approaches are useful but when it comes to Python, most of the time is spent developing the logic of the code. Sometimes, the students may have appropriate knowledge regarding the question being asked but are stuck at constructing a proper logic and syntax. Overall, it is a nice and valuable experience to learn Python, and the language is relatively easier compared to JS and C++.

Learning Python was a great experience as it exposed me to new skills. The advantage of learning it is that it could come in handy once I have graduated and stepped into the working world. As for the disadvantage, it would be the time taken to figure out the right code.

Hand calculation advantage is that it requires shorter time to complete, provided we are calculating it once or twice. However, the disadvantage of the hand calculation is human error and round-off error could happen while performing the calculation. On the other hand, the Python method uses the shorter time to perform the calculation than hand calculation because everything is computed within seconds. It also can be used repeatedly. However, this method is not worth the time for a one-time calculation as it takes longer than hand calculation to build the coding.

It's a new experience to use Python coding to perform the calculation and hand calculation, and it's very useful to learn to code but for myself, I need more time to get better in Python coding.

Learned about Python through this project and discussing about it with my group. My group members took the time to explain how the coding works, and even though I did not fully partake in the final coding, I practiced it by myself. It is definitely faster than hand calculation once you can master it, though it will take some time for beginners to fully understand how it works. The learning curve for Python is quite steep, with consistent practice. Python makes it easier to calculate and it's straightforward but needs practice to get it right, while hand calculation takes a longer time and is tedious, but you can see how each process/equation/calculation takes place. Python coding is definitely recommended, provided that the learner can understand it quickly.

I like python more because you will be more creative when creating the coding. When you have done the coding; you can easily insert the values and get the answer immediately

I would definitely prefer Python advantage of python is it can reduce careless mistakes because python does the calculation. The disadvantage is it took a lot of time to do and run the coding, but worth it. The advantage of hand calculation is that we can directly calculate using the formula and calculator, but it takes a long time cause need to calculate it 1 by 1. Hand calculations also can lead to more careless mistakes due to human error. I will recommend python for future use. Improvement for hand calculations, You probably need to do double-check after doing the calculations or maybe ask help from excel to check the answer. For Python, for me maybe need to learn python more (to improve coding)

It was a great benefit to learn Python. The benefits of learning Python include time savings and ease of use, but the disadvantage is that we must understand how to use it. While hand calculation has the advantage of being much easier to understand the steps of the calculation, but it is time-consuming. Python is my preferred programming language because artificial intelligence is influencing our future.

Phyton coding ease my work due to less time consuming compared to the manual calculation

Good. I might use python in the future to save time and energy

It was a good experience, where we learned more about python and how to use it. python coding was better than hand calculation because it can solve equations faster after it is done, which can save time and effort

At first, it was hard. But as time passed it was a really good learning experience for the Python programming language. It will be very useful and helpful for our future. Thank you, Sir.

This project made me realize the important of coding.

For me, there are many other Python functions that I need to know and learn so that the coding will be easier compared to hand calculation which only has one way but of course, it is time-consuming. That's why I prefer python but still need to learn more knowledge and function in python

I have learned so many things by doing the Python Project and it has somehow increased my knowledge and experience in utilizing software to complete my work. I would say that python would be more preferable than hand calculation because it is less time-consuming.

Python is definitely a new way to perform the calculation as it is a method that trains you on machine learning/data analytics which is a skill that is high in demand in the current industry.

To be honest, I think python is better than writing but you need to understand the write one first before getting the coding done.

I would like to recommend using python since it is less time-consuming. Even it's quite hard to build the program but worth it.

My preference will be the Python coding as it is easier when dealing with big numbers. The advantage is that the python coding is fast but the disadvantage is that you need to do the coding correctly.

Python eases calculations done and saves up a lot more time. Repetitive calculations can be solved in under a minute as compared to performing hand calculations. Learning the Python programming language may take time, but I believe it is definitely a better method.

Python is easy to calculate but the coding part is hard for me. For handwriting, it takes a longer time to complete the calculation but no need to do coding and easy to get incorrect answers.

The experience is everyone gathers in a meeting and everyone brainstorms on the coding. The advantage is that the user can select between the methods used to calculate the needed result, making it faster to get what is needed. The disadvantage is errors can happen and tweaking the coding is needed due to unpleasant outcomes. Overall, python does speed up things on the calculation part.

This is my first time using Python. It is a new experience that is very valuable for my future since everything is undergoing digitalization. However, it was very tiring due to a lack of practice and understanding in terms of its logical expression. I believe I have tried my best and gained a skill which I would like to train and enhance anytime soon. I have always preferred a manual to complete any tasks given because it is easier for me to understand the flow and concept. Then, it will be easier for me to apply the knowledge in an application or software. I strongly believe I will still prefer a manual way of doing things even in the future before using any software because I love to work that way. I do agree that hand calculation will consume time, but it guarantees me an understanding step-by-step. As for the automatic calculation, it looks super cool and saves time, which will be even easier with continuous practices, regardless of other factors like connectivity which are too technical. Anyways, in my honest opinion, I will prefer hand calculation first before proceeding to automatic one.

For me, hand calculation with cause the manual error as it is easy for a human to transpose numbers or make other seemingly minor mistakes that could have far-reaching consequences. Otherwise, the likelihood of a mistake using Python coding can be reduced as it will simply follow through with commands. By using Python coding can also get the answers more quickly instead of performing a hand calculation. However, this Python project really helps me to strengthen my coding skills.

The hand calculation makes us more understand about the whole concept of the IMPES method while for the python method will save our time to get the final answer. I prefer to use python since the manual calculation will take too much time. Of course, to us to build a coding that can compute the calculation automatically, we still need to understand it first through the manual calculation. So, each method is really important for us as a student that still learning on this topic.

TRANSITION TO ONLINE PROBLEM-BASED LEARNING IN COASTAL ENGINEERING DUE TO THE COVID-19 OUTBREAK

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Introduction

Design of Coastal Structures (DCS) is one of the Coastal Engineering elective courses offered to the final year Civil Engineering undergraduate students. The Course Learning Outcomes (CLO) and the mapping to the Program Outcomes (PO) are presented in Table 1. The CLOs require the students to observe coastal problems, assess the design concepts, create a feasible engineering solution, and finally develop detailed engineering design calculations. Without site investigations, site measurements and real design experiences, the students' CLO attainment were somehow low in the September 2018 semester. Hence, a structured Problem-Based Learning (PBL) was introduced and implemented for the DCS of Jan 2019 and Jan 2020 Semester to enhance the student learning experience and the academic performance [Teh & Pereira, 2019; Teh et al., 2020]. Nonetheless, site investigations and face-to-face engagements could not be conducted due to the COVID-19 pandemics and the movement restrictions imposed by Malaysia's Government in 2020. Therefore, there was a need to substitute the physical PBL with a virtual PBL conducted online.

Table 1 Mapping of course learning outcomes to program outcomes

Course Learning Outcome		Programme Outcomes (POs)	
		PO2: Identify, formulate, and solve complex civil engineering problems using creativity and innovativeness.	**PO3**: Design and develop solutions for complex civil engineering problems.
CO1	Analyze site condition and identify data requirement for design works	X	
CO2	Assess the overall design concept and needs, and develop the required design parameters	X	
CO3	Evaluate the feasibility of various coastal protection measures and develop preliminary design concept		X
CO4	Undertake detailed engineering design for complex coastal structures and develop construction strategy		X

Problem-Based Learning

Problem-Based Learning (PBL) is a student-centered, inquiry-based instructional model in which learners engage with an authentic problem that requires further research [Jonassen & Hung, 2008]. The PBL involves seven processes, i.e., clarifying terms, defining problems, brainstorming, structuring and hypothesis, learning objectives, independent study and synthesis [Schmidt et al., 2011]. These processes identify what they already know, what they need to know, and how and where to access new information that may lead to the resolution of the problem. In other words, PBL focuses on the learner's reflection and reasoning to construct their own learning [Clough & Shorter, 2015]. It also helps learners to develop skills that are necessary for their future practices and encourages ongoing learning within a team environment [Melzner, et al., 2015].

Innovative educational adaptations have been essential during the COVID-19 pandemic [Liang et al., 2020]. The limitations imposed by the COVID-19 lockdown have forced the teachers to do emergency distance or online learning things. Most PBL models available are for PBL in face-to-face environments. It is a challenge to explore how to apply PBL in the online environment. Havenga (2020) outlined the challenges, opportunities and insights gained regarding an engineering course due to a rapid transition to online PBL. One typical challenge is distracted by increasing screen time and access [Coiado et al., 2020]. A direct transition from the conventional PBL into an online PBL may not have the same impact [Foo et al., 2021]. Hence, evaluations before permanent adoption of the online PBL are warranted.

Real-life Problem

Coral Beach is one of the most attractive recreational beaches on Pangkor Island, Perak. The 550 m sandy beach is located on the west coast of the midland Pangkor Island, which is approximately 5 km from the Pangkor Island Jetty. The beach is bordered by a pair of natural headlands and is partially sheltered by Pulau Giam, as shown in Figure 1. Coral Beach is known for its mild sloping beach, filled with fine white sand and clear water. On the 18th - 20th of May 2020, a stretch of Coral Beach, as shown in Figure 1, experienced severe erosion, causing loss of sand mass, fallen trees, damage of coastal infrastructures, etc. Figure 2 and Figure 3 show the damage of the coastal infrastructure due to wave destruction to the existing rock revetment lining the shore of Coral Beach, where the concrete buildings located. These buildings were used for storage and servicing of small motorboats.

Prior to this incident, this stretch of the beach was badly affected during the 2017 storm. A rock revetment was placed at the site without a proper detailed engineering design to immediately protect the shore after the 2017 storm. The nominal diameter D50 of the chosen rocks was about 0.5 m, which could be easily lifted when confronted by severe waves. Furthermore, the rock revetment was not properly constructed which a pile of rocks of various sizes was placed on the beach slope and the thickness of the revetment was not consistent throughout the length of the structure.

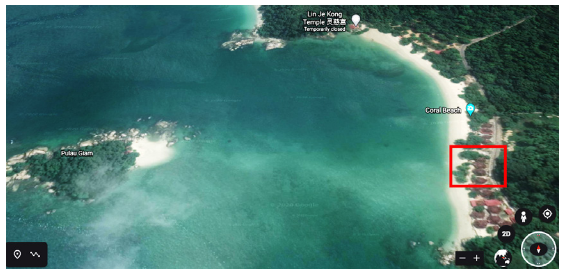

Figure 1 Location of Coral Beach and the eroded site (highlighted in red).

Figure 2 Failure of the existing rock revetment

Figure 3 Erosion and the damages to the coastal infrastructures at Coral Beach

The revisit of the 2020 storm at Coral Beach had caused severe damage to the under-designed rock revetment and the adjacent infrastructure. The coastal erosion problem triggered attention from both local authorities and the local community. Hence, the Department of Irrigation and Drainage (DID) Manjung would like to look for a more sustainable engineering approach to overcome the coastal erosion problems at the beach. Taking advantage of this opportunity, a PBL project was designed and executed for the DSC of May 2020 Semester. Under the influence of COVID-19 pandemics and governmental restrictions on movement control, site visits and students' physical investigations were not possible to be undertaken.

Consequently, it would be a challenge for the DCS students of May 2020 Semester to comprehend the course learning outcomes when the physical (hands-on) site investigation was omitted from the course. To sustain the teaching and learning quality for the DCS course, a virtual PBL project was devised and executed in the online environments in May 2020 Semester. The PBL project was expected to be able to enhance students' understanding and retention of knowledge through virtual site investigation, data analysis, a proposal of solution and development of the detailed engineering design. Apart from technical competency, it was also aimed that this PBL activity would help to develop communication, problem-solving, critical thinking, collaboration, personal and self-directed learning skills. This study aims to assess the DCS learner perspectives of problem-based learning in the online environment and determine the effectiveness of the proposed PBL activity in student learning and academic performances.

Methodology

The online PBL approach was executed for the DCS students of May 2021 Semester. The student class size was 27. Six groups were formed, with each group consisting of 4 to 5 students. Each group was required to execute the tasks as given in Table 2 within 10 weeks. Prior to the execution of the PBL activity, the course instructor conducted a personality test to measure the student individual's characteristics in response to active learning. The Myer-Biggs Type Indicator (MBTI), indicating differing psychological preferences in how people perceive things and make decisions, was adopted in this study [Myers et al., 1995]. This survey exercise was important to help the course lecturer understand the learners' behaviors and expectations prior to the implementation of the PBL in the online environments.

Figure 4 presents the workflow of this online PBL project,

1. Preparation work for pre-site investigation
2. Virtual site investigation
3. Coastal data acquisition
4. Data analysis
5. Development of design parameters
6. Proposal of an engineering solution
7. Development of detailed designs
8. Group presentation
9. Group project report submission

Table 2 Project tasks

No	Tasks	CLO	Weightage
1.	Prior to the site investigation, it is important to identify the types of coastal data and the information needed to support the work. Propose a detailed plan for the acquisition of the coastal data for this project. Assess the site condition before and after the storm event.	CLO1	30%
2.	Develop the required design parameters, e.g., wave height, tidal level, wind, etc.	CLO2	20%
3.	Severe wave action is the key factor causing the coastal erosion problem at Coral Beach. Propose a coastal engineering structure that would be able to reduce the wave energy. Justify your proposal using a conceptual drawing	CLO3	20%
4.	Provide a detailed design of the structure proposed in part (3). Attach the detailed engineering drawing of the complete design.	CLO4	30%

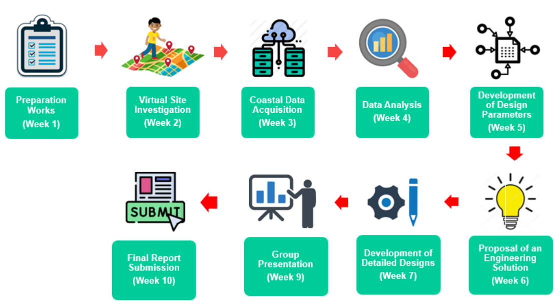

Figure 4 Project workflow

Prior to the virtual site investigation, the DCS students identified the types of coastal data and the information needed to support the given work on a group basis. The students explored the given site – Coral Beach using Google Earth to identify the coastal features and the beach conditions. They brainstormed among themselves and developed the frameworks of the project, which was expected to be executed within ten weeks. They prepared a list of questions pertinent to the project site pre-and post-storm wave event. In Week 2, the course instructor arranged a virtual site visit with the help of the Department of Irrigation and Drainage (DID Manjung District) and a boatman who possessed more than 15 years of experience running his boat business at Coral Beach. His premise at Coral Beach was damaged because of coastal erosion that was taken place in the year 2020. Due to the ease of accessibility, the site visit and interview were conducted using an online platform – Zoom. The boatman explained and showed the actual condition of the eroded beach with the aid of his smartphone. He also took several photographs of the site and shared them with the DCS students using WhatsApp.

All questions asked by the students were addressed comprehensively by the boatman. The detailed technical information and the related site data, including historical wave height, tidal and current information, etc., were acquired from DID for further analysis by the students. Other meteorological data were downloaded from online sources. The DCS students compiled all the required background data for statistical analysis using computing software in Week 4 and subsequently developed the design parameters associated with the study site in Week 5. Based on the knowledge they gained in the class, they proposed a viable coastal engineering structure (e.g., revetment, bottom mounded breakwater, floating breakwater, seawall, etc.) in Week 6 to provide necessary coastal protection to Coral Beach. The choice of the proposal was justified from the perspectives of the structure's functionality, environmental and socio-economic impacts, and cost optimization. In Week 7, the group members were to produce the detailed design of the proposed coastal engineering structure according to the design parameters developed in this study and the detailed construction drawing. In Week 9, the proposed solutions of the respective groups were presented to the course instructor and other group members using an online platform – Big Blue Button. The design concept, parameters and solution were critically scrutinized and challenged by the course instructor and the peers from other groups. The design limitations of each proposal were identified and improvised by the group members prior to final report submission in Week 10. The oral presentation and report submission were parts of the summative assessments for this course, and the course instructor graded the work quality for each group accordingly. Note that each group was given a budget of RM200 to make purchases of any tools and consumables required for this project.

The DCS students spent 10 weeks to complete the full cycle of this online PBL activity. To gauge the effectiveness of the online PBL approach, two interventions were scheduled in Week 3 and Week 10. For each intervention, an online questionnaire request was sent to each student via email for their honest feedback and responses on the PBL exercise and their learning experience at the current stage. The questionnaire acquired the students' perceptions on their CLO attainments, technical and soft skills development, T&L effectiveness and the overall PBL satisfaction. The outputs from the students' reflection will indicate the effectiveness of this PBL approach in creating the students' interest towards the course in the online environments.

Results & Discussions

A personality test using the MBTI was adopted in this study to characterize the psychological preferences of the participating students. The test attempts to characterize each of the participating students based on four categories: introversion (I) or extraversion (E), sensing (S) or intuition (N), thinking (T) or feeling (F), judging (J) or perceiving (P). One letter from each category is taken to produce a four-letter test result, like "ISTP" or "ENSJ". A total of 27 student participants participated in the personality test prior to a series of PBL activities. Figure 5 detailed the psychological preferences of the DCS students based on the 16 personality types of the MBTI instrument. The dominant personality types were ISTP and ENFJ. The ISTPs are action-oriented, logical, analytical, spontaneous, reserved and independent. They enjoy adventure and are skilled at understanding how mechanical things work.

On the contrary, ENFJs are caring, enthusiastic, idealistic, organized, diplomatic and responsible. They are skilled communicators who value connection with people (www.myersbriggs.org). Both ISTPs and ENFJs have a list of opposite characteristics. The characteristics of other combinations can be obtained from (www.myersbriggs.org).

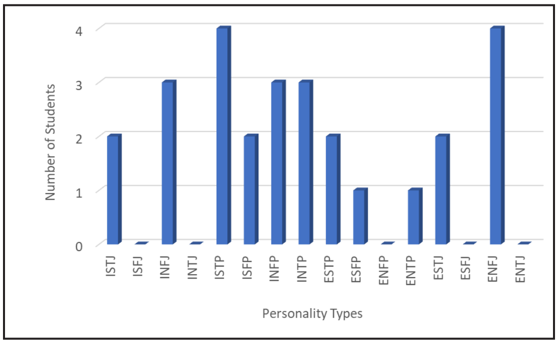

Figure 5 The psychological preferences of the DCS students are based on the 16 personality types of the MBTI instrument

To ease the analysis, the general psychological preferences of the DCS students are presented based on the four general categories in Figure 6. The participating students were categorized into one of the two general personality groups – INTP or ENFJ. Overall, the DCS students of the May 2020 batch were dominated by the INTP type (at approximately 60%). INTPs are often described as quiet, reserved, thoughtful and analytical (www.16personalities.com). They enjoy spending time alone, thinking about how things work and coming up with solutions to problems. They tend to be flexible, tolerant, highly logical and objective. They are good at thinking "outside of the box". INTPs typically do best in undertakings with they have a great deal of flexibility and independence. They love ideas and place a high value on intelligence and knowledge. Because INTPs enjoy solitude and deep thinking, they can get lost in their own thoughts and lose track of the outside world. INTPs tend to be quite easy-going, but they can become uncompromising when their beliefs or convictions are challenged. Because they rely on their own minds rather than others, they can be very difficult to persuade (www.onlinepersonalitytests.org [3]. This might be a challenge when grouping the INTPs with an almost equal number of ENFJs who have the opposite characteristics. Note that the characteristics of the ENFJs have been described in the earlier paragraph. In this PBL project, the course instructor assigned 2-3 ENFJs to the respective groups making the INTP: ENFJ as 60:40.

Based on the intervention 1 survey results as demonstrated in Figure 7, only 4% of the DCS students showed a strong interest in active learning, and 58% did not show any passion for active learning. 87% of the DCS students claimed that they preferred traditional teaching more than the active learning teaching practised in the courses they took in the previous years. This finding is somewhat alarming as these final year students did not seem to fully comprehend the philosophy of active learning and to appreciate the efforts made by the UTP course lecturers in running various active learning activities in physical classes. It is presumed that the 42% of the participating students who showed strong or mild interest in active learning were of the ENFJ personality type. ENFJs are people with the Protagonist personality type (www.16personalities.com). They are charismatics, tolerant, reliable, altruistic and have strong leadership. They are expressive and more responsive to a given task, e.g., PBL activities. Hence, it can be deduced that effective learning takes place for the students of the ENFJ personality type more easily than those of the INTP type.

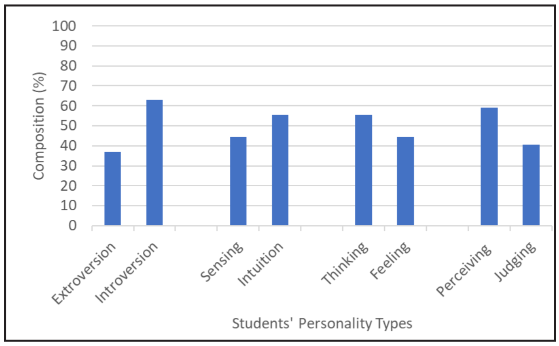

Figure 6 Psychological preferences of the DCS students based on the four categories – introversion/ extraversion, sensing/intuition, thinking/feeling, judging/perceiving

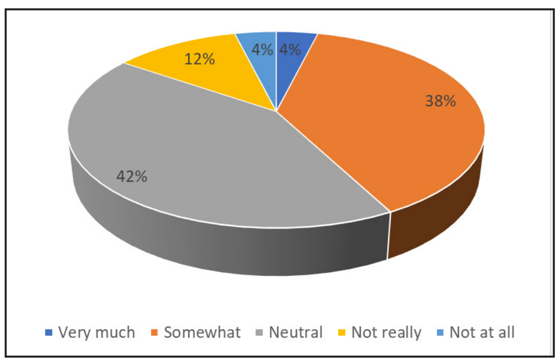

Figure 7 Students' preferences for active learning

The online questionnaires conducted pre-and-post PBL project measure the students' perceptions of their CLO attainment during and after the activity. Figure 8 presents the average students' CLO attainment scores for CLO1, 2, 3 and 4 during the pre-and-post PBL project. The course learning outcome attainment scores of the DCS students for CLO1, 2, 3 and 4 are 71%, 68%, 64% and 59%, respectively. After a series of PBL activities throughout the ten weeks, the students' perception scores on their CLO attainment for CLO1, 2, 3 and 4 have risen to 76%, 77%, 75% and 72%, respectively. It is encouraging to notice that the PBL implemented in this study has strengthened the students' perceptions on the attainment of CLO1 by 5%, CLO2 by 9%, CLO3 by 11% and CLO4 by 13%. The current PBL project helped the students select feasible engineering solutions to coastal problems and development of detailed engineering designs. Thus, the PBL activity executed in this study successfully enhanced the students' understanding and ability to achieve all the course learning outcomes of DCS.

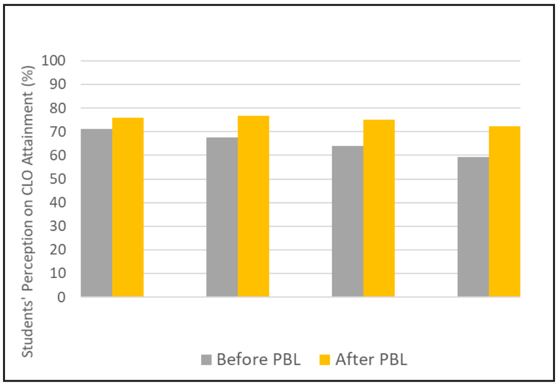

Figure 8 Average CLO attainment scores for CLO 1, 2, 3 & 4 during pre-and-post PBL activity

Table 3 presents the students' perception of their technical and personal skills during the pre-and-post PBL project. The INTPs are easily felt disconnected from other people, especially in a large group, and they may inadvertently come across as insensitive or unkind, even though their intentions are generally good [2]. Such personalities may hinder them from being effective team players. This explains why the 'working in team' score remain low (55.6%) in Table 3. The present PBL project was able to boost the score to 66.7% as the students started to acknowledge working in team was the only key to unlock the complexity of the project. Further, the nature of this project also required the students to demonstrate leadership quality as they led an aspect or component of the project. This leads to an improvement of the leadership score from 71.2% to 80.8%. Positive sharing attitudes were practiced by the DCS students throughout the project period as they constantly shared information and data as well as provide guidance and help to their group members. This PBL project successfully imparts such value in the hearts of the participating students with an incremental score of 8.2%, as seen in the table. Undeniably, effective communication among the group members is the prerequisite to nurturing team spirit, leadership quality and positive sharing attitudes. Due to regular meetings and interactions with the team members, the DCS students perceived that their communication skills somehow improved from 77.8% to 84.4% upon completion of the project. The problem-solving skills of the final year students are generally higher than the students of lower grades, giving a total score of 77.8% prior to the PBL project. The students were given a chance to demonstrate their ability to solve the real complicated problems using all the resources made available to them. They agreed that their problem-solving and self-directed learning abilities were respectively upskilled by 8.2% upon completion of the project. In summary, the PBL activities undertaken in this study successfully encouraged learning within a team environment (collaborative learning), built the technical skills and nurtured numerous positive personal traits, communication and positive sharing attitudes among the DCS students.

Table 3 Students' perception on their technical and personal skills during the pre-and-post PBL project

Skill Sets	Attainment (%)		Improvement
	Before PBL	After PBL	(%)
Working in team	55.6	66.7	11.1
Communication skills	77.8	84.4	6.6
Problem solving skills	77.8	86.0	8.2
Self-directed learning skills	77.8	86.0	8.2
Leadership skills	71.2	80.8	9.6
Positive sharing attitudes	80.0	88.2	8.2

Table 4 presents the change of students' perspective towards adopting active learning through PBL of a real problem. Prior to the PBL project, the majority of the DCS students were passive about active learning based on their previous experience. Almost 70% of the students were not keen on having active learning in their final year. However, 77% of the student population were excited about being introduced to PBL for the first time through the DCS course. As they completed the full cycle of the 10-week PBL activities, many of them had improved their perspectives on active learning and PBL as a whole. It is motivating to report that the existing PBL project successfully convinced an additional 37% (from 29.6% to 66.7%) of the DCS students about the positive impact of active learning. In addition, 83% of the DCS students acknowledged that the PBL adopted in this study was an effective tool to facilitate active learning among the students. They enjoyed the whole process of the PBL activity and were particularly happy dealing with the real problems in a virtual environment. They believed that the experience would consequently help to improve their academic performances (Table 5). They highly recommended using this online PBL method in future DCS courses where physical classrooms are not feasible due to the COVID-19 pandemics.

Table 4 Students' perceptions on the effectiveness of the PBL activity undertaken in this study

Preferences For	Attainment (%)		Improvement (%)
	Before PBL	After PBL	
Active learning in class	**29.6**	**66.7**	**37.0**
Problem-based learning	**77.0**	**83.8**	**6.8**

Table 5 Student self-reflection

Self-Reflection Statements	Intervention 1	Intervention 2	Improvement (%)
I can apply the knowledge gained from this course.	4.38	4.67	6.62
I had a clear understanding of the aims and goals of this course.	4.50	4.67	3.78
The requirements of the assessments assigned were made clear to me.	4.35	4.63	6.44
The instructor/lecturer was able to facilitate the learning process.	4.38	4.48	2.28
I can make connection between this course and other courses that I have learnt.	4.46	4.59	2.91
I was provided with various resources to help me learn.	4.35	4.56	4.83
I always received adequate and timely feedback from the instructor/lecturer.	4.42	4.59	3.85
The way the course was conducted created conducive environment for student-lecturer interactions.	4.31	4.48	3.94
Average	4.39	4.58	4.33

In Table 6, the median grades of CLO1, CLO2, CLO3 and CLO4 for September 2018, January 2019, January 2020 and May 2020 semesters are compared. Note that PBL was not implemented in September 2018 Semester, and the PBL involving physical site visits were implemented in the January 2019 and January 2020 semesters. For the September 2018 batch, and the median grade for CLO1, CLO2, CLO3 and CLO4 are B, C+, B and B+, respectively. With the implementation of PBL in January 2019, January 2020 and May 2020 semesters, the CLO median grades improve by one or two grades relative to the performance in the September 2018 semester. It is also interesting to learn that the overall students' performance in May 2020 Semester is comparable with those in January 2019 and January 2020 Semesters where physical PBL was implemented. This implies that the virtual site visit and online PBL program introduced in May 2020 Semester were effective in engaging the DCS students in their learning. The result is in agreement with the finding of Coiado (2020) that overall student performance was similar between online and in-person PBL sessions. Hence, it is safe to conclude that the online PBL method developed in this study does help to improve the academic performances of the DCS students.

Table 6 CLO median grades for September 2018, January 2019, January 2020 and May 2020

CLO	Median Grade			
	Sep-18*	Jan-19	Jan-20	May-20
1	B	B+	B+	B+
2	C+	B	B	B+
3	B	B+	B+	B+
4	B+	A	B	A-
Class Size	17	18	7	27

*PBL activities were not implemented

Conclusion

In summary, a systematic online PBL program was developed to facilitate the learning of the DCS students of May 2020 Semester during the COVID-19 outbreak. Through this online program, the participating students were exposed to virtual site visit experience with real-life engineering problems and consequently mastered the relevant knowledge and technical skills adequately. The program successfully improved the median grades of all CLOs and nurtured numerous positive personal traits, communication, and positive sharing attitudes among the DCS students. In short, the PBL program developed for the DCS course has met its objective to a high degree.

Acknowledgment

The author would like to thank Universiti Teknologi PETRONAS and the Eramus+ Programme of the European Union for funding this research using SOTL Grant (015LF0-024) and Marine Coastal and Delta Sustainability for Southeast Asia (MARE) International Grant (015ME0-142), respectively.

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CLASSROOM ASSESSMENT TECHNIQUES (CATS) IN IMPROVING TEACHING AND LEARNING (T&L): A CASE STUDY FOR ENGINEERING FLUIDS MECHANICS

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Introduction

Engineering fluid mechanics is a common and fundamental engineering course that needs to be studied by engineering students. However, the finding shows that a declining trend of the students' performance for this course in the Department of Civil & Environmental Engineering of the University since 2017. Hence, this study is proposed to investigate the issue and provide the mitigation strategies to improve the course's Teaching and Learning (T&L)

Teaching & Learning challenges in Engineering Fluid Mechanics

Studies showed that many students find the subject, engineering fluid mechanics, difficult to understand and, as a result, low levels of engagement and performance (Webster, Majerich, & Madden, 2016) (Hai Lu, Xiaoyu Zhang, Di Jiang, Zijie Zhao, Jianhui Wang, 2012). Further in detail, it was highlighted that the principal challenge of teaching engineering fluid mechanics are the level of abstraction that comes with the subject. Fluids move in complex and beautiful patterns, but the flow is often difficult to be visualized with the naked eye, hence the imagination of the behavior and motion is restrained (Bondehagen & Univer-, 2011). Though the traditional lecture/laboratory/discussion format allowed the appropriate material to be introduced, explained, and tested to meet curricular requirements, student interest in and awareness of the importance of the subject had declined over the years, evidenced at the end of the semester student evaluations and enrollment in elective, follow-up courses (Courter et al., 2011).

The learning mechanisms of this generation of students have transformed from being traditional and passive to being more hands-on and active (Choudhury & Rodriguez, 2017). Replacing lecture time with activity-based learning positively affects university students by reinforcing concepts learned during lecture, visually teaching new concepts and providing an outlet where the students are free to interact more casually with the instructor and their peers (Bottomley, As-, & Mentoring, 2012).

Different active learning models were initiated to improve the students' interest and performance for the course. For example, (Bottomley et al., 2012) introduced twist and turn for fluid flow, construction function for pipe flow etc. in the fluid mechanic's class. Meanwhile, (Rahman, 2016) introduced blended learning approach, (Hadi, 2017) introduced laboratory kits for remote online learning, (Courter et al., 2011) introduced an assignment to include the work experiences, observation, or curiosity to demonstrate their understanding of fluid mechanics concept introduced in class. All of this is proven by the

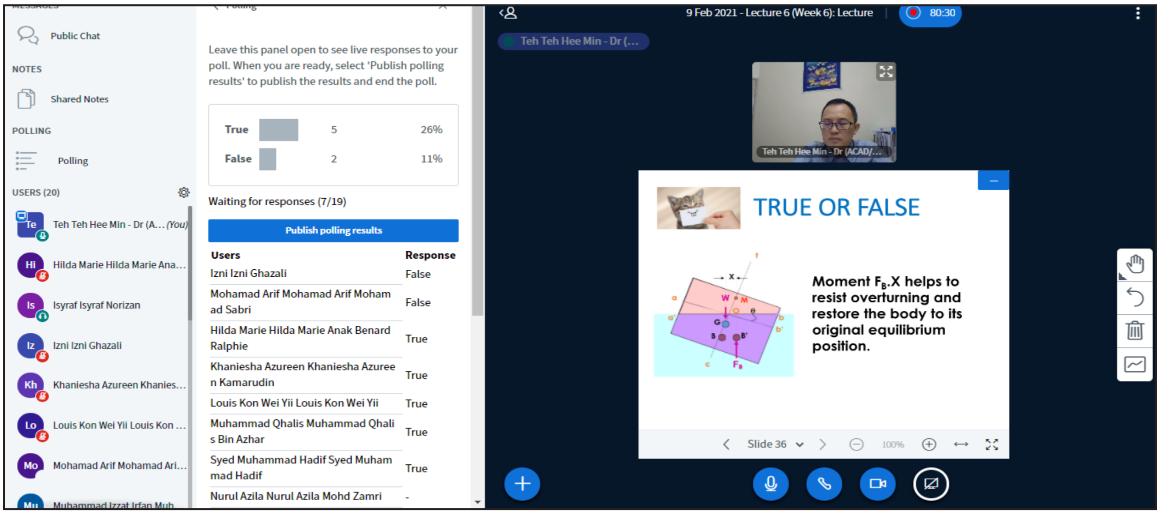

Figure 1 Screen shot of the live session during CATs

Kyere, 2017. CATs were well explained by Angelo and Cross (1993). It has been highlighted that formative assessments played a significant role in the T&L to monitor the student learning progress and understanding. With this, this project aimed to investigate the issue of students' performance decline for the course and to improve it by Classroom Assessment Techniques (CATs).

Methodology

A statistical analysis is planned herein to analyze the effectiveness of the CATs as part of the classroom activity, based on 95% confidence level. Sampling was considered from May 2020 to Jan 2021. In detail, May 2020 and September 2020 semesters have no implementation of CATs, hence the data will be treated as the benchmark cases. Meanwhile, the effectiveness will be compared for data from January 2021, in which CATs was implemented. Table 1 shows the sampling size for the classes from May 2020 to Jan 2021.

Table 1 Sample size

Semester	Class size
May 2020	26
Sep 2020	10
Jan 2021	25

CATs were implemented in the form of formative assessment in order to measure the students' understanding while they are still in the process of learning. This project has been designed so that the lecturer of the course conducted a survry studentey polls right after each lectures to evaluate the students' comprehension. Continuation from this, the feedbacks on their comprehension were summarized and given immediately during the session. Figure 1 showed the live session when the CATs was conducted during the class. A satisfaction survey was conducted to get feedback from students regarding the CATs conducted over the semester.

Results and Discussion:

Quantitative assessments by statistical analysis

The data was to be analyzed the stability and normality prior to the comparison to validate the variance. Results obtained from the Stability test by I-Chart and Normality test by Probability plot are illustrated below.

Stability Test by I-Chart for Test

The main purpose of conducting the stability test is to access if the data is stable or random. It can be observed from Figures 2 to 4 that the test data are mainly lying between the upper and lower limits. It can be concluded that the test results are stable to be considered for the next analysis.

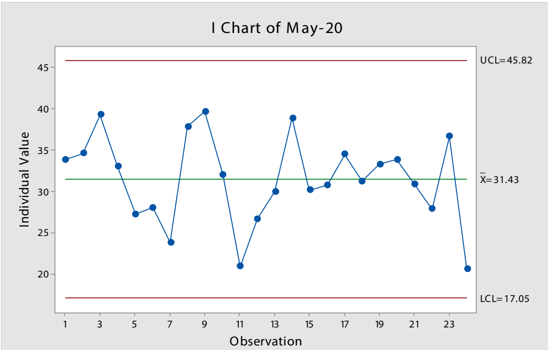

Figure 2 Stability Test by I-Chart for Test in May 2020

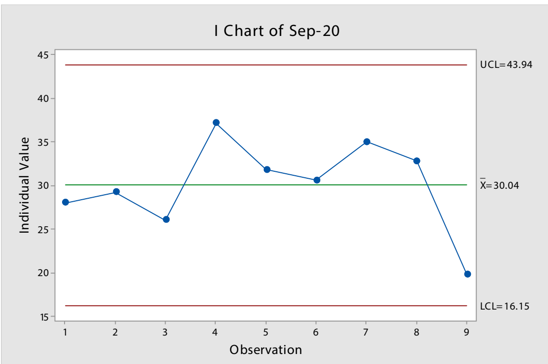

Figure 3 Stability Test by I-Chart for Test in September 2020

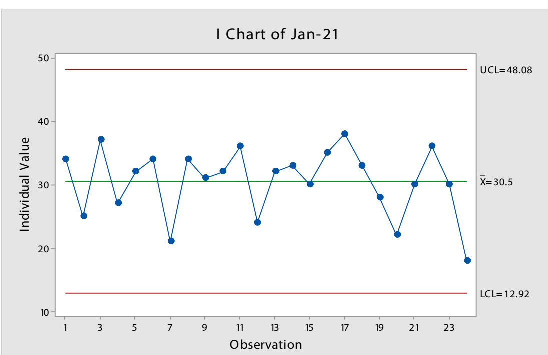

Figure 4 Stability Test by I-Chart for Test in January 2021

Stability Test by I-Chart for Final Assessment

The same test was conducted for final assessments from May 2020 to Jan 2021 semesters. It can be observed that other than the data for May 2020 that has one observation failed on the I-Chart below the lower limit, data for September 2020 and January 2021 are considered stable. Figures 5 to 7 illustrated the stability test results by I-Chart for final assessments from May 2020 to Jan 2021.

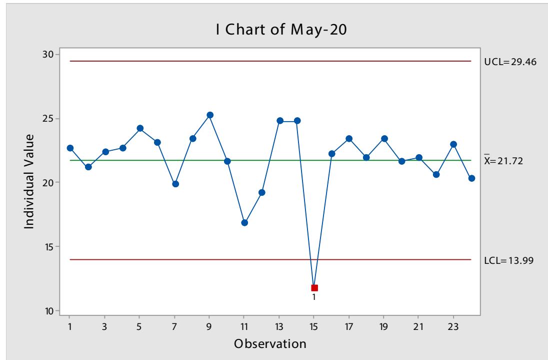

Figure 5 Stability Test by I-Chart for Final Assessment in May 2020

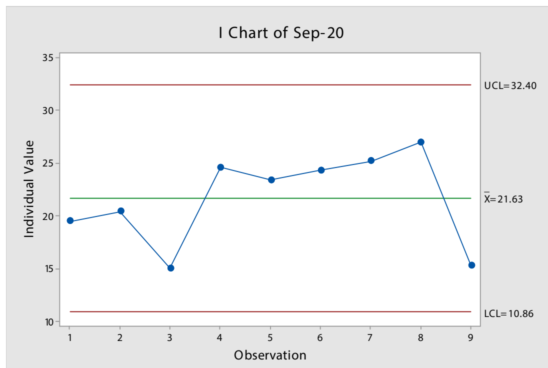

Figure 6 Stability Test by I-Chart for Final Assessment in September 2020

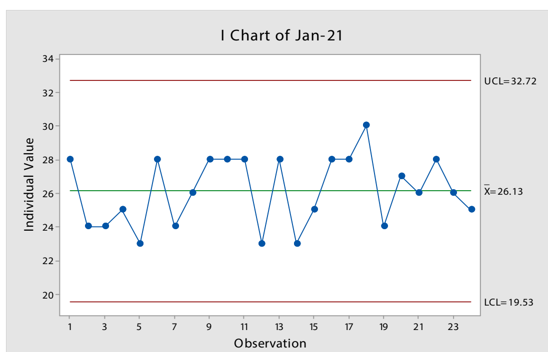

Figure 7 Stability Test by I-Chart for Final Assessment in January 2021

Normality Test by Probability Plot for Test

After the stability test, data is to be tested the normality by the probability plot. Figures 7 to 9 below show the probability plots for a test from May 2020 semester to January 2021 semester. From the figures, the P-values are to be observed. It can be seen that the P-values of all three sets of data are greater than the significance level of 0.05. Therefore, the data fails to reject the null hypothesis that following the normal distribution. In other words, the data passed the normality tests.

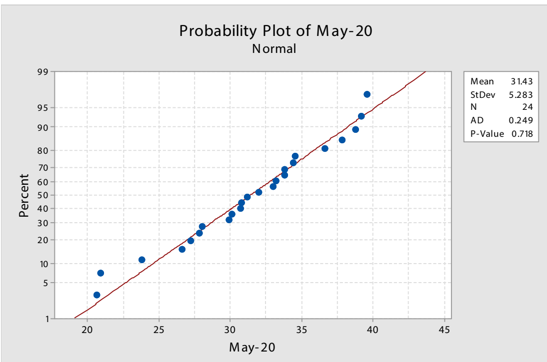

Figure 8 Normality Test by Probability Plot for Test in May 2020

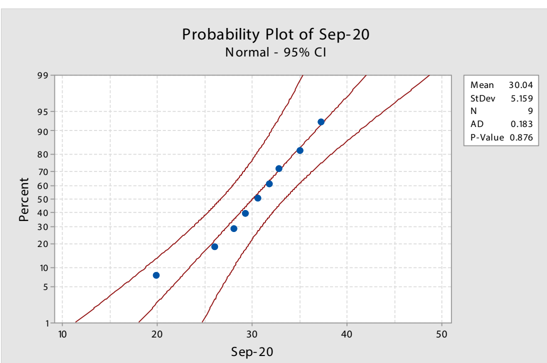

Figure 9 Normality Test by Probability Plot for Test in September 2020

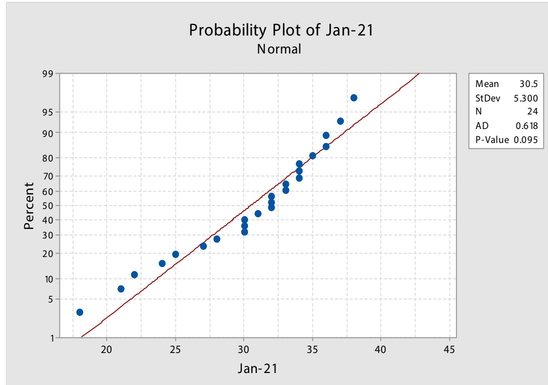

Figure 10 Normality Test by Probability Plot for Test in January 2021

Normality Test by Probability Plot for Final Assessment

The data for the final assessment is to test the normality by the probability plot. Figures 10 to 12 illustrated the probability plots for the final assessment from May 2020 semester to January 2021 semester. By observing the P-values from the figures. A conclusion was drawn that only the final assessment in September 2020 semester passed the test. Nevertheless, this may indicate that the median data will be used in the following analysis for the final assessments in May 2020 and January 2021 semesters.

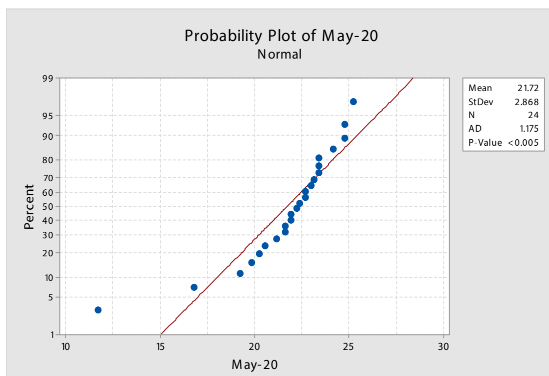

Figure 11 Normality Test by Probability Plot for Final Assessment in May 2020

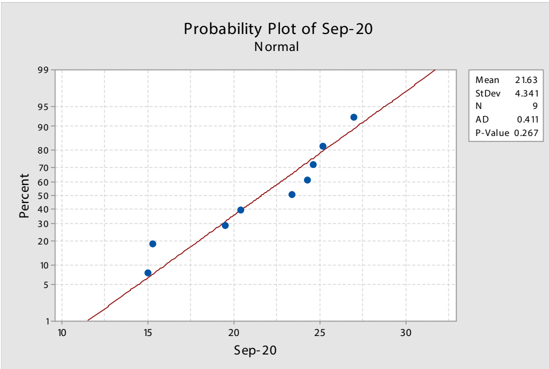

Figure 12 Normality Test by Probability Plot for Final Assessment in September 2020

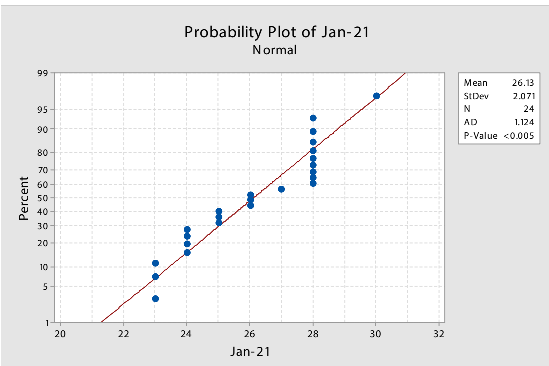

Figure 13 Normality Test by Probability Plot for Final Assessment in January 2021

Paired T-Test for Test

To determine whether the mean of the difference between the two paired samples differs from 0 and to calculate a range of values that is likely to be included in the population mean of the difference, Paired T-Tests are conducted for both the Tests and Final Assessments. In the tests, May 2020 and September 2020 were set as the before or the benchmarked case. Meanwhile, Jan 2021 semester was set as the after with the implementation of the CATs in the T&L activities. Figures 13 and 14 below demonstrate the finding from the Paired T-test. Again, by observing the P-Values, it can be concluded that the test data failed to reject the null hypothesis and no significant difference between the students' test performance before and after running the CATs.

Paired T-Test and CI: May-20, Jan-21

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
May-20	24	31.43	5.28	1.08
Jan-21	24	30.50	5.30	1.08

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ_difference
0.93	6.11	1.25	(-1.65, 3.51)

μ_difference: mean of (May-20 - Jan-21)

Test

Null hypothesis H₀: μ_difference = 0
Alternative hypothesis H₁: μ_difference ≠ 0

T-Value	P-Value
0.75	0.462

Figure 14 Paired T-Test results for Test comparing May 2020 and Jan 2021

Paired T-Test and CI: Sep-20, Jan-21

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Sep-20	9	30.04	5.16	1.72
Jan-21	9	30.56	5.17	1.72

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ_difference
-0.51	8.74	2.91	(-7.23, 6.21)

μ_difference: mean of (Sep-20 - Jan-21)

Test

Null hypothesis H_0: μ_difference = 0
Alternative hypothesis H_1: μ_difference ≠ 0

T-Value	P-Value
-0.18	0.865

Figure 15 Paired T-Test results for Test comparing September 2020 and Jan 2021

On the other hand, observing the test results for students' final assessment performance, as in Figures 15 and 16, the P-values are less than the significant level of 0.05. Henceforth, a conclusion is drawn here that the implementation of CATs indeed has an impact on the final assessment, compared with both May and September 2020.

Mean Score for Overall Assessments

A comparison of the students' performance on the overall assessments has been conducted, as shown in Table 2. It can be observed that assignments and final assessment in January 2021 showed an improvement of about 1% and 15% respectively, as compared to May 2020 and September 2020.

Paired T-Test and CI: May-20, Jan-21

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
May-20	24	21.725	2.868	0.585
Jan-21	24	26.125	2.071	0.423

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ_difference
-4.400	3.384	0.691	(-5.829, -2.971)

μ_difference: mean of (May-20 - Jan-21)

Test

Null hypothesis H₀: μ_difference = 0
Alternative hypothesis H₁: μ_difference ≠ 0

T-Value	P-Value
-6.37	0.000

Figure 16 Paired T-Test results for Final Assessment comparing May 2020 and Jan 2021

Paired T-Test and CI: Sep-20, Jan-21

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Sep-20	9	21.63	4.34	1.45
Jan-21	9	25.56	2.01	0.67

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ_difference
-3.92	5.07	1.69	(-7.82, -0.03)

μ_difference: mean of (Sep-20 - Jan-21)

Test

Null hypothesis H₀: μ_difference = 0
Alternative hypothesis H₁: μ_difference ≠ 0

T-Value	P-Value
-2.32	0.049

Figure 17 Paired T-Test results for Final Assessment comparing May 2020 and Jan 2021

Students' satisfaction survey on CATs implementation
A survey consisting of 14 questions was conducted to measure the level of students' satisfaction towards the implementation of CATs. The survey was conducted for all the 24 students from Jan 2021. More than half of them show that they are satisfied with the CATs implementation. On top of that, this group of students also agreed that the purposed and benefits of CATs implementation has been clearly elaborated. Nevertheless, they would also like to recommend implementing the CATs in the coming semester or other courses. Figure 17 summarizes the survey response; the survey questions, and response details are attached in Table 3.

Table 2 Mean Scores for All Assessments by Semesters

	Weightage	May-20	Sep-20	Jan-21
Assignment	20	15.7	18.4	18.6
Quiz	10	7.6	9.4	6.4
Test	40	31.5	30.1	30.5
Final Assessment	30	21.6	21.6	26
Overall	100	76.4	79.5	81.5

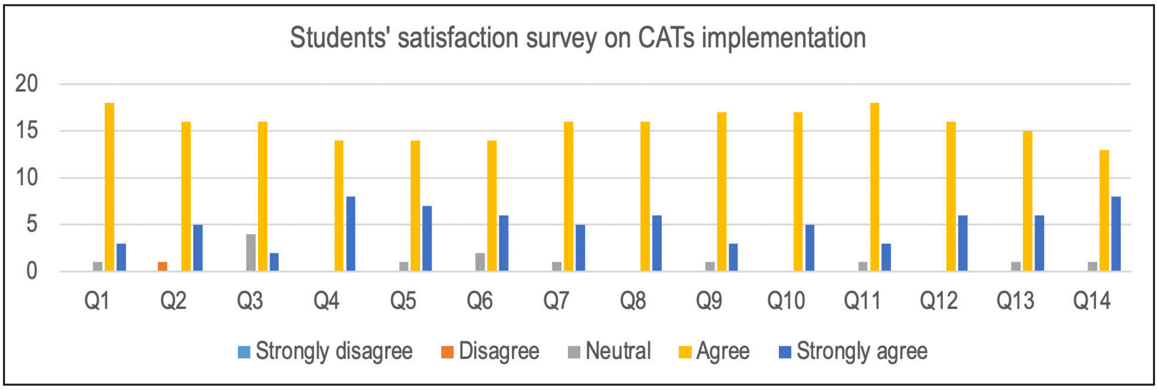

Figure 18 Students' satisfaction survey on CATs implementation for Jan 2021

Table 3 Questions and Responses of Students' satisfaction survey on CATs implementation for Jan 2021

No	Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	The CATs adopted in the class provided just-in-time feedback about the teaching-learning process.	0	0	1	18	3
2	The CATs adopted in the class helped me to better monitors my own learning	0	1	0	16	5
3	The CATs adopted in the class made me feel less anonymous in the group.	0	0	4	16	2
4	"The CATs adopted in the class provided concrete evidence that the instructor cares about learning."	0	0	0	14	8
5	The course instructor explained the purpose of the activity to students and then conducted it.	0	0	1	14	7
6	The course instructor reviewed the results with students after the CAT activities.	0	0	2	14	6
7	The course instructor showed how you learned from the CAT.	0	0	1	16	5
8	The CATs adopted in the class helped to sustain my attention.	0	0	0	16	6
9	The CATs adopted in the class helped me to demonstrate current knowledge and skills.	0	0	1	17	3
10	The CATs adopted in the class helped me to apply the principles and concepts I learned.	0	0	0	17	5
11	The CATs adopted in the class improved my analytical skills.	0	0	1	18	3
12	The CATs adopted in the class developed and enhanced my problem-solving skills.	0	0	0	16	6
13	I am happy with my experience with the CATs introduced in the class.	0	0	1	15	6
14	I recommend CATs to be implemented in Engineering Fluid Mechanics in the coming semesters or other courses.	0	0	1	13	8

Acknowledgment

This project is funded by the Scholarship of Teaching and Learning (SoTL) grant (015LFO-040). The authors would like to thank the management of Universiti Teknologi PETRONAS for the continuation of supports in Teaching and Learning.

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STUDENTS' PREFERENCE OF ELECTRONIC DEVICES TOWARDS ONLINE LEARNING DURING COVID-19 PANDEMIC

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Introduction

The usage of electronic devices in learning has increased drastically since the COVID-19 pandemic hitting the globe, as online learning has become a necessity during the pandemic (UNESCO 2020). The physical learning process has changed, and students are highly connected to the computer and their mobile phones to access the e-learning platform (Sanni 2019). It is essential for the educator to be competent in online learning tools (König, Jäger-Biela, and Glutsch 2020), be it hardware and software. As academic activities have transitioned to online learning platforms, problems concerning the preparation, design, and effectiveness of e-learning have emerged as a new concern in academia (Muthuprasad et al., 2021). Although students are suggested to choose the affordable electronic device for online learning (König et al. 2020), various devices can affect the standard display of teaching content. The usage of smartphones in learning produced a small display that is not suitable for wordy teaching content. This study examines the preferable electronic device for engineering and non-engineering students in UniKL MSI and Politeknik Tuanku Sultanah Bahiyah to prepare for future teaching material.

Through an online survey of 303 students, this study reached to understand the student's preference for online learning. According to the findings, 100% of respondents embrace online classes and dedicated themselves to online learning during this pandemic. Smartphones, PC, and laptops are the most chosen devices during class. Students believe that online programs are appealing because of their flexibility and convenience. However, broadband connectivity concerns in remote locations make it difficult for students to participate in online learning and survey efforts. This study also can provide the learning insight from student's perspective on practical courses that conducted online. The results from this article will serve as empirical evidence to help develop a teaching method for a new norm.

Method

A questionnaire is developed consisting of Part A and Part B. Part A contains the respondents' personal information. Part B is concerned with the assessment of students' preference in the electronics devices for online learning.

Part B is divided into four sections, covering the student learning year, field and electronic devices. Part B is using a rating scale for an answer in a Likert-type question. Questionnaires are distributed to correspondence online covering the Kulim district area.

The information gathered from the questionnaires is analyzed with the help of a bar chart. The discussion on the graph pattern is elaborate along with the findings.

Result and discussion

The percentage between engineering and non-engineering is shown in Figure 1, with engineering students are the majority of more than half in the survey.

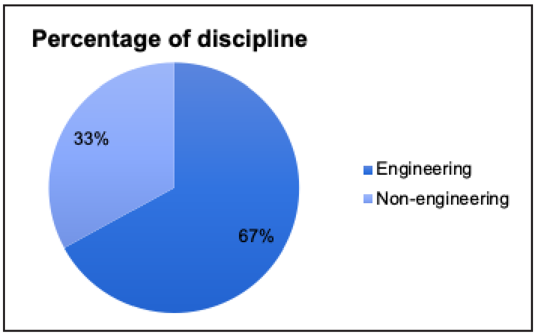

Figure 1 Percentage of both fields

Participation of students for the survey came from various semester and year. Figure 2 shows the percentage tabulation of students based on the learning year for engineering and non-engineering course.

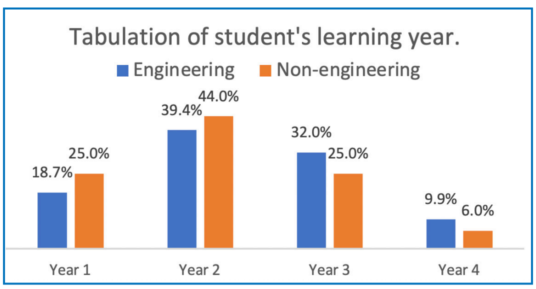

Figure 2 Tabulation of students

From the tabulation, further investigation on the first-year students is conducted. Figure 3 shows the preferred device for the first-year students for both engineering and non-engineering students and is obvious that smartphones are the most preferred devices in both fields.

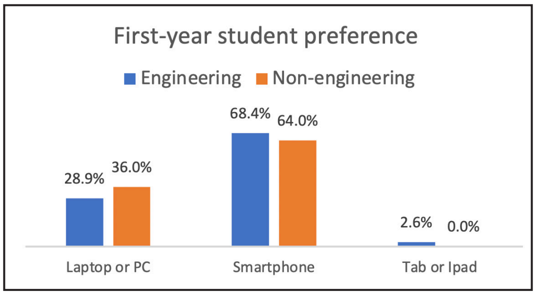

Figure 3 First-year student

For the second-year student, the percentage of the preferred smartphone has decreased as students choose to laptop and PC. Figure 4 shows the result.

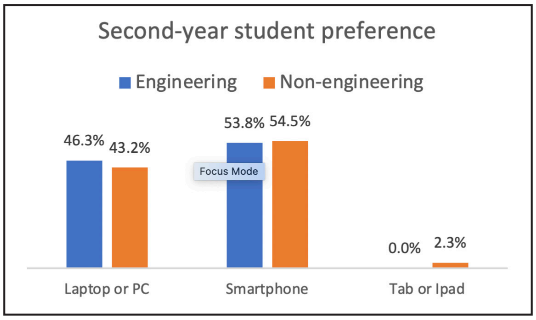

Figure 4 Second-year student

Further decrease of the percentage has been recorded for third and fourth-year students, as shown in Figure 5 and Figure 6. It is understandable that during these semesters, students are taking specific subjects based on their degree program.

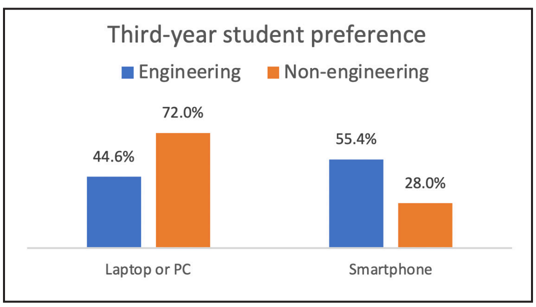

Figure 5 Third-year student

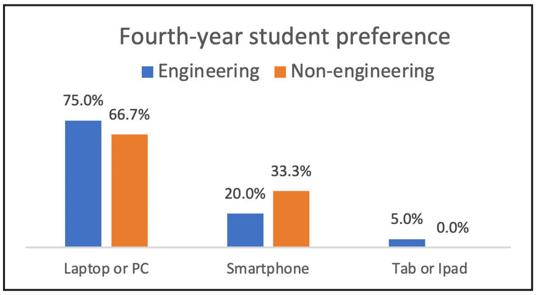

Figure 6 Final-year student

The data shows a worrying pattern of engineering student preference. Complicated subjects with complex solution processes are always associated with an increase in learning years. As shown by Figure 5, the data is almost similar to the preference of the second-year student, and the size of smartphones may not be sufficient for technical comprehension.

Turning to the final year, the increase of engineering students to use PC and laptop are significant. It is understood that this is the stage of capstone subjects, and the final year project requires a lot of individual and group presentations. Thus, the usage of PC and laptop are inevitable.

Conclusion

In essence, online learning has emerged as a significant factor in transforming the educational landscape, particularly in Malaysia. In response to COVID-19, it is crucial to plan teaching material for online learning. This document is intended to serve as a starting point for planning and implementing a significant learning transformation. The current trend of students' preference for electronic devices will require suitable teaching material for better comprehension, both engineering and non-engineering. In conclusion, COVID-19 required educators to be creative in planning online teaching materials. Educational institutions must keep up with the new norm of students' mindsets and culture to ensure the quality of future graduates.

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IMPLEMENTATION OF INDUSTRIAL TRAINING ON ELECTRICAL ENGINEERING STUDENTS DURING COVID-19 A CASE STUDY

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Introduction

Industrial Training (IT) is crucial for students as it gives students great exposure to a working environment outside the classroom. IT with a code subject of EGND324 is a compulsory subject for a Diploma in Electrical Engineering program with 16 weeks. Although we are facing the COVID-19 pandemic for more than a year since 2020, students still need to complete their IT in order to complete their studies. Before the IT started, the COVID-19 situation was improving, and the government had eased up or lift-off traveling restrictions. Students were expected to have face-to-face (F2F) or physical IT. The COVID-19 situation during the early stages of the IT issue was complicated by the requirement for students to apply for their IT placements. Considering this situation, the department is concerned about providing students with enough engagement and knowledge without sacrificing their work-based learning in their IT program. Due to the COVID-19 situation, the students do their IT in either one of the three modes; Work From Office (WFO), Work From Home (WFH), and a combination of both. The department has taken actions to improve their learning as many physical IT was cancelled and shifted online. Those working from home must complete the mini-projects assigned by the coordinator. In addition, they need to complete their webinars for a minimum of three sessions in order to complete their industrial attachment program.

The aim of this study is to investigate the experience gained and challenges of IT implementation during the COVID-19 pandemic. The objectives of this study are to identify the demographics, types of IT, and resources required for IT during the COVID-19 pandemic and to evaluate experience gained and challenges associated with IT implementation during the COVID-19 pandemic.

Literature Review

IT is a work-based learning approach that engineering students must undergo as a part of their diploma studies. IT is defined as training in engineering technology in a professional engineering-practice environment. IT has lately been identified as a "high-impact" practice that increases student engagement and academic success (Kuh, 2008), prompting many schools and institutions to encourage or even enforce IT programs as a required experience. Engineering practice training will give first-hand exposure in an engineering practice environment outside of the Institute of Higher Learning (IHL). Familiarity with all common engineering technology processes is necessary, as is practical training in various processes at a level acceptable to the students. Industrial exposure offers students with both technical and interdisciplinary skills essential for holistic development in modern engineering education (Mariana et al., 2019). According to Cannon and Arnold (1998), the main goal of IT is to expose students to various aspects of IT practices and ethics, to apply training knowledge for a final year project, to allow students to integrate theory with practice, to introduce students to industry and its work culture, and to provide the opportunity to integrate theory with practice. IT with a minimum of 16 weeks is one of the main requirements for an accredited engineering diploma by the Engineering Technology Accreditation Council (ETAC), under the Board of Engineers Malaysia (BEM) (Engineering Technology Accreditation Council, 2019). IT should be a symbiotic relationship between students, institutions, and host organizations, not a parasitic relationship, as it sometimes appears to be (Paul et al., 1997). According to the guidelines published by BEM on June 5th, 2021, all students who are undergoing IT and affected due to any form of Movement Control Order (MCO), can continue the IT exposure after the completion of the final semester.

The institute of higher learning may consider alternatives to IT that might provide significant comparable results, such as properly monitored in-house repair and maintenance and supervised virtual industrial attachment. Remote internships seemed to hold promise for overcoming these barriers to fair participation, and some academics even wondered aloud if the online internship could increase equity and diversity in the IT world on its own (Kraft et al., 2019). An e-internship, according to Bayerlein and Jeske (2018), is an internship that is primarily mediated by computer technology, whereas a simulated internship is associated with and hosted by a college or university rather than an employer. In 2020, online internships will undoubtedly become the most popular mode of work-based learning for students all around the world (Braga, 2020; Lumpkin, 2020). In the context of national assessments of vocational education and training, IT must be reexamined in light of disputed findings on policy, administration, workplace practice, and learning outcome evaluation. (Norhazzah et al., 2012). A gap analysis is necessary for such alternatives to guarantee that the desired outcomes are achieved (Board of Engineers Malaysia, 2021). Hands-on learning and industrial working experience were not feasible due to lockdown; nevertheless, the objective of IT may well be adjusted for a virtual setting (Tahoura et al., 2021). Furthermore, we emphasize the potential for IT to provide students with an immersive experience in an organization's workplace culture, which can provide rich opportunities for development developing professional networks and discipline or occupation-specific professional skills and competencies within our own research center (Hora et al., 2020).

Research Methodology

The research employs a Program Implementation Case Study with a mixed-method approach in which students' perception of IT implementation was treated as variables that can be measured through the usage of questionnaires. The distribution of questionnaires was done without compromising respondents' private information and locality. As a matter of fact, the target audience was strictly defined as Engineering diploma students taking IT. To ensure conformance and impartiality, respondents had been made aware that the integrity of all the information is uncompromised and in no way would be relatable to them as individuals. A set of questionnaires was created by an online platform and was segregated to the respondents through the blasting of e-mail. Detailed instructions were also incorporated in the e-mail notification. Responses then shall be recorded and kept confidential. The study employed quantitative and qualitative approaches through the dissemination of online questionnaires. The data is gathered from Diploma in Electrical Engineering students at the end of their IT. The questionnaire consists of five parts: Demographic, Resources, Challenges, Health and Safety Concerns, and Feedback and Suggestion on IT during COVID-19. The questionnaire has two different formats (a yes/no format and a five-point Likert-scale format) provided as response options. A five-point Likert scale ranging from Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4) and Strongly Agree (5) was provided as response options.

Results and Discussion

Section A: Demographics

The data was gathered from a sample of 36 students from the Diploma in Electrical Engineering program. 69.4% of them are male students, and 30.6% are female students, as shown in Table 1. 72.2% of the respondents are 20 years old. Students who are 21 and 23 years old are 22.2% and 5.6% respectively. Most of the students were on their final semester at 61.1% and another 38.6% will need to return back to campus to finish off the study, having a few more subjects to graduate.

Table 1 Sample demographics

Gender	*N*	*%*
Male	25	69.4%
Female	11	30.6%
Total	36	100%
Age	*N*	*%*
20	26	72.2%
21	8	22.2%
22	0	0%
23	2	5.6%
Total	36	100%
Instruction level	*N*	*%*
Diploma, 3rd Year	14	38.9%
Diploma, Final Semester	22	61.1%
Total	36	100%

Students were asked whether they consider the distance between workplace and home when accepting internship placement offers. 86.1% of the students answered Yes, and 13.9% of students answered No. Before the semester begin, the government has loosened the Movement Control Order (MCO), this may suggest why the students considered the distance between workplace and home when accepting the offers. However, on the fifth week of the semester, the government enforced a much stricter traveling order. On the work mode during Movement Control Order (MCO), 27.8% of them experienced fully Work From Home (WFH) and 44.4% of them fully Work From Office (WFO). 27.8% of students experienced a combination of WFH and WFO or hybrid mode.

Section B: Resources

In Section B, the students were asked about the resources they already have and received from the company during the IT. 66.7% of the students answered that they have all the essential equipment and remote tools to perform their daily tasks, 61.1% have a stable internet connection to communicate with their supervisor, 61.1% does not receive any hardware assistance for IT from the company, and 58.3% does not have to purchase additional electronic devices for the IT. The institution via the information technology support staff should be able to provide subscribed software by the institution and assist the student in downloading and using relevant software for their IT.

Section C: Experience Gained

In Section C, the students were asked to rate their satisfaction with the IT on a 5-point Likert scale as in Table 2. Most of the students gave mainly positive feedback or rated the statements at the highest scale (Strongly Agree), as shown in Figure 1. Based on the result in Figure 1, students gave the most positive feedback on questionnaire item number 5. This shows that students are very motivated to learn new skills during the IT despite the COVID-19 situation. The students gave the lowest positive feedback on questionnaire item number 7. Based on the feedback in item number 7, 36.1% Strongly Agree, 44.4% Agree, 11.1% Neutral, 2.8% Disagree, and 5.6% Strongly Disagree. Item number 7 was the only questionnaire item with Strongly Disagree responses.

Table 2 Sample demographics

Number	Questionnaire Items
1	The industrial training tasks given by my supervisor are relevant to the course I am taking.
2	I received enough guidance from my supervisor to complete the tasks given.
3	I received a reasonable volume of work tasks to be accomplished within a given timeframe.
4	I was able to complete the tasks given by my supervisor.
5	I am motivated to learn new skills during my internship.
6	I managed to improve and enhance my skills during my internship.
7	I regularly receive feedback or discussions about my performance with supervisors during the internship.
8	My supervisor helps me to learn new skills during the internship.
9	The implemented industrial training course has achieved its objectives.
10	I am satisfied with the industrial training conducted in terms of skills and knowledge development.

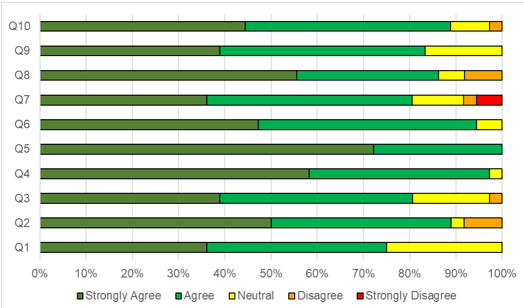

Figure 1 Student's feedback on experience gained during internship

Students were also asked to answer Yes or No on the questions given (Table 3). Based on the responses, students were able to maintain their well-being during the IT. However, more than a third of them felt stressed or burnt out during their IT.

The institution can support in terms of technical aspects related to IT to ease the students, especially in WFH mode. To help students gain technical experience, the coordinating department has instructed the students to attend at least three out of four selected webinars in engineering. Students who did their IT fully WFH need to do a mini project as a part of their IT. The accreditation body is also suggesting these implemented procedures in their published guidelines.

Table 3 Questionnaire items on wellbeing during internship

Number	Questionnaire Items	Yes	No
1	Do you communicate regularly with your team and supervisor?	35 (97.2%)	1 (2.8%)
2	Do you work in a conducive and ergonomic working environment?	33 (91.7%)	3 (8.3%)
3	Do you have a balanced and healthy work-life during your internship?	32 (88.9%)	4 (11.1)
4	Are you in control of managing your time when working during the internship?	35 (97.2%)	1 (2.8%)
5	Do you feel stress or burnout during your internship?	14 (38.9%)	22 (61.1%)

Students were also asked to write and share the challenges they faced during the IT. Most of the challenges are due to the conditions of having to work from home, lack of communication with colleagues, unable to balance work and life, poor Internet connection, and unconducive workspace at home.

> *"Heavily rely on a laptop (my laptop once broke and need to ship out to the repair center)."*
> *"Since my IT is fully working from home, I was not able to obtain live working experience of managing the building's automation system due to the very strict company Standard of Procedure (SOP)."*

Apart from instructing the students to join engineering-based webinars only, the students may also benefit from participating in other non-engineering-based online activities organized by the clubs under the institution. Regular meetings should also be encouraged between students and their assigned supervising lecturers to monitor students' condition better while doing IT.

Section D: Health and Safety Concerns

In Section D, students were asked about their health and safety concerns, which covers both COVID-19 and non-COVID-19 concerns. 13.9% of students had to seek medical attention due to illness is not related to COVID-19. 55.6 % responded affirmatively when asked if they were required to take the COVID-19 swab test during their IT. The reason for the swap test is probably because they have to follow the Standard Operating Procedure (SOP) to enter the workplace. 19.4% of students were identified as close contacts during the IT and 2.8% of students was tested positive for COVID-19 during her IT. 63.9% of students received two doses or complete doses of COVID-19 vaccines, 27.8% of students have partial vaccination or one dose of the vaccine only, and 8.3% of students have not received their vaccinations appointments during the IT period. The institution via the Student Affairs Centre department, should do a briefing early of the semester regarding the medical coverage by the insurance provider administered by the university for them to know their medical benefits as UNITEN students.

Section E: Feedbacks and Suggestions

Even though the students faced many challenges during the IT, most of the students gave good feedback on the IT experience. Most of the students appreciate the initiatives done by the university and the company in managing the IT during the COVID-19 pandemic. Some of them are appreciative of the technical skills gained, the industrial and hands-on exposure that help them to strengthen their theoretical knowledge.

> *"IT with my company was a good journey. I learned new things that were helpful for my study and pursuing higher education in future."*
>
> *I gained a lot of new experience, especially the technical works because that is my company's main activity, maintenance. Pretty good experience to be part of the team. I got to learn more about the electrical fields, including substations, overhead*

lines, and cables. I was exposed to the real working environment since I followed them to the sites every working day."

Conclusion

The study has evaluated students' satisfaction with the IT that they went through during a full semester in the COVID-19 pandemic. Students were able to gain valuable experience working in the industry from the IT that was implemented. Therefore, the study has provided insights on the current implementation of IT during the COVID-19 pandemic besides coming up with some suggestions which can be better implemented in the future. The research should be employed in the following years to keep track of the IT implementation by the institution.

Acknowledgment

We are thankful to the Department of Engineering Foundation and Diploma Studies, College of Engineering, and Innovation & Research Management Centre (iRMC), Universiti Tenaga Nasional for their support in assisting us in completing this paper.

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HERE WE GO! EXPLORING MICRO-CREDENTIAL (MC) PRACTICES IN MALAYSIA: A REVIEW

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Introduction

The Covid-19 pandemic has caused many to suffer the loss of jobs, businesses, and assets. This has also impacted the young learners at colleges and universities as their parents are unable to support them financially. As a result, more dropouts and suicidal cases among the younger generations. While some are forced to work on a part-time to support the family, hence they are unable to return to campus and have to delay their studies.

This outbreak has recently transformed the learning and teaching practices towards "anytime, anywhere, and affordable". The traditional face-to-face teaching and learning are losing their popularity as more learners are seeking towards blended learning or 100% online learning. At present, higher learning providers are offering courses at extensive volume and depth within few years of studies before a certificate of competency is awarded to the learners. The blooming of the Gig economy era in today's world's fast-paced industry demands employees and experts with specific skill sets to suit ever-more specialized jobs. In order, to satisfy these demands, higher learning providers need a quicker and more dynamic form of learning, which arrived in the form of Micro-Credential a recognized player in 21st-century training and education.

Micro-credential is a new buzzword in town. It is becoming even more evident after the strike of the Covid-19 pandemic that spurs the development of the Gig economy. It has been a year since the pandemic outbreak, and experts believe it will stay longer than expected. This has changed the entire landscape of education. Everything has gone online, from shopping to learning and to working. Now, everyone has the opportunity to learn, re-learn, re-skilling, and up-skilling on various knowledge, skills, and competencies of their interest or for professional development. Many learning providers and big companies are offering courses in smaller modules of various topics at an affordable fee, which the learners can complete at the flexibility of their time.

With the release of the Malaysia Qualification Agency (MQA) guideline on Micro-credential, it has become the biggest push factor for both big and small players of education & training providers to embark on this journey. The guidelines are very much generic; hence each higher learning institutions are required to work on the bits and pieces of implementing Micro-credential practices as well as online platform with digital batches and digital certificates. The execution of the Micro-credential program at each university is subjected to internal arrangement, management, and approval, while aligned to Malaysian Qualifications Agency(MQA) requirements.

UNESCO (2018) defined Micro-credential as "erm that encompasses various forms of certifications, including 'nano-degrees', 'micro-masters', 'credentials', 'certificates', 'badges', 'licenses' and 'endorsements'" (UNESCO, 2018). Oliver (2019) described micro-credential as "digital certification of assessed knowledge, skills and competencies which is additional, alternate or complementary to or a component of formal qualifications" and also known as alternative credentials (Oliver, 2019). Furthermore, more granularly certified learning creates better trust, value, and sustainability via digital systems since it recognizes prior learning for experienced learners through a national credit structure (Selvaratnam & Sankey, 2021).

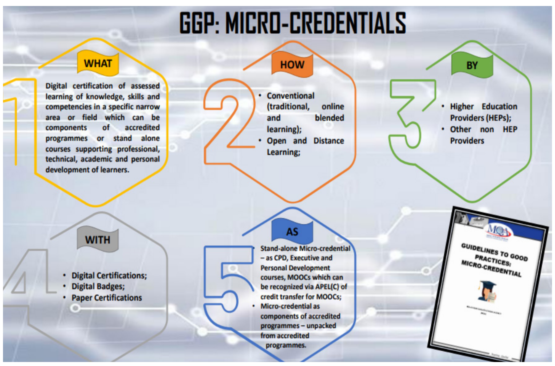

Figure 1 MQA Micro-credential guideline (Malaysian Qualifications Agency, 2020)

With an ongoing pandemic, a three- or four-year degree may no longer be suitable to secure a permanent job, or long-term work as the matching of the qualifications in a timely manner is limited. At the same time, current employment requires a constant update on the knowledge and skills. The demand for flexible just-in-time and continuous learning is increasing among learners and workers who seek to remain relevant in an ever-changing work environment (Selvaratnam & Sankey, 2021). The quick and sustainable solution is to offer micro-credentials courses.

However, the academic literature in micro-credentials is very much limited (Selvaratnam & Sankey, 2021) The recent studies found that micro-credentialing is a positive step forward. Hence, institutions must increasingly collaborate with other institutions and industries to offer micro-credential courses that develop capabilities and competency required (Tehan & Cash, 2020), a robust ecosystem of policy and infrastructure (Ghasia et al., 2019) and a sustainable business model (Rossiter & Tynan, 2019) to ensure the success.

Figure 2 illustrates Macro-credentials versus Micro-Credential. conventional or university credentials like the diploma, bachelor, master, and doctorate are characterized as macro-credentials, and in contrast, Micro-Credential focus on a much smaller volume, narrow scope, bite-size and demand-driver of learning over a shorter duration.

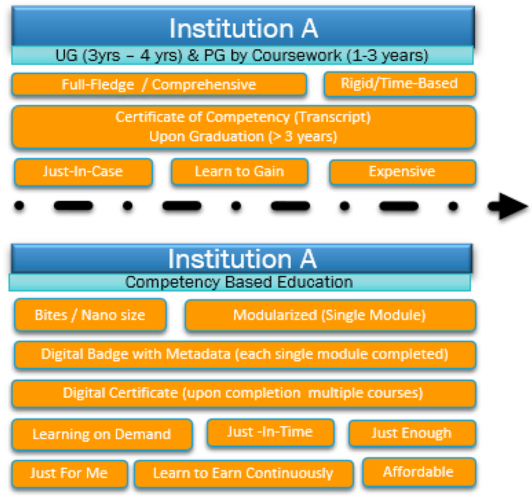

Figure 2 Macro-credentials vs. Micro-credential

Hence, with the introduction of Micro-credential globally, higher learning providers, private learning institutions and giant companies like Microsoft, Google, Amazon, edX, Coursera, LinkedIn Learning are embarking on this journey, including Malaysia. In August 2020, Malaysia Qualification Agency (MQA) published two guidelines on the implementation of Micro-Credential for higher learning providers. The implementation of macro-credentials is champion by University Sains Malaysia, followed by Universiti Malaya, Universiti Teknologi Malaysia, e-Asia University, Open University Malaysia and a few more.

The paper aims to address the research questions and achieve the objectives, which are (1) To develop an understanding of current practices of Micro-credential among public universities in Malaysia; (2) To identify the online platform for Micro-credential courses offering; (3) To propose strategies for Micro-credential implementation for institutions in Malaysia.

Method

This study has conducted desktop or desk research and secondary data analysis to examine the implementation of the Micro-Credential courses among the top three public universities in Malaysia. The analysis is divided into three aspects:

1. Three public universities in Malaysia that have implemented Micro-credential
2. Online platform for Micro-credential courses offering for three public universities
3. MQA guidelines and/or other MC related guidelines

The activities conducted can be summarized into seven steps, as follows (O'Leary, 2020)

1. Determine your research question
2. Identify sources and locate data
3. Evaluate the reliability of sources
4. Conduct screening search
5. Assessing credibility and relevance of the data
6. Dig deeper, and Analyze
7. Summarize on way forward

Results and Discussion

Diving into the three public universities in Malaysia, we discovered the business process activities in flow charts for Micro-Credential implementation in Figure 3, Figure 4, and Figure 5. Let we explore each case study as discussed below:

Case Study 1: Universiti Malaya (UM)

The desktop analysis of the Micro-Credential of UM is illustrated in Figure 3. The three groups of internal stakeholders are:

1. Deans, Directors; Head of Department; Program Coordinators
    a. Purpose/Role: To identify program, courses, subject matter experts/lecturers and modules

2. Subject Matter Experts; Lecturers
    a. Purpose/Role: To attend MC workshop by ADec; To plan & develop content based on FutureLearn & MC UM development checklist; To prepare T&L plan-based MC module mapping template

3. Academic Enhancement and Leadership Development Centre (ADeC) – FutureLearn Coordinators; Instructional Designer; Graphic Designer; Video Editor; Technical, Logistics & Camera Assistant
    a. Purpose/Role: To decide MC module to be published; To conduct feasibility study & internal review; To set consultation on session between Instructional Designer and SMEs/Lecturers; To check storyboard & script; To assist in designing module content; To check quality of MC module; To set video recording slot; To edit recorded videos; To send module to be reviewed by FutureLearn; To inform SMEs/lecturers on a published date; To publish the module on FutureLearn platform.

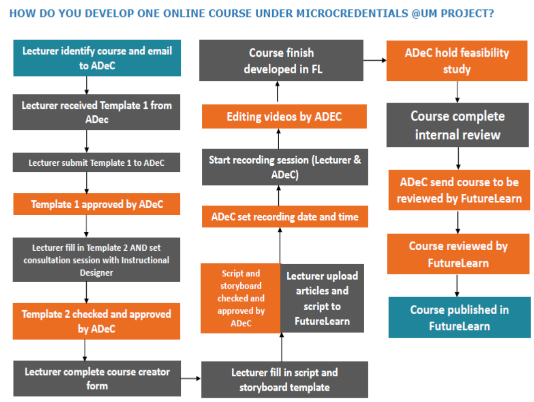

Figure 3 UM's Micro-credential
(Universiti Malaya, 2020)

Case Study 2: Universiti Teknologi Malaysia (UTM)

Another sample of micro-credential activities from UTM is presented in Figure 4. Based on the analysis of the flowcharts, the activities carried out in UTM are similar to UM. For UM, the flowchart is structured according to the stakeholders' role, while for UM is according to the type of activities to be carried. The four stages with internal Person-In-Charged (PIC) are:

1. Planning – PIC: Subject Matter Experts; Module Developer
2. Purpose/Role: To attend MC Development workshop; To identify suitable program/course; To identify module title, objectives, mode of delivery, target market, pricing; To conduct course mapping
3. Development - PIC: Subject Matter Experts; Module Developer
4. Purpose/Role: To develop the module based on MC Course Development Checklist; To submit MC course form; To apply and access Educator Account on OpenLearning; To develop content for the approved module & mapping
5. Quality assurance – PIC: MC Committee
6. Purpose/Role: To examine the module and content according to the requirement
7. Offerings – PIC: MC Committee
8. Role/Purpose: To publish on Open Learning platform; To notify MQA

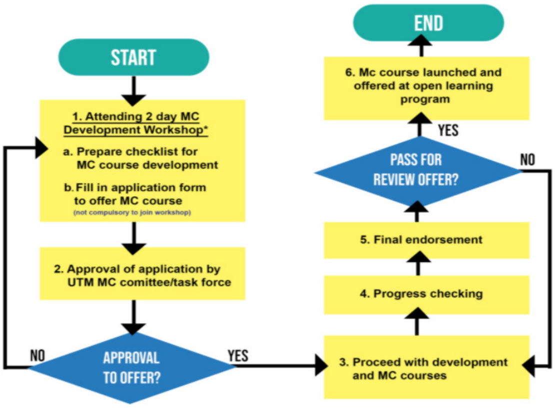

Figure 4 UTM's Micro-credential
(Universiti Teknologi Malaysia, 2017)

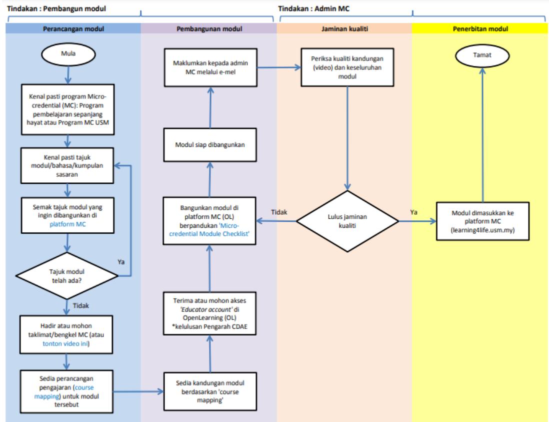

Figure 5 USM's Micro-credential
(Universiti Sains Malaysia, 2021)

Case Study 3: Universiti Sains Malaysia

The third case study is from USM, as demonstrated in Figure 5. Based on the desktop analysis, USM is regarded as the active implementor for Micro-credentials in Malaysia. Similarly, UTM, the MC activities are divided into four stages which are:

1. Planning ("Perancangan Modul") – PIC: Subject Matter Experts; Module Developer
2. Purpose/Role: To identify suitable program/course; To identify module title, objectives, mode of delivery, target market, pricing; To attend MC Development workshop; To conduct course mapping
3. Development ("Pembangunan Modul") - PIC: Subject Matter Experts; Module Developer
4. Purpose/Role: To develop the module based on MC Module Development Checklist; To apply and access Educator Account on OpenLearning; To develop content for the approved module & mapping
5. Quality Assurance ("Jaminan Kualiti") – PIC: MC Committee
6. Purpose/Role: To examine the module, content & video
7. Publishing ("Penerbitan Modul") – PIC: MC Committee Role/Purpose: To publish on learning4life.usm.my (via Open Learning platform

Another discovery from analyzing these three university MC business activities is that UM is utilizing FutureLearn, whereas UTM and USM are using OpenLearning as the platform to implement the MC module/courses. Next questions, why are these platforms? Let dive into these platforms, as illustrated in Figure 6 and Figure 7.

Figure 6 UM – FutureLearn (FutureLearn, 2020)

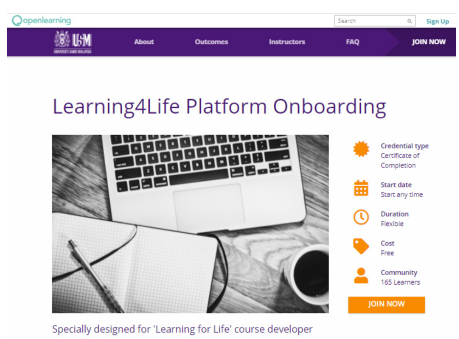

Figure 7 USM – OpenLearning
(openlearning, 2021a)

Platform 1: FutureLearn

FutureLearn is a London-based online learning platform that offers fully accredited online courses, micro-credential programs, and online degrees. It was founded in 2012, The Open University wholly-owned FutureLearn till 2019. FutureLearn's initial funding is from Open University and the other 12 UK-based founding universities.

FutureLearn is currently co-owned by the Open University and the Seek Group, both of whom have a 50% percent stake in the company. FutureLearn now has over 175 global institutional partners and 10 million learners. The courses provided by FutureLearn are accredited, recognized and certificates are issued by partnered universities.

In FutureLearn, most online courses can be taken for free, except for premium courses, micro-credential programs, and online degrees. For non-paying students, have access to the course for the entire course duration plus 14 days extra only. Moreover, the free courses exclude the course tests or certificates.

FutureLearn's micro-credential programs are one of the first to abide by Europe's new *Common Microcredential Framework (CMF) standards.* Other founding partners include France Université Numérique (FUN), OpenupEd, Miríadax, and EduOpen (FutureLearn, 2021). The framework was created to standardize micro-credential in ensuring high standards of consistency, quality, and portability across MOOC platforms.

Thus, to be qualified as a micro-credential course, it must adhere to the following requirements (European MOOC Consortium, n.d.)

1. Have a total study time of no less than 100 hours and no more than 150 hours, including revision for and completion of the Summative Assessment.
2. Be leveled at Level 6 or Level 7 in the European Qualification Framework or the equivalent levels in the university's national qualification framework.
3. Provide a summative assessment that enables the award of academic credit, either directly following successful completion of micro-credential or via recognition of prior learning upon enrolment as a student on the university's course of study.
4. Operate a reliable ID verification method at the point of assessment that complies with the university's policies and/or is widely adopted across the platforms authorized to use the CMF.
5. Provide a transcript that sets out the learning outcomes for micro-credential, total study hours required, EQF level and several credit points earned. These requirements are crucial to ensure the Micro-Credential courses are recognizable between different higher education institutions in creating an ecosystem for learners to have the flexibility to take courses across the partnered universities.

Platform 2: OpenLearning

Adam co-founded OpenLearning.com, a social learning platform, with world-renowned UNSW Prof Richard Buckland and David Collien in 2012.OpenLearning is a scalable online learning platform that is adaptive to the new wave of education teaching, learning and delivery enabling educators and institutions to prepare their learners for the future.

Hence, OpenLearning focuses on creating a social learning environment where students are empowered through profound learning experiences and naturally driven learners are brought together in passionate communities practice. A million students have joined courses, mainly from Australia and Malaysia, where it has become the popular national MOOC platform for public universities and polytechnics. OpenLearning now employs 65 people and is headquartered in Sydney with its Southeast Asia head office in Kuala Lumpur.

OpenLearning launched *OpenCreds Framework* for Australia in July 2020 after consulting around 85 participants from educational institutions and industry bodies. In Malaysia, the *OpenCreds Framework* was launched in October 2020, and it is designed to align with the Malaysian Qualifications Framework (MQF) and the Guidelines to Good Practices: Micro-Credential (GGP: Micro-Credential) by the Malaysian Qualifications Agency (MQA).

In November 2020, OpenLearning offered OpenCreds Investment Fund for Malaysia (OMIF), to support private higher education providers, vocational education and training organizations, industry associates, and professional bodies in developing market-leading Micro-Credential utilizing the *OpenCreds Framework* for Malaysia.

The *OpenCred Framework* applies to courses completed under these three types of learning categories, which are (1) (Professional Learning; (2) Technical and Vocational Education and Training (TVET); or (3) Higher Education (HE). The requirements to be fulfilled are (openlearning, 2021b).

1. Implements best practices in learning design as set out in a quality assurance criterion
2. Assess learners based on the specified learning outcomes resulting in the learner producing authentic

evidence of learning that demonstrates their development of knowledge, skills, and competency in a particular area.
3. Specifies learning hours.
4. Is classified as one or a combination of two OpenCred classifications (Pathway, Credit-bearing and/or Industry-recognized).
5. Delivered via the OpenLearning platform
6. Provide details of any learning paths, credit/ recognition of prior learning, or industry/association agreements in place, including any expiration date if known.

The OpenCreds framework defines seven sizes of Learning Hours and are designed for stackability. The tiers consist of 4, 10, 20, 40, 80, 120 and 160 learning hours. The smallest Learning Hours tier is 4 hours following the Human Resources Development Fund (HRDF) requirement of a minimum of 4 hours to be eligible for claimable allowances (HRDF, 2020). While the biggest tier is 160 hours, equivalent to four-credit hours HE's course in an accredited program.

Next question, do eDX and Coursera offer Micro-Credential courses? Based on the studies conducted by OpenLearning resulted in these findings, as demonstrated in Table 1:

OpenLearning and FutureLearn discovered that Micro-Credential awarded by MOOC in edX, Coursera and Udemy platforms shows a major variation within credentials and between them. This variability and lack of standardization poses a problem for both learners and employers, as it makes it difficult to compare and stack the various Micro-Credential.

Table 1 Comparison of OpenCreds and other micro-credential platforms openlearning, 2021b)

Platform	Coursera	edX	FutureLearn	OpenLearning
Micro-Credential Name	Coursera Specializations	edX MicroMasters	European Micro-credential Framework	OpenCred
Level	Masters	Masters	Levels 6-7 in the European Qualification Framework	Level 7 in the Malaysian Qualification Framework
Relationship with a formal qualification	Seven specialisations comprise an Australian Masters	25% of an Australian Masters	Approximately one unit in an Australia higher education qualification	Determined by the provider, including: Pathway or Credit-bearing OpenCreds lead towards qualifications
Partnership arrangements				Encouraged. Flexibility and interoperability of OpenCreds reduces barriers for partnerships and collaboration.
Learning Hours per Unit	20 hours to 100 hours (no set standard)	150 hours	100 hours or more	Specified sizes between 4 hours to 160 hours

There are other observations from the content analyses that deem vital. Hence, this study is proposing a list of strategies along with an action plan for any institutions that is embarking on a Micro-Credential journey:

1. Mapping and alignment to:
    a. MQA Guidelines
    b. OpenCreds Framework
    c. Common Microcredential Framework (CMF)

2. Readiness and Acceptance Studies for various stakeholders:
    a. Students & Learners
    b. (Customers/Consumers/Users)
    c. SME/Lecturers/Instructors/Course Developer
    d. Parents/Guardians
    e. Industries/Hiring Companies
    f. MQA/HRDF/MoHE etc.

3. Benchmarking Studies:
    a. MC Platform Providers (OpenLearning, FutureLearn, eDX, Coursera, Udemy, Internal Platform)
    b. Internal IT Infrastructures
    c. Omnichannel of Communication
    d. Resources (Financial & Non-Financial)

4. The internal MC team must consist of members from different backgrounds, skills, and knowledge with clear assigned roles to develop a complete Micro-Credential module/course. Some of these expertise could be obtained within the institutions itself, or if it is not viable, the institutions may outsource to the third party. Hence, the team needs to consist of:
    a. Subject Matter Expert/Lecturer/Instructor
    b. Instructional Designer (ID)
    c. User Experience (UX) Designer
    d. Graphic Designer
    e. Camera/Video Editor
    f. Technical / IT Support
    g. MC Coordinator
    h. MC Branding & Marketing Coordinator
    i. MC Quality & Service Coordinator

5. Institutions Internal MC Framework that consists of:
    a. MC General Guidelines for Institutions
        i. Course/Module Creation
        ii. Course/Module Publishing
        iii. Course/Module Branding, Marketing & Benchmarking
        iv. Course/Module Quality & Service Assurance & Approval Guideline

b. Micro-Credential Flowchart Activities
   i. SME/Lecturer/Instructor
   ii. Designer/Technical/IT Team/ MC Coordinator
   iii. Quality & Service Assurance Committee/ Business Development, Branding & Marketing Committee
   iv. MC Committee & Approval Committee

c. MC Competency Taxonomy & Framework for Students/Learners
   i. Knowledge
   ii. Skills (technical & soft)
   iii. Abilities/Capabilities
   iv. MC Course/Module Template
   v. MCLO
   vi. MQF Level
   vii. MC Classifications/Types
   viii. SLT Mapping
   ix. Credit Transfer/Prior Learning
   x. Synopsis
   xi. Content
   xii. Activities
   xiii. Assessment
   xiv. Duration
   xv. Digital Batch with Verified ID
   xvi. Certificate
   xvii. Transcript

d. MC Course/Module Checklist
   i. Content
   ii. Design
   iii. Storyboards
   iv. Video Script
   v. Graphic
   vi. Audio
   vii. Video
   viii. Thumbnails/Banners

Conclusion

This paper has looked at the implementation of Micro-Credential among the top three public universities in Malaysia. Along with the review, it is discovered that OpenLearning and FutureLearn are adopted as their online platforms to market and offer Micro-Credential courses. On top of that, the paper briefly presented the Micro-Credentials guideline or framework from Malaysia by MQA and OpenCred Framework for Malaysia, as well as Europe's Common Microcredential Framework (CMF). There are other Micro-Credentials frameworks such as the Australian Qualifications Framework (AQF) and New Zealand Qualifications Framework (NZQF).

It is observed that micro-credentialing is gaining traction among Malaysia's higher education institutions, with a few universities currently providing courses in the area while others are still in the planning and development stages.Therefore, it is just a matter of time for those who soon embark on micro-credentialing journey are presented with few strategies and action plans to be critically considered in the planning, development, quality assurance, marketing and offering end-to-end cycle.

Acknowledgment

The authors are grateful to Universiti Teknologi PETRONAS (UTP) for their support, and funding under YUTP (No: 015LC0-122). The authors would like to express our appreciation to the anonymous reviewers for their constructive feedback.

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A FRAMEWORK ON CASE-BASED VIRTUAL PLANT VISITS FOR ENHANCING TECHNICAL AND SYNTHESIS SOLUTION SKILLS OF CHEMICAL ENGINEERING STUDENTS

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Introduction

Technical and Synthesis Solution Skills (TSSS), a subset of cognitive skills is enhanced by exposure to various information via multiple learning channels (Akçayır & Akçayır, 2017). Industrial-related subjects in Chemical Engineering are best taught by a mix of traditional and blended learning, including plant visits to relate theoretical and practical input, in support of TSSS enhancement. The content for blended learning consists of six primary elements which are learning management system, electronic content, communication, evaluation, instructor's role, supporter's role and teaching method (Bonk & Graham, 2012; Songkram et al., 2015). UTP is competent in five of the six teaching components with the exception of electronic content, which is only limited to the E-Learning platform. Accordingly, UTP is committed to enhance electronic resources for effective blended learning, such as in the work of Azizan et al. (2018). Due to the COVID-19 pandemic, physical plant visits are limited as a result of travel restriction thus, Virtual Reality (VR) can be introduced as a technique for blended learning. This calls for suitable VR content that reflects a specific course syllabus. A proper VR learning module enables students to study at their convenience, regardless of the place and time. This promotes self-paced learning, which is in line with lifelong learning goals.

This paper outlines the framework of action research on TSSS enhancement on the Energy and Plant Utility (EPU) course taken by final year students. Assessments on cognitive domain improvement is carried out by conducting a set of Pre-test and Post-test activities such as using surveys, quizzes and interviews. The results will be verified on other subjects across all levels of study from Year 1 to Year 4. Due to the ongoing Covid-19 pandemic, data collection is strenuous hence, this paper evaluates the theory supplemented with circumstantial justifications.

Methodology

There are three stages to the research study as listed:

1. Stage 1: Subject Delivery. This stage is conducted to a specific subject for data collection.
2. Stage 2: VR Content Development. The virtual plant tour module is developed with in-house experts.
3. Stage 3: Cognitive Skills Assessment. The VR module is verified on its effectiveness to enhance cognitive skills among students of the selected course.

The overall research plan is outlined in Figure 1.

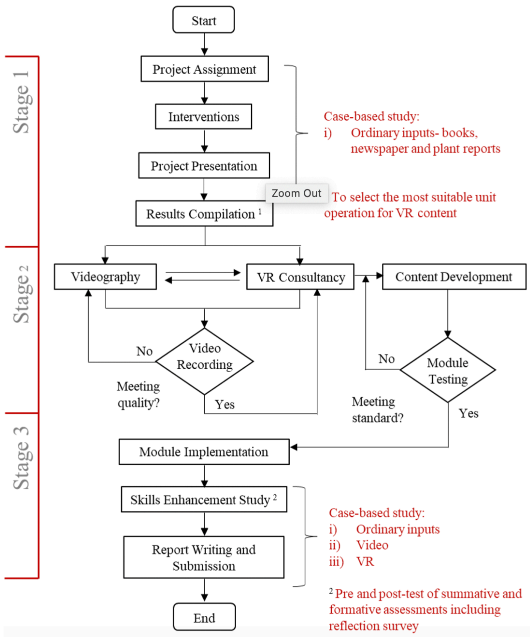

Figure 1 Project flowchart

Case-Based Study Learning

To develop the initial VR module for the plant tour, the EPU subject is chosen as the course content relates well with the industry. The subject has about 40 students, which makes it an ideal case subject to create an effective module. A case-based approach in the form of a project work is applied for data collection as a foundation for the VR module development. The theme of "Chemical Plant Operation" is proposed for this project. A framework of a case-based study is depicted in Figure 2.

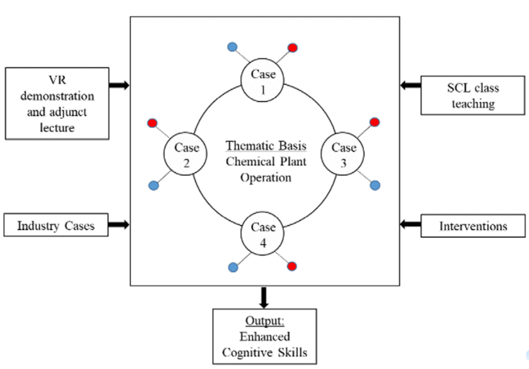

Figure 2 Project-based learning framework

The students are divided into teams of 4. During the course introductory phase in Week 1 and 2, a specific plant operation is assigned to each team, denoted as Case 1, 2, 3 and 4. Examples of suitable plant operations include heat exchanger, absorption column, distillation column and reactor system. The students are required to develop teaching materials consisting of the purpose of the plant operation, working principles and Health, Safety and Environment (HSE) considerations. During this phase, an example of real practice in the industry regarding a specific plant operation is presented to start the learning process. The teams analyze the designated problem to allow their ability to reason and application of knowledge to be challenged, evaluated and developed. The teams identify the learning issues, prior knowledge and what they need to know, which leads to the individualized study. The knowledge acquired is shared among the members and with the rest of the class.

The list of cases for the project is co-developed with in-house VR experts to select the most suitable plant operation to be developed into a teaching module that is significantly identical compared to the real environment, avoiding complicated plant operations. As part of a scaffolding system, both the lecturer and VR experts provide guidance and intervention strategies to the teams. The overall teaching framework based on Herrington's authentic learning and tasks framework outlines the "Task-Resources-Supports" nexus, as shown in Figure 3. The three elements rely on each other to fulfil the learning objectives (Reigeluth et al., 2016). Herrington's model promotes "authentic" learning conducted through realistic tasks that enable students to behave as they would in the real world. This is vital as the aim is to enhance the students' cognitive skills on plant operation without conducting a physical visit. Through scaffolding and intervention methods as outlined in Figure 3, the students are foreseen to reach the competent level required with respect to the subject's content. Specific resources and support strategies from the external party are introduced to complement the classroom learning. Interventions from facilitators are done based on students' feedback, results and other non-summative assessments. Throughout this course, five unit operations in a chemical plant are scrutinized with respect to their functions, process operation and HSE aspects. The findings attained serve as a constructive foundation for the VR content.

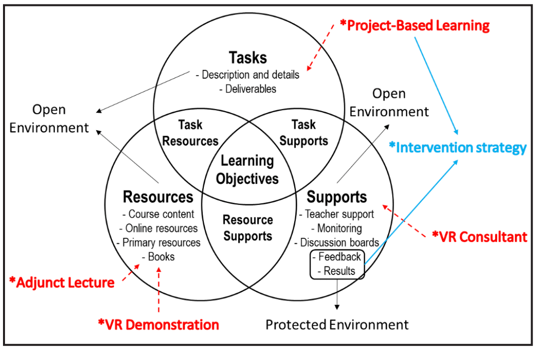

Figure 3 Proposed teaching framework derived from Herrington's authentic learning

Results and Discussion

Based on the flow of cognitive level assessment shown in Figure 4, it is targeted for the VR module to be ready by the end of July 2021 together with TSSS assessment tools.

Cycle 1 and 2 of the research is conducted by a case-based study using video and presentation of the plant operation. Stage 3 of the VR module implementation will test the effectiveness level of VR-assisted plant tours on students' cognitive skills compared to the findings in Cycle 1 and 2. Three Chemical Engineering courses will be selected to verify the effectiveness of the VR module across different years of study. Stage 3 will be conducted in two consecutive semesters with respect to UTP's trimester mode. This method gives a larger sample size to verify the results reproducibility of the VR teaching approach on students' cognitive skills.

To observe the cognitive skills improvement, TSSS is set as the parameter. A comparison study between a quasi-experimental Pretest and Posttest on different batches of students is conducted through interview questions, surveys and quizzes. Cycle 1 and 2 is conducted without VR implementation while Cycle 3 is aided with VR-assisted plant visit. The assessment materials emphasizes on cognitive elements of thinking, remembering, reasoning and focusing.

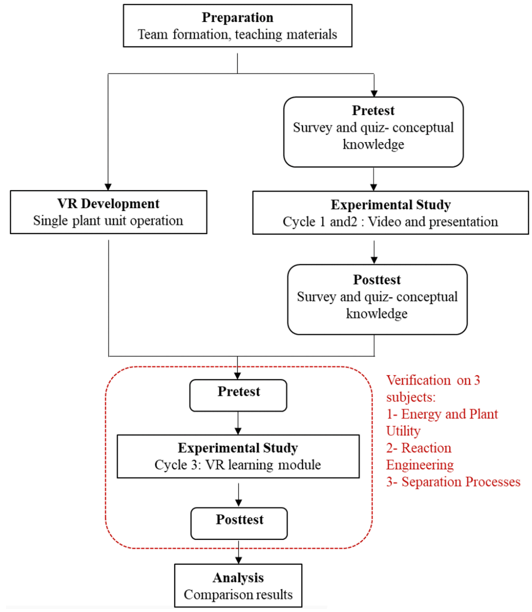

Figure 4 Flow of skills enhancement study

Conclusion

Chemical engineering subjects, especially those associated with the industry, demand students' exposure to plant operation. Due to the COVID-19 pandemic, a virtual plant tour could be an excellent alternative instead of typical PowerPoint presentations. A VR module emphasizing plant equipment with its auxiliary connections can be developed on a VR interface. The effectiveness of the module is verified through students' cognitive skills. The VR integration as a blended learning approach is expected to enhance students' knowledge of plant operation as well as their readiness level prior to entering the workforce.

Acknowledgment

The authors would like to acknowledge the grant (SOTL- 015LF0-045) from CETaL and support from Chemical Engineering Department, Universiti Teknologi PETRONAS, during this research study.

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FINAL YEAR PROJECT FOR BACHELOR ENGINEERING TECHNOLOGY IN MECHANICAL DESIGN: METHODOLOGY AND EXPERIENCE

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Introduction

According to Bi (2018), mechanical design involved designing parts, components, products, or systems of mechanical nature to meet the prescribed primary criteria such as functions, safety, weight, size and manufacturability. An example of a mechanical design is to design various machine elements such as shafts, bearing, clutches, gears and fasteners.

The Bachelor Engineering Technology (BET) in Mechanical Design (MD) program has been offered by UniKL Malaysian Spanish Institute since 2016, with its first batch graduated in 2019. The program aims to assist the graduates to become full-fledged Mechanical Engineering Technologists with the required knowledge and technical skills to serve the industry upon graduating. Besides Mechanical Engineering knowledge, these students also have the advantage of specializing in Mechanical Engineering Design.

The final year project (FYP) is a compulsory 2-semester subject for these students where they will apply existing and learn new knowledge to solve an engineering problem. BET MD students are expected to design and develop A solution to a mechanical problem. The scope of FYP for these students is different from the FYP works for other engineering technology programs as the former must implement the engineering design process throughout their FYP.

Therefore, this paper outlines the methodology or the approach that the BET MD students must take in order to ensure that their FYPs meet the program's educational objectives.

Requirements for a good BET MD FYP

The FYP for a BET MD student must meet the requirements as shown in Table 1.

Methodology of an FYP BET MD

The methodology undertaken by the BET MD student to complete his/her FYP must comply with the engineering design process as illustrated in Figure 1.

Define the Problem

The engineering problem to be solved or the need that must be satisfied should be clearly defined.

Table 1 Requirements of a BET MD FYP

Phase	Requirement
Before the start of the FYP	• Project title must align with the industry needs, regardless of the size of the industry
During the FYP	• Follow the proper engineering design methodology (as discussed in the next section) • Includes design calculations and iterations. • Using suitable Computer Aided Engineering (CAE) tools supported with analysis. • Produces detailed design for the Final Design via technical drawings that can be used for fabrication • Produces mock-ups, prototypes or complex digital models • Conduct materials cost analysis
After completion of the FYP work	• Produces complete technical drawings for the Final Design that includes exploded, BOM, parts drawings, assembly drawing with complete title block. • Demonstrate functionality of prototypes or complex digital models

Conduct Background Research

Once the engineering problem is identified, the student shall conduct background research on existing designs and assess the designs' strengths and weaknesses. If the intended design for the FYP is unique and there is no existing design, the student shall gather background information from users' feedback.

Specification of Design Requirements

Based on the findings from the background research, specific requirements of the design can be formulated, which can be its geometry (size and shape), physical characteristics (e.g., mass), performance characteristics (e.g., strength), aesthetics and many other specifications.

Brainstorming & Conceptual Designs

Based on the desired specifications, the student shall prepare a minimum of three conceptual designs to solve the engineering problem.

Design selection

The final design selection from the conceptual designs shall be conducted using tools such as the functionality chart, morphological chart, evaluation matrix and decision matrix. Simulation and material cost analysis may assist in the selection.

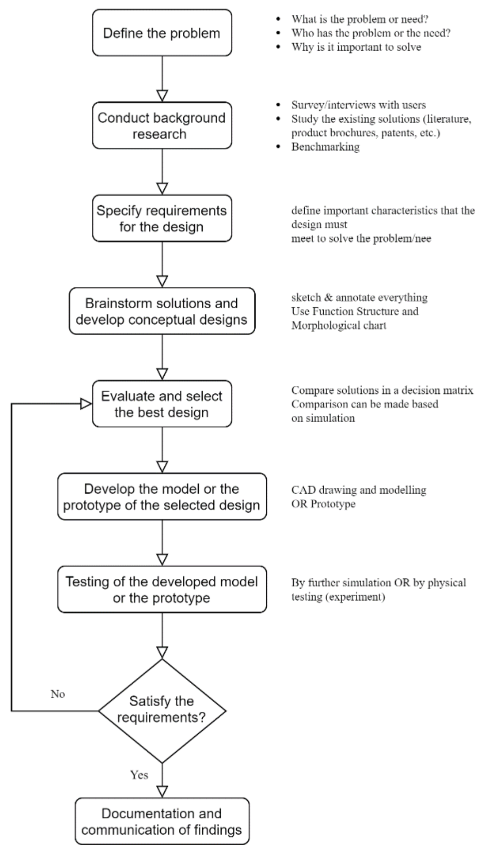

Figure 1 The engineering design process that must be undertaken by the FYP BET MD students

Design Analysis

Analysis of the designs must be conducted using CAD or CAE software such as Solidworks and Abaqus. Depending on the designs, simulation can be used to perform structural analysis, flow simulation (CFD), thermal simulation and motion analysis.

Selection of best design

Based on the evaluation of the conceptual designs with strong justification, the best design will be selected. The student shall prepare complete CAD drawings for this design to be fabricated or modeled.

Model / Prototype Development

The student shall fabricate the model or the prototype of the selected design. If there is no tangible prototype, a digital design model with adequate complexity can be created.

Testing of the Prototype

The student shall plan and conduct testing of the model or the prototype to ensure that it functions and meets the required specifications. Improvement on the prototype should be made if the testing indicates an unsatisfactory function. Product verification with the final design must be conducted.

Documentation of Final Detailed Design

Using CAD software, the student shall prepare detailed drawings of the final design, which includes parts drawing, material specification, assembly drawings (in the form of orthographic, isometric, sectional, exploded views), BOM, and tolerance analysis. The drawings must contain enough details that would enable the fabrication of the design by another person. Document details in the drawing title blocks must also be completed.

Results and Discussion: Example of a good BET MD FYP

In this section, a good FYP of a BET MD student is presented and the design process carried out for the project is briefly discussed.

The main objective of this project is to design and develop a solar photovoltaic (PV) panel that is capable of tracking and moving according to the position of the sun. Three conceptual designs were developed and compared using the Parameter Design Table. The finished design is shown in Figure 2. Simulation of the design using SOLIDWORKS indicates that the structure is a sturdy, stable, and low risk of toppling due to wind. The prototype employed the use of a 50-W-solar panel with a 12V-solar charge controller. A 12V-batteries are connected with the solar charge controller as an energy storage and an energy source to move the solar panel. An 800-mm-maximum-length linear actuator accomplishes the movement of the solar panel with a speed of 10 mm/s. A DC timer was used to terminate the flow of current from the battery.

Testing the solar panel operating under active and passive setup has been conducted. Figure 3 shows the power generated by the panel for active and passive setup. The results showed that the active solar panel system can capture greater energy compared to a passive system.

Figure 2 The finished prototype

Conclusion

Mechanical design is an important aspect in mechanical engineering. The FYP for the BET MD students is different in their scope of work than the other engineering programs. This paper provides the guidelines on the methodology to be undertaken by the students in order to execute their projects. It is demonstrated that if the student follows the methods and satisfies the requirements for the project, he/she will deliver an excellent quality of the design model or prototype that will prove their successful FYP.

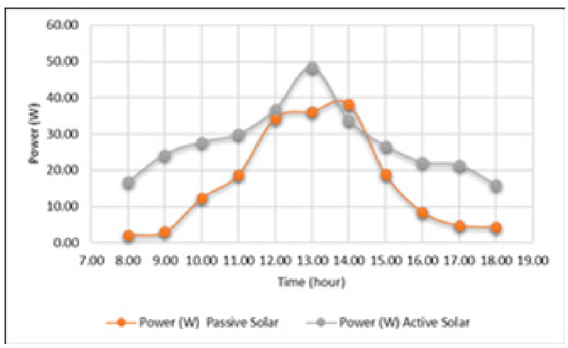

Figure 3 The power generated by the solar panel

Acknowledgment

The authors would like to acknowledge the support of UniKL MSI during the preparation of this paper.

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FINAL YEAR PROJECT FOR BACHELOR ENGINEERING TECHNOLOGY IN MECHANICAL DESIGN: GOOD PROJECTS

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Introduction

The Bachelor of Engineering Technology (BET) in Mechanical Design (MD) has been offered by UniKL Malaysian Spanish Institute since 2016, with its first batch graduated in 2019. The program aims to assist the graduates to become full-fledged Mechanical Engineering Technologists with the required knowledge and technical skills to serve the industry upon graduating. Besides Mechanical Engineering knowledge, these students also have the advantage of specializing in Mechanical Engineering Design. According to Bi (2018), mechanical design is to design parts, components, products, or systems of mechanical nature to meet the prescribed primary criteria such as functions, safety, weight, size, and manufacturability. An example of a mechanical design is to design various machine elements such as shafts, bearing, clutches, gears and fasteners.

The Final Year Project (FYP) is a compulsory 2-semester subject for these students where they will apply existing and learn new knowledge to solve an engineering problem. BET MD students are expected to design and develop a solution to a mechanical problem. The scope of FYP for these students is different from the FYP works for other engineering technology programs as the former must implement the engineering design process throughout their FYP. This paper aims to describe past FYPs that satisfy the requirements of good BET MD projects.

Project #1 Modular CNC machine manipulator

Objective

The main objective of this project is to design and develop a multipurpose semi-automated Computer Numerical Control (CNC) machine that can perform different operations for the small and medium industries.

Method

Three conceptual designs of a mini CNC machine were created based on existing models. Function Structure table, Morphological chart, and decision matrix method were used to select the best design for the semi-automatic CNC machine. The final design is shown in Figure 1.

Simulation using SOLIDWORKS was conducted for the final design to determine the structural integrity of the design. The completed setup of the design is shown in Figure 2. Testing the machine's accuracy was conducted by instructing the machine to draw a star shape, rectangular shape and polygon shape with a specified dimension.

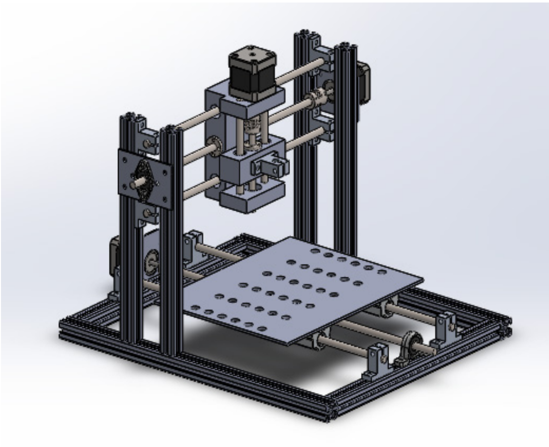

Figure 1 Final design of the CNC machine

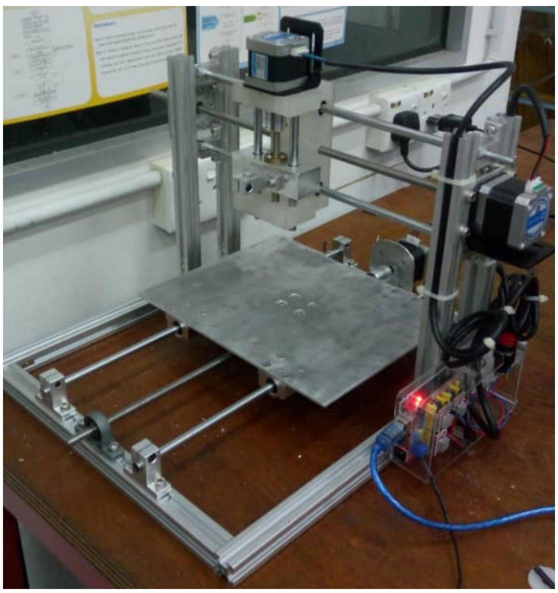

Figure 2 Prototype of the CNC machine

Results & Discussion

The drawn dimensions by the machine were then compared with the input dimension. Results indicate that the drawn dimensions differ by as low as 0.2% and as high as 0.95%, indicating excellent performance by the CNC machine.

Project #2 Wireless Imitating Humanoid Robotic Hand

Objective

In this project, a humanoid robotic hand that mimics the finger movement of an operator by the wireless connection was developed. The operator would wear a glove fitted with flex sensors, whose motion will be captured and processed by a microcontroller. The outputs from the flex sensors are transmitted by wireless communication to the robotic hand unit.

Method

By using a morphological chart, three design concepts were developed. A decision matrix was used to evaluate and select the best design that meets the specified requirements. The detailed design of the final concept is shown in Figure 3.

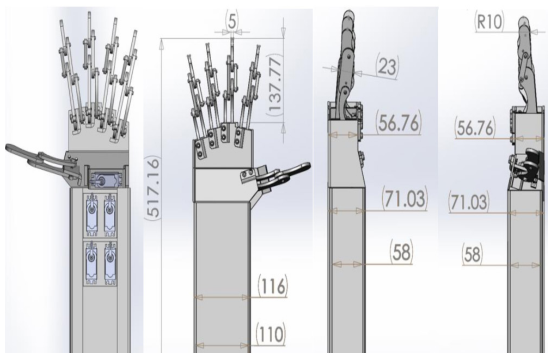

Figure 3 The final design of the robotic hand

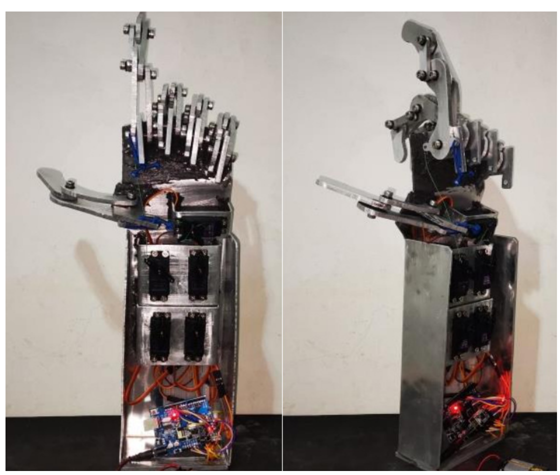

Figure 4 Prototype of the robotic hand

Bidirectional flex sensors to be fitted in the operator's glove were designed and developed. The resistance values of the flex sensors and Analog-to-Digital Converters (ADC) are collected using a multimeter and interface of the Arduino program. Then, the microcontrollers of the receiver unit (robotic hand) and transmitter unit (glove) were programmed by using the Arduino program. Figure 4 shows the final assembly of the robotic hand.

Results & Discussion

The performance of the robotic arm was tested physically. Results indicate that the robotic fingers are capable of mimicking the finger movement of an operator by wearing a glove fitted with a flex sensor.

Project #3 Active solar PV panel

Objective

The main objective of this project is to design and develop a solar photovoltaic (PV) panel that is capable of tracking and moving according to the position of the sun.

Method

Three conceptual designs were developed and compared using the function structure table, morphological chart and decision matrix, where Design 2 was selected as the best design (Figure 5).

Simulation of the design using SOLIDWORKS indicates that the structure is sturdy, stable, and low risk of toppling due to wind. The design employed the use of a 50-W-solar panel with a 12V-solar charge controller. A 12V-batteries are connected with the solar charge controller as an energy storage and an energy source to move the solar panel. An 800-mm-maximum-length linear actuator accomplishes the movement of the solar panel with a speed of 10 mm/s. A DC timer was used to terminate the flow of current from the battery. The signal is transmitted to a linear actuator to move the solar panel horizontally.

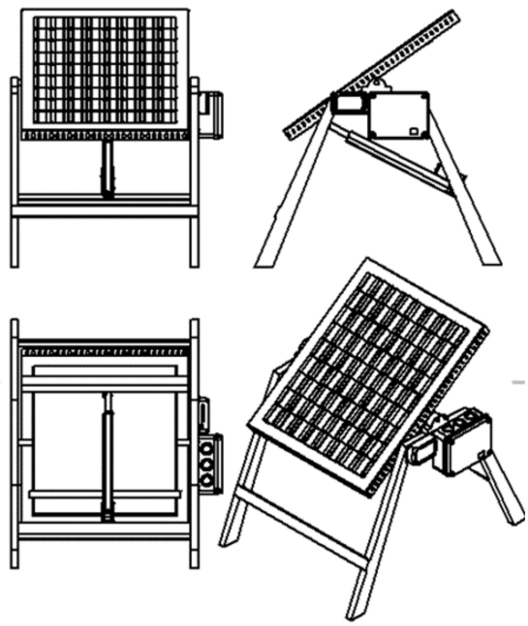

Figure 5 The final design of the active solar PV panel

Figure 6 The prototype of the active solar PV panel

Results & Discussion

Testing the solar panel operating under active and passive setup has been conducted. Figure 7 shows the power generated by the panel for active and passive setup. The results showed that the active solar panel system is capable of capturing greater energy compared to a passive system.

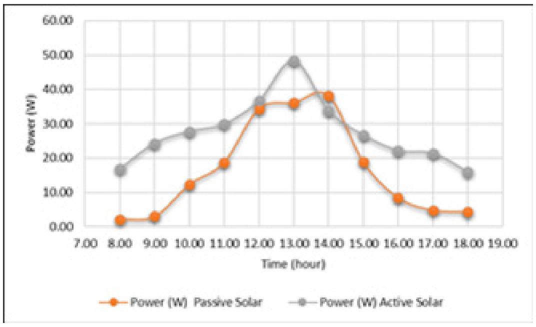

Figure 7 Power generated by the solar panel

Conclusion

Mechanical design is an important aspect of mechanical engineering. The FYP for the BET MD students are different in scope of works than the other engineering programs as they must follow the engineering design process during the execution of their FYPs. This paper describes the final year projects of BET MD students that satisfy the requirement of good execution of FYP.

Acknowledgment

The authors would like to acknowledge the support of UniKL MSI during the preparation of this paper.

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FRAMEWORK FOR FUTURE EMPLOYMENT PROSPECTS OF UNDERGRADUATES IN SINGAPORE THROUGH MULTI-CLASS CLASSIFICATION PREDICTION USING MACHINE LEARNING ALGORITHMS

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Introduction

In today's education scenario, higher education is predominantly a means to a job and is a source for an individual's economic opportunity. Consequently, institutions have a greater responsibility for students' career outcomes. This study aims to investigate how an Institution of Higher Learning (IHL) in Singapore, i.e., School of Electronics and Info-comm Technology (SEIT), can improve the career outcomes of its students.

Purpose

The study is to conceptualize a framework which determines to what extent an undergraduate student's academic and experience employability signals – including major, GPA, co-curricular activities, and internships – can perform prediction by multi-classifying different classes of skills by using Support Vector Machine (SVM) and Neural Networks (NN) machine learning algorithms to analyze an optimal solution in assessing the suitability of employment. In addition, the findings are due to be investigated for Support Vector Machines (SVM) which are best suited to multi-classify the skills with greater optimality and help maximize the margin between different classes of the training data.

The results demonstrate that one skill is more inclined towards a specific class of skills even though the algorithms can detect outliers.

Literature Review

Importance of Careers for Individuals and Society

In the importance of Careers, according to the authors, De Vos, Jacobs & Verbruggen, (2021) of Career transitions and employability article, we understand how individuals can be employed and make successful career transitions throughout their work-life is gaining increased attention from scholars in the field of vocational and organizational psychology for several decades now. Although contemporary career literature implicitly or explicitly assumes a strong connectedness between career transitions and employability, these two concepts have their historical development in the literature.

Engineering, nursing, and accounting have an undersupply and are critical to have skilled people fill positions in such occupations. Individuals whose skills match the posts are satisfied with their careers. They present few costs to society instead of huge job turnover.

US Congress ostensibly understood that,

1. School preservation rate would be upgraded by helping students to understand the link between school and future careers,
2. Increased preservation would lead to higher earning latent for graduates, and
3. The society would profit from having a more accomplished workforce.

In the past, Psychologists developed several theories regarding career development with the significance of careers to individuals and society. These theories have produced valuable discoveries. However, there are precarious gaps within the career advising literature.

Student Employability Skills

We need to note that there is a difference between employability and employment. Employability is the ability to be employed, whereas employment indicates employment status if a person is or is not employed. Employability enhances skills, knowledge, experience, emotional intelligence, personality, and career learning; they collectively refer to as employability skills.

According to the National Association of Colleges and Employers (2018), it annually provides a list of rank-ordered employability skills for undergraduate college students desired by employers. As per Hugo Linsey, 606 employers assessed the employability, expertise of large and small organizations signifying 20 industries. The employability skills comprise problem-solving or critical thinking, work ethic or professionalism, written or oral communications, leadership, collaboration or teamwork, career administration, and information technology application (National Association of Colleges and Employers, n.d.). The National Association of Colleges and Employers, USA, develops the list of employability skills from an employer's perspective, which works as informational rather than unlawful.

Job Market Signaling – A Theory

As per Lillrank & Nilsson (2021) in the Job Market Signaling in the European labor market, the theory of signaling assumes that there is information asymmetry in the labor market. The employer cannot gauge the innate ability of a job applicant during an interview or even during the beginning of employment. It is possible to measure a worker's knowledge in the field thus far, but it is not possible to know their true potential. Hiring a new employee can therefore be seen as a lottery to the employer.

Signals of observed employability

When screening theory was discovered a few decades ago, higher education alone represented a strong signal of student perceived employability. However, employers use multiple signals to determine perceived employability in today's generation, given the significant increases in higher education attendance and increased competition for entry-level jobs.

A study directed by the National Association of College and Employers (2017c) utilizes a 5-point Likert measure to assess employer observations of related employability signals. Employability signals were evaluated as 1 means no influence, two means not much influence, three means somewhat of an influence, four means very much influence, and five means extreme influence. The study ranked the indications in the resulting order: school attended (2.8), involved in extracurricular activities (3.3), high GPA (3.0 or above) (3.4), contains general work experience (3.7), held a leadership position (3.7), major (3.8), has internship experience in the industry (4.4), completed an internship with the organization (4.6).

Figure 1 National Association of Colleges and Employers (2017c) Employability signals for undergraduate students

Based on the significance noted by National Association of Colleges and Employers (2017c) studies, this research focuses on GPA, major, co-curricular activities, and internships, four primary independent variables signaling undergraduate student employability to employers.

Perceived Employability Signals

Major: As per Duckju Kang, CEO, Value Champion, research carried out to know one of the University Majors in Singapore has an utmost return on investment. The findings showed that the NUS graduates with a bachelor's degree in computing and engineering were inclined to have the highest ROI on tuition after valediction. On the other hand, bachelor's degrees in arts, music, and science had some of the lowest ROIs on tuition. Dentists and Doctors also incline to have very low ROI on tuition in terms of initial salary. However, this may masquerade the fact that their income stream is very steady for a long time matched to other occupations, earning an honors degree surges one's starting wage by almost 40% and employment rate by around 10%, equating to a normal degree in the same major (Kang. D, 2020).

GPA: According to a Singapore recruiter's point of view in a blog, Quora.com, the leading manpower outsourcing recruitment agency in Singapore for the government sector and global MNCs do not consider GPA as a signal of perceived employability.

Co-Curricular Activities: In the Singapore context, examples of co-curricular activities include music lessons, sports, debate, choir practice, religious study (usually sacred scriptures - Biblical, Koranic, Talmudic, etc.), theatricals, science clubs, charitable fundraising, even hobbies such as crafts, gardening, dancing, and cooking. It is seen as non-academic, remains a recognized part of education with planned and required sessions for all pupils (Marais. P, 2020). According to Singapore Management University's (SMU) blog, the two "Soft skills" attributes that employers seek in Singapore are Maturity and Balance, Teamwork, and communication skills other than Past achievements and experience and Academic record.

Lebron, Stanley, Kim, and Thomas (2017) research on co-curricular student organizations highlights that student can apply concepts from the classroom aligned with their desired career. Moreover, co-curricular activities provide opportunities for leadership and teamwork, two of the topmost five abilities employers pursue from college alumni in the United States (Lebron, Stanley, Kim, & Thomas, 2017; National Association of Colleges and Employers, 2017b).

Internships: According to an article on todayonline.com by Kenneth Lam, Career Advisor with NUS Business School's Career Services Office, Singapore, gone are the days when university and polytechnic graduates were guaranteed a job. When the competition for top jobs is intense, graduates of tertiary institutions need to rely on other factors such as extracurricular activities and volunteer experiences to stand out from the crowd. However, one area that employers will most certainly zoom in on is whether those seeking jobs for the first time have done internships after their post-secondary education.

"By their very nature, internships are experiential. Students learn by doing actual work in a career-related field of interest" (Rothman & Sisman, 2016, p. 1004). The National Association of Colleges and Employers, USA (2017b) reports that "students who participated in multiple internships do have a higher chance of being employed relative to seeking employment six months after graduation in comparison to those with no internships" (p. 27). Internships not only provide a signal of perceived employability to employers often, but students also receive full-time offers of employment because of internship experiences. In 2017, employers offered 67.1% of internship participant's full-time employment, and the acceptance rate was 76.4% (National Association of Colleges and Employers, 2017a).

According to the Institute of Higher Learning (IHL) in Singapore, apart from other 21st century skills, it stresses three important skills such as Customer Orientation, Collaboration, and Communication to be acquired by its students. This paper provides an endeavor to report the employability prospects of the graduates at the end of their graduation.

Research Methodology

The purpose of this study is to evaluate Garbage in Garbage Out (GIGO) research methodology. The concept of GIGO refers to the quality of output received from the computer using Machine Learning Algorithms depends on the quality of information used for input. In this research, the data needs to be transformed to a good quality before being processed by the computer for authentic results and will lead to better decisions or

The research methodology employed will be the quantitative method with a pragmatic philosophy, and the research approach for oncological & epistemological positions would be deductive with a cross-sectional study on historical data obtained from the institution.

The prediction is performed using a Machine learning algorithm and mining the information using prospective data with essential parameters.

The research focuses on a sample size of transformed data of 289 post-secondary students' graduation records. It also focuses on employment, enhanced by a foundational understanding of employability skills using different machine learning models, emphasizing Support Vector Machine or Neural Networks.

This research will predict and help to analyze students who are potential candidates for employment offers during their graduation.

Discussion

The research findings are proposed using tools such as SPSS, SAS, Azure ML, or any other tool for which multi-class classification of employability prospects of undergraduates can be observed, and the findings can be reported based on the results.

Thus, it may lead to discussion based on the new findings and gaps that can benefit the institution, the partnering companies, and the employers. Those who are unable to get offers will have coaching services by intervening early before their graduation.

Results

Based on the Literature Review, the following conceptual framework of Job Matching based on Student Profile was derived.

The conceptual framework has four entities such as Undergraduates, Institution, Partnering Company, and the Employer. Once the undergraduate completes his course of study, the Job Matching System has to generate perceived employability signals that whether an undergraduate has a successful prospect of getting employed by a partnering company. If this does not happen, then corrective actions for a student to complete competency course skills are to be completed and assessed for employability signals.

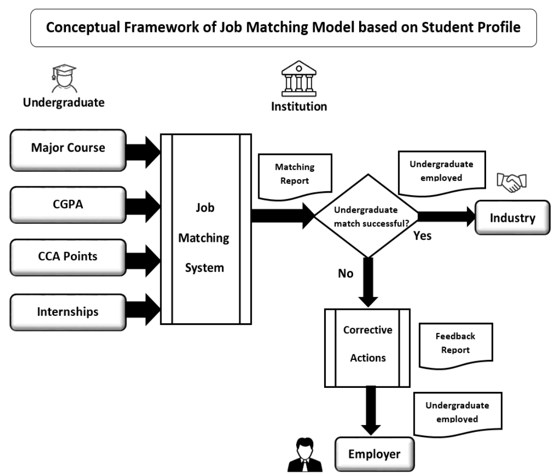

Figure 2 Conceptual framework of job matching model based on student profile

The conceptual framework of Job Matching Model based on a student's (undergraduate) profile containing 4 independent variables such as Major Course, Cumulative GPA, Co-curricular Activities Advantage point and Internship's data is supplied to the Job Matching System with Institution playing an important role in analyzing an undergraduate is successful in securing a job during his/her internships with a Partnering Company (Industry). When the undergraduate is unable to secure a job, then Corrective Actions are needed to attain the three important 21st Century Skills mentioned by the IHL, such as Customer Orientation, Collaboration and Communication along with the Course of Competencies(CoCs), or the undergraduate can seek SG Skills Future to obtain employment advice and support, acquired additional skills and have amended their CVs to apply for the jobs and to get employed by an Employer. The process may require an undergraduate to obtain new competency-based skills if he/she is unsuccessful in their endeavors. The feedback mechanism is performed at every stage of the Corrective Actions so that the undergraduate is successful in his/her employment.

Conclusion

The findings of this study/framework will be beneficial for the policymakers and stakeholders of the Institutions and the partnering companies. It's a contribution to the insightful information for better decision-making. Lastly, the contribution to the body of knowledge and concerning theories related to the machine learning process.

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COMPARISON ON BLENDED-EXPERIENTIAL LEARNING IN AN INDUSTRIAL SETTING AGAINST CLASSROOM ENVIRONMENT FOR UNDERGRADUATE VIBRATIONS COURSE

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Introduction

Vibrations is a core course for third-year mechanical engineering students at Universiti Teknologi PETRONAS (UTP). It is aimed to apply and build on prior knowledge in statics and dynamics. The intended learning outcomes after successfully completing this course, the students should be able to:

1. Model vibratory systems based on the mass-spring-damper concept.
2. Analyze single degree of freedom and multi-degree of freedom systems using force/moment balance and work-energy methods.
3. Evaluate unwanted effects of vibrations in a dynamic system using appropriate vibration measuring instruments and techniques.
4. Design ways to isolate or minimize unwanted effects of vibrations in a dynamic system.

Table 1 Record on the attainment of course learning outcomes

Sem.	No. of students	CO1		CO2		CO3		CO4		CO5	
		Avg (%)	Pass (%)	Avg (%)	Pass (%)	Avg (%)	Pass (%)	Avg (%)	Pass (%)	Avg (%)	Pass (%)
May 2016	102	63.9	98.0	68.6	100.0	57.9	90.2	66.1	98.0	66.8	98.0
Sep 2016	120	65.0	95.8	55.2	88.3	66.4	97.5	62.6	87.5	63.0	87.5
May 2017	149	66.8	100.0	71.3	100.0	64.1	98.7	74.9	97.3	63.3	93.3
Sep 2017	133	70.8	93.2	66.0	91.7	74.3	96.2	64.2	83.5	65.6	88.7
May 2018	23	53.2	65.2	61.6	87.0	67.8	91.3	64.6	78.3	57.3	78.3
Sept 2018	120	72.9	97.5	70.1	99.2	79.7	99.2	62.7	93.3	N/A	N/A

*Note that for September 2018 onwards, the previous course learning outcomes 2 and 3 have been combined and harmonized into the present learning outcomes 2 (Analyze single degree of freedom and multi-degree of freedom systems using force/moment balance and work-energy methods), while previous learning outcomes 4 and 5 have been relabeled as learning outcomes 3 and 4, respectively.

Students have considered vibrations as a difficult subject. Table 1 shows a consistent low course outcomes attainment due to poor performance by students for the past few years. The recent attempts in employing active learning approaches seem to improve the attainment of course outcomes 1 and 2. However, course learning outcomes 3 and 4 appear to be somewhat a persistent issue; a significant number of students experienced difficulties in evaluating unwanted effects of vibrations using vibration measuring instrumentation and redesigning ways to isolate or minimize unwanted effects of vibrations in a dynamic system. This is because these two learning outcomes involve a significant amount of industrial or practical knowledge, which is still lacking with the previous implementation of the subject.

Based on a survey that consists of 104 respondents, laboratory work has been ranked as the least important and/or useful for learning among all course materials of the subject (refer to Figure 1).

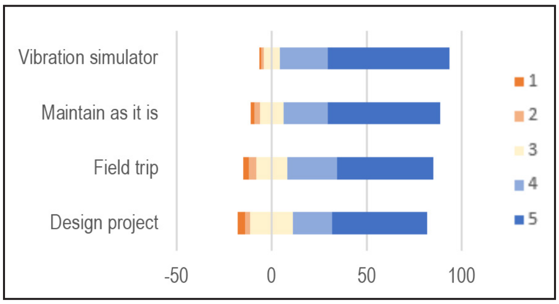


Figure 1 Outcomes of teaching and learning (T&L) survey on the importance/usefulness of course materials for MDB3093 Vibrations (Scale 1: Strongly disagree, Scale 3: Neutral, Scale 5: Strongly agree).

This is rather understandable because the experiment only allows for hands-on practice to demonstrate theory in action – those that are relevant to course learning outcomes 3 and 4.

This, however, does not reflect much on the actual scenario/situation of vibration effects and their evaluation in industries. As illustrated in Figure 2, many respondents agreed that adding a vibration simulator (or any component that could 'simulate' actual vibration) could further enhance their learning ability/achievement.

Furthermore, a desktop comparison between the Vibrations course at UTP and its equivalent subject in other universities, locally and abroad, shows that our implementation continues on traditional textbook-centric theory despite the fact that the 21st century market seeks engineers who can conceive and apply technologically-driven instrumentations. It is common industrial practice to conduct diagnostics on any types of machinery (especially rotating) using a vibration analyzer. Such analyzer allows the students to listen to a distinct vibratory sound, see and feel vibration motion, and evaluate/analyze the effects of unwanted vibration. This highlights the need to revamp the laboratory component, which contributes towards learning outcomes 3 and 4 with a new exercise/method that is technologically driven and relevant to life-like industries.

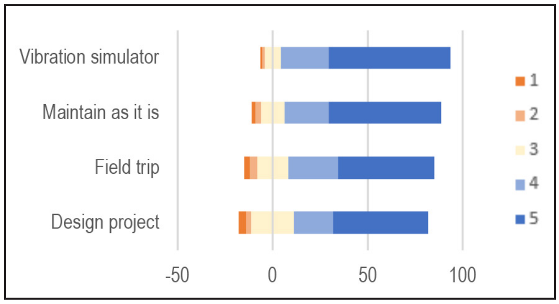


Figure 2 Outcomes of T&L survey on potential of additional items that can further enhance MDB3093 Vibrations students' learning (Scale 1: Strongly disagree, Scale 3: Neutral, Scale 5: Strongly agree).

Chinese philosopher Confucius once wrote:

> I hear and I forget
> I see and I remember
> I do, and I understand!

Hence, there is a need to provide an opportunity for students to be immersed or blended within an industrial setting (or its mimic) to allow them to create experiences where they could draw invaluable life-long learnings from them. This paper compares the preliminary implementation of experiential-learning exercise in an industrial setting versus in a classroom setting for Vibrations students.

Literature Review

Experiential learning is one of the teaching and learning methodologies for engaging students to get them to actively participate in a learning process. Kolb (1984) defined experiential learning theory as "the process whereby knowledge is created through the transformation of experience.

Knowledge results from the combination of grasping and transforming experience". Kolb's cycle of experiential learning starts with 'concrete experience', which represents a new encountered experience/situation till 'active experimentation', where students get to reflect on their observation, conceptualize/digest it and continue to build further experience.

There are two types of experiential learning: field-based experiences and classroom-based learning (Lewis & Williams, 1994). Field-based learning requires students to be at the real places or scenarios, such as service-learning and internship, to learn. On the other hand, classroom-based learning involves case studies, simulation, etc., to 'feel' and practice experiential learning. Examples of experiential learning include,

1. Southern Arkansas University conducted experiential learning called 'Student in Free Enterprise's Walgreens Wrangle', where students with business programs got to interact with managers of four major corporations for three days. The value to the students is the list of mentors and networks they build, the interview opportunities they receive from participating companies, and the opportunity to apply the knowledge they are learning in classes (Clark & White, 2010).
2. Simon Fraser University conducted experiential learning for ENSC-150 Introduction to Computer Design. It found that approximately 37% of the class favored the experiential learning method compared to 28% who preferred the conventional method. The rest of the students do not have a preference (Hajshirmohammadi, 2017).
3. The National University of Singapore employed Game-based learning using Kahoot! to augment experiential learning for an introductory engineering course offered for the freshmen of the computer engineering cohort. The feedback from the survey shows that the introduction of a game-based student response system promotes learning by students in an experiential learning environment (Sasidhar et al., 2018).
4. Using an application-oriented design project, Griffith University applied experiential learning in a mechanical engineering course (Design of Machine). They found that the learning method improved student engagement and learning experience significantly (Huaizhong, 2019).

The concept of experiential learning has been mostly applied in the arts and humanities and natural sciences to a certain extend but very minimal in the engineering context. Intuitively, this is mainly because humanities subjects are close to human experience. Regarding the engineering program, incorporating experiential learning is more easily achieved in upper-division courses through internships and capstone projects. However, it is important to integrate theoretical knowledge the students gain with industrial practices as early as possible to ensure that they have experience with real-life examples related to what they learn. For lower-division courses, experimental work in a laboratory setting is often considered as hands-on practice for the students to conceive their knowledge in a practical context – this, however, is not enough to expose students to the required technical experience.

Unlike traditional laboratory, non-traditional laboratory, such as virtual simulators and remote lab, can be conducted as many times as the students wish, and they could be accessed remotely. This kind of teaching and learning method is classified as blended-experiential learning, an approach where teaching and learning for hands-on/experimental skills are conducted partly online or virtually. In this approach, a virtual simulator/lab allows the students to work on real equipment and instrumentation located at a distance via internet connection without visiting the physical laboratory. Virtual simulators are the imitations of real experiments; all the infrastructure required for laboratories is not real but simulated on computers. Although a virtual simulator provides a limited capability for deep experiential learning, it has been shown to be equivalent to a physical lab for explaining and reinforcing concepts. In 2006, a study conducted by Ma and Nickerson showed that a virtual simulator/lab could be designed such that it results in a close resemblance to traditional hands-on laboratories in achieving conceptual understanding. More recently, Brinson (2015) conducted a review of empirical studies on a comparative study of the learning outcome achievements in non-traditional (virtual and remote) versus traditional (hands-on) laboratories. The study's outcome discloses that students' learning outcome achievement is equal or higher in non-traditional compared to traditional labs across all learning outcome categories (knowledge and understanding, inquiry skills, practical skills, perception, analytical skills, and social and scientific communication).

The followings are a few examples of blended-experiential learning applied in the context of undergraduate Vibration course,

1. Stevens Institute of Technology developed web-based interactive applications and virtual experiments integrated with remotely controllable real instruments. The system has been used and evaluated favorably by students. It is claimed to

be able to enhance the students' understanding of vibration phenomena greatly and assist them in grasping the concepts of mechanical vibrations in the context of practical engineering applications (Aziz et al., 2007).

2. Universidad Carlos III de Madrid developed a graphical user interface to acquire and process vibration and acoustic signals in MATLAB environment. The interface allows the students to easily obtain or simulate signals from mechanical elements without deep previous knowledge, thus making it a friendly teaching and learning tool. However, the impact or efficacy of the implementation has not been quantified (Gomez, 2015).
3. The University of the Basque County presents the capacities of the dynamics module implemented in GIM software for obtaining free solid diagrams, internal forces maps/diagrams and motion simulation. In addition, interacting prototypes for experimentation have also been proposed. However, the impact or efficacy of the implementation has not been quantified (Urízar, 2019).

To date, there is no report on the application of the experiential learning method in an industrial setting. This is because the learning method is more challenging and time-consuming when compared to the conventional method, and possibly due to the lack of access of a university to industry. At UTP, such a virtual simulator and remote lab for vibration courses have not yet been implemented. Despite the implementation of virtual labs in the context of undergraduate vibration courses in other universities, there is no systematic assessment on the efficacy of blended-experiential learning for improved students' competency, especially for large class sizes and distance- and self-learning modes. Hence, this warrants the investigation on the efficacy of blended-experiential learning in an industrial setting and classroom environment for this specific course.

Methodology

The context of this blended-experiential learning is limited to the practice of vibration data acquisition and analysis of a piping system to address course learning outcomes 3 and 4. This study was implemented for Vibration course students from four different semesters, as outlined in Table 2. The implementations are divided into,

1. Industrial setting (Visit to UTP Gas District Cooling)

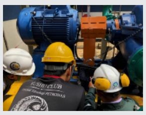
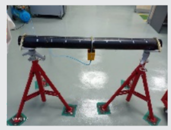
   A batch of 132 students was divided into the following categories:
   a. 109 students underwent conventional laboratory work
   b. 23 volunteered students underwent both conventional laboratory work and experiential learning in an industry

   The conventional laboratory work focused on the effects of unbalance masses on vibration response of a rotating system using Rotor Kit (Model RK4) and Bentley Nevada System I. On the other hand, the experiential learning exercise conducted at GDC Plant involved measurement and analysis of vibrational data from healthy and slightly faulty running pumps (see Table 2 for illustration of the work).

2. Classroom environment
   For classroom exercises, the work is divided into a project (i), project (ii), physical lab and remote lab. Project (i) acts as a direct comparison to the fieldwork done at UTP GDC but in a laboratory environment. Project (ii), physical lab and remote lab exercises are a part of a hybrid lab implementation that mimics an industrial setting in a laboratory environment. Unlike project (i), the setting for a hybrid lab allows for safe remote access for distance/virtual learning. Hence, the efficacy of its implementation is also included as an alternate comparison against the industrial exercise at UTP GDC.

Note that the number of students for each implementation varies from one another depending on the number of students for enrolled for the semester.

Table 2 Implementation of blended-experiential learning in industrial and classroom settings

Blended-experiential learning approaches	Industrial setting	Classroom environment			
	At Gas District Cooling UTP	Project (i)	Project (ii)	Physical lab	Remote lab
Batch of students	January 2019	May 2020	May 2021	September 2021	September 2021
No. of students involved	Selected 23 out of 132	83	70	40	45
Setting					
Data acquisition techniques	In-situ hands-on data collection via direct physical access	No data collection (Pre-recorded data was supplied)	No data collection (Pre-recorded data was supplied)	In-situ hands-on data collection via direct physical access	In--situ hands-on data collection via remote access
Exposure	Adjunct lecture on vibration data acquisition and signal processing Supplementary notes/readings	Pre-recorded materials & supplementary notes/ readings on vibration data acquisition and signal processing	Adjunct lecture on vibration data acquisition and signal processing Supplementary notes/readings	Adjunct lecture on vibration data acquisition and signal processing Supplementary notes/readings	Adjunct lecture on vibration data acquisition and signal processing Supplementary notes/readings
Feedbacks / Assessments	Pre-implementation survey Post-implementation interview Course outcome attainment	Course outcome attainment	Pre- & post-implementation surveys Course outcome attainment	Pre- & post-implementation surveys Course outcome attainment	Pre- & post-implementation surveys Course outcome attainment

A survey and interview were conducted to assess students' perspectives of their level of engagement before and after the implementation of experiential learning. In addition, the impact of experiential learning on their understanding of the subject matter was assessed through their reflection and all relevant assessments (e.g., reports, assignments, quizzes) that contribute toward the attainment of course learning outcomes 3 and 4.

The followings are the questionnaires used for the 5-point Likert survey after the implementation of the hybrid lab,

1. Knowledge acquisition and motivation;
   a. The physical lab (or the practical lab via teleconference) helped me to understand and relate to the T&L discussed in the theoretical classes.
   b. The hands-on (or the practical lab via video) work in the physical lab positively impacted my learning.
   c. My motivation for studying the course via physical lab (or the practical lab via teleconference) was stimulated.

2. The importance of reinforcing learning goals;
   a. The physical lab (or the practical lab via teleconference) assisted the course learning outcomes in the related modules.
   b. The physical lab (or the practical lab via teleconference) has the same importance for learning the concept discussed in the theoretical class.

3. Skills acquired;
   a. New skills useful for my academic development acquired during physical lab (or the practical lab via teleconference).

4. Need for physical apparatus;
   a. Based on my experience in a physical lab (or the practical lab via teleconference), it is fundamental to use and manipulate apparatus in a physical lab.

5. Academic formation without physical apparatus
   a. Vibration students can be professionally well prepared without using physical lab (or the practical lab via teleconference)

6. Learning impairment;
   a. The difficulty in handling the physical lab (or the practical lab via teleconference) impaired my learning of the objective of the respective lab

7. Think about alternative methods?
   a. In its current form, would you recommend that new students use the remote lab/physical lab/field trip (depending on which batch of implementation they are in)?

Table 3 Record on the attainment of course learning outcomes, reflected in students' performance

Semester	No. of students	CO1		CO2		CO3		CO4	
		Avg (%)	Pass (%)	Avg (%)	Pass (%)	Avg (%)	Pass (%)	Avg (%)	Pass (%)
Jan-19 (Visit to GDC)	132	66.8	90.9	75.3	98.5	79.1	97.7	62.6	75.8
May-20 (Project (i))	75	76.7	95.2	77.3	100	66.6	95.2	60	92.8

Results and Discussion

Comparison between Industrial work at GDC against Project Work (i)

The attainment of course learning outcomes was gathered through (i) Outcome-Based-Education (OBE) analysis reflected in students' performance and (ii) survey to students at the end of the semester. Table 3 compares the performance of the batch of students that underwent fieldwork at GDC against those who experienced it via project. Since the result represents the performance of the whole batch, not just selected few students who went experiential learning, no conclusive remarks can be made on the efficacy of its implementation. However, based on the survey findings on the attainment of course learning outcomes for students in January 2019 semester, as shown in Figure 3, it was found that on average, the students who went through experiential learning rated that their attainment on course outcomes 3 and 4 as 4.65 and 4.76 out of 5, respectively, which are higher than those who went through conventional lab work (i.e., 4.59 and 4.63). Although this survey rating is only a reflection of students' perception of their comprehension, it indicates the potential of experiential learning in enhancing students' participation and performance.

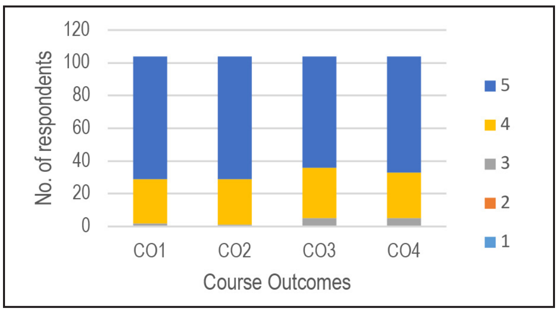


Figure 3 Rating on attainment of course outcomes via survey (Scale 1: Poor attainment, Scale 3: Neutral, Scale 5: Best attainment).

Figure 4 illustrates a comparison in ratings on the usefulness/importance of experiential learning before and after its implementation. Almost half of those who participated in the visit to GDC regarded that such exercise is useful for their learning and maintained their importance after they went through such exercise. About 23.6% of the participants who were neutral and skeptical about the implementation of experiential learning before attending it have rated the method highly (i.e., rating 5) after they went through the exercise. This demonstrates that with proper implementation of experiential learning, students would be more interested and could be actively participating in their learning process.

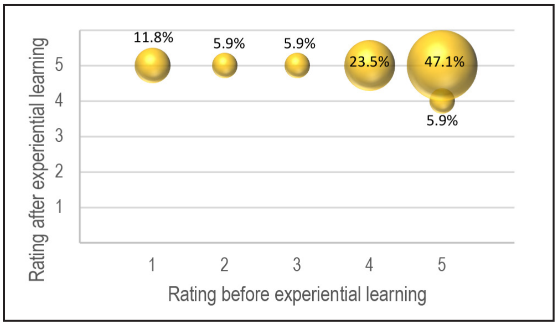


Figure 4 Comparison in ratings between pre- and post-experiential learning with regards to usefulness/ importance of experiential learning (Scale 1: Strongly disagree, Scale 3: Neutral, Scale 5: Strongly agree).

The followings are some selected, recorded audio feedbacks by students after the implementation of experiential learning at GDC,

a. "It really exposed me (with) a lot lah, in terms of vibration analysis and real-life applications... "
b. "...it is actually interesting as we are exposed on how (what) we learned actually works because previously we are only exposed to only knowledge...during the session just now, we know some of the things we learned are actually applied in the real industrial situations..."
c. "...in the classroom, we just developed a problem and analyzed..., but here we can actually see and hear..."
d. "...it is a really good exposure, a practical platform...really exciting experience at GDC, get to use the knowledge in real-life applications..."
e. "...actually today only I know that to find out the source of vibrations, we have such devices to detect and from there we can know what's the problem..."

Based on the interview outcomes, the majority of the students expressed that experiential learning in an industrial setting allows them to connect the theoretical knowledge they acquired in the classroom with practical application in the vibration industry, and thus hopefully better prepare them for the working environment upon graduation.

Prospect and Challenges of Blended-experiential Learning in Industrial Setting and Classroom Environment

For brevity, the findings on the comparison of industrial work against the project (ii), physical lab and remote lab are included in the oral presentation during the conference itself. Overall, this paper demonstrates that the blended-experiential learning approach possesses a huge potential to intensify the engagement between students and facilitators, further enhance their practical skills, and make them highly relevant to industrial practices. However, the implementation of this learning method in an industrial setting is more challenging and time-consuming when compared to other approaches, especially for large class sizes. In addition, it is difficult to identify an industry that is willing to work closely with a university, especially when one must accommodate a significant number of students during its active operation. This drawback, however, can be addressed if the "laboratory" work can be executed via teleconferencing or remote access, as piloted in the case of the remote lab mentioned earlier.

Further investigation needs to be conducted to establish a framework that could effectively implement blended-experiential learning in an industrial setting, especially for large class sizes.

Conclusion

This paper presents the preliminary implementation of experiential learning exercises in an industrial setting and classroom environment for the Vibrations course. On average, the students who went through experiential learning in an industry rated that their attainment on course outcomes 3 and 4 as 4.65 and 4.76 out of 5, respectively, which are higher than those who went through conventional lab work – this represents a good reflection of students' perception on their comprehension through experiential learning.

In addition, about 23.6% of the participants who were neutral and skeptical about the implementation of experiential learning before attending it has rated the method highly (i.e., rating 5) after they went through the exercise. This demonstrates that with proper implementation of blended-experiential learning, students would be more interested to participate in their learning process actively and thus ensure good attainment of the course learning outcomes. In addition, given a proper design and execution, a successful blended-experiential learning in an industrial setting can be implemented based on the remote-lab concept.

Acknowledgment

A heartfelt thanks to all staff from both Intekma Engineering and Services Sdn. Bhd. and Makhostia Sdn. Bhd. for sharing their vast knowledge, experience and facilities with MDB3093 Vibration January 2019 semester students throughout this experiential learning exercise. The authors would like to acknowledge the financial support provided by Universiti Teknologi PETRONAS, under SoTL grant no. 015LF0-049.

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COORDINATED WAY TO DEAL WITH SCHOOLING EDUCATIONAL PLAN BASED ON CURRENT INDUSTRY NEEDS IN INDONESIA

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Introduction

Education will have an impact on progress for both individuals and a nation. In addition, someone with high education will be respected and become an individual whose expertise is needed (O'Neil et al., 2020). The Indonesian Education Encyclopedia explains that education is a process of guiding humans or students from darkness, ignorance, and intelligence of knowledge. Of course, developed countries have also prepared steps to improve competitiveness, talent, and the quality of human resources (Pokrovskia et al., 2021). Quoted from the 2020 Global Talent Competitiveness Index (GTCI), it is a ranking of country competitiveness that can be used as an indicator to measure how developing countries and cities provide human resources to increase competitiveness (Acs et al., 2020).

Some of the indicators for this index assessment include education, per capita income, computer information technology infrastructure, gender, environment, tolerance level, and political stability. In 2019 Indonesia's ranking on the Global Talent Competitiveness Index (GTCI) was in position 67, which increased to position 65 in 2020 from 132 countries (Affandi et al., 2020). Even though it is increasing, of course, with the current data, Indonesia's competitiveness with other countries is still low. At the ASEAN level alone, Indonesia's competitiveness is still low. Singapore ranks first with a score of 78.48. The next ranking is followed by Malaysia (60.04), Brunei Darussalam (52.17) (Syamsul, 2001). Meanwhile, Indonesia is in fifth place with 41.81, only ahead of Thailand, Vietnam, Laos, and Cambodia. Singapore is a country in ASEAN that we can use as an example in terms of competitiveness. Not only excelling at the ASEAN level (Au, 2021).

Therefore, a bold overhaul is needed to show a positive trend for the quality of Indonesia's competitiveness. Only then can Indonesia compete with other countries and produce quality human resources. Education observer Mohammad Abduhzen views education in Indonesia as too rigid, bureaucratic, and empty of meaning. The reason is that the application of the learning system used is very fixated on standards, on the target curriculum content, empty of meaning, and possibly less pragmatic (Sneha et al., 2021). "If the system is still implemented in Indonesia, it will produce graduates who are less qualified," he assessed, not only at the basic education level but also at the tertiary level. Overcoming educational problems is not as easy as turning the palm of the hand. The existence of educational inequality due to the lack of effectiveness and efficiency is still easy to find. The teaching style that is less effective and only piles education on the role system without understanding is also a problem that has not been found for a long time (Ssenyonga, 2021).

To improve the problem of education, it is necessary to have criticism and suggestions to find out the shortcomings and fix these shortcomings. First, eradicating corruption in the education sector has not been the main focus of the government. Second, suppress more effective teacher training. Facts on the ground that many teacher certifications are taken in the fast lane. Third, equal placement of teachers (Cerro, 2020). Fourth, for cities with adequate facilities, blended learning must be implemented. Nowadays, the term flipped classroom appears in the teaching and learning system. The flipped classroom, which is listening to material through videos at home but practicing questions at school. From here, the teacher as a facilitator can see if the students have understood yet. There is also more time to discuss in class to improve students' critical thinking. Here is Indonesia's low competitiveness in Figure 1 (Qureta, 2021).

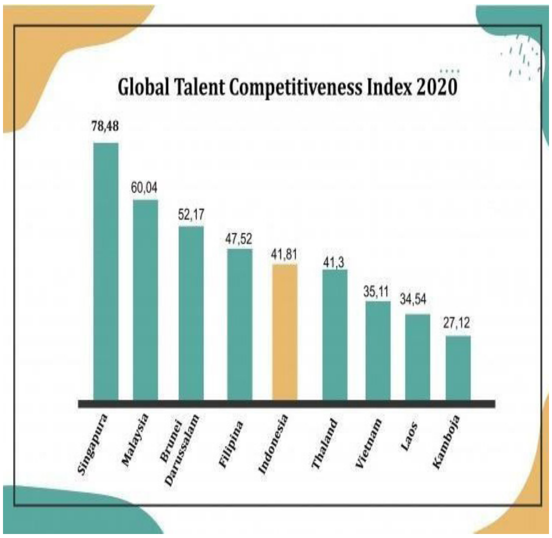

Figure 1 Indonesia's competitiveness on a global scale

Indonesia's Unemployment Rate was reported at 7.07% in 2020, and this record is up from the previous 5.18% for 2019. Indonesia's Unemployment Rate data is updated annually, with an average of 5.94% from 1984 to 2020, with 37 observations. This data reached a high of 11.24% in 2005 and a record low of 1.62% in 1984. Indonesia's Unemployment Rate data remains active at CEIC and is reported by the Central Bureau of Statistics. The data is categorized in the Indonesia Global Database presented in Figure 2 (CEIC, 2021).

To adapt to the changes brought about by the industrial revolution 4.0, a worker must have abilities that machines cannot. Soft skills are the key. The World Economic Forum also released skills that workers absolutely need to be able to deal with changes in 2020 and beyond. Some of the skills that must be possessed by these workers are complex problem solving, namely the ability to think clearly and deeply about a problem by identifying, selecting information related to the problem, determining solution options, and evaluating them, and implementing options as solutions in overcoming the problem. Critical thinking is the ability to think critically and provide feedback accompanied by logical reasons. Creativity is the ability to find something unique and original. It doesn't have to be completely new, but you can also develop what already exists. People management is the ability to manage people, including leadership skills. Coordinating with the ability to work together with other people, both inside and outside the team. Emotion intelligence is the ability to regulate emotions. This includes the ability to identify, manage and utilize emotions. Judgment and decision making is the ability to make decisions under any conditions, including when under pressure. Service orientation is the ability to 'serve', either for the company or the customer, without expecting mere rewards. Negotiation is the ability to negotiate in aspects of work, even though it is difficult to do. Cognitive flexibility is the ability to switch or shift in thinking according to needed needs (Adnan et al., 2021).

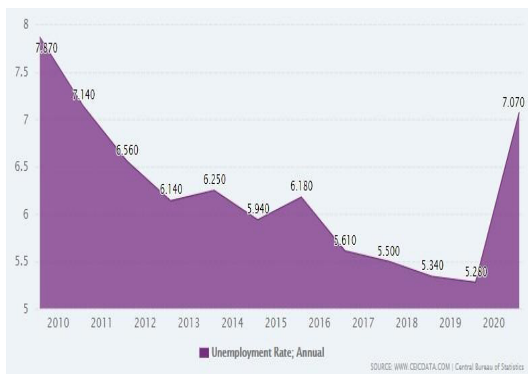

Figure 2 Data on Indonesia's unemployment rate 2010-2020

In Indonesia, education is centrally controlled by the ministry of national education. The primary phase follows optional pre-school playgroups that may commence in a child's third year. As the Islamic education system operates in parallel to this (Suryadi, 2020). The junior high school offers a bridge between the gentler pace of the elementary phase and the challenges of senior high school that may follow. It also assists educators to determine a possible future direction for their students. The Islamic education system continues to provide an alternative. There are two different kinds of Indonesian high schools providing two streams of education for those who choose to enroll optionally. One of these is aimed at those who intend to go to university. The other is for those who plan to find jobs right away (Dwijayanti, 2020). Other young people choose the Islamic alternative. Vocational training is mainly provided by private training colleges and initiatives by donor countries. Unfortunately, this continues to occur mainly in the cities. This continues to condemn most of the rural poor to a life of drudgery and manual labor. The University of Indonesia is the oldest University founded in 1947. It has an outstanding local reputation and was ranked among Asia's top 50 in Asia in May 2011 (Cen et al., 2021). The following will be explained in Table 1 regarding the level of education in Indonesia.

Table 1 Educational levels in Indonesia

Education	School level	Grades	Age	Years	Notes
Primary	Kindergarten		3 to 5	2	
Primary	Elementary	1 to 6	6 to 11	6	Literally-Elementary School
Middle	Middle School	7 to 9	12 to 14	3	Junior High School
Secondary	High School	10 to 12	15 to 18	3	Senior High School and Vocational High School
Post-Secondary	Associates Degree			1 to 3	Associate Diploma
Tertiary	University First Degree			4	Bachelor Degree by Subject Degree
Tertiary	University Second Stage			2	Master Degree
Tertiary	University Third Stage			3	Doctor, Highest Award Conferred in Indonesia Universities or Institutes

Based on what has been explained in the background, it is necessary to have a clear problem formulation so that the existing research is directed and consistent with the topic referred to. It does not go anywhere in the discussion. The following is the formulation of the problem that will be explained in this study:

1. How to make collaborations in improving skills or skills, creating quality, skilled individuals, having work attitudes, and having an entrepreneurial spirit?
2. How to get a policy from the government to improve education in Indonesia?
3. How to create cooperation between teachers and lecturers in emphasizing this industrial-scale education?

When described in the background of research as communication causes conflict that is difficult to quell. And in the previous discussion, the parameters of the problem formulation in this study have been described. Therefore, the objectives of this research are described as follows:

1. There is cooperation in improving skills or skills, creating qualified, skilled individuals, having work attitudes, and having an entrepreneurial spirit.
2. Obtain policies from the government to improve education in Indonesia.
3. Creating cooperation between teachers and lecturers in emphasizing this industrial-scale education.

Based on what has been described starting from the background of research on communication, problem formulation, and research objectives. Then the next stage is to describe the benefits of research on the role of this communication, among others, as follows:

1. Produce superior seeds that can improve the quality of companies in the world of industry.
2. Opening wider access to the business world and the industrial world.
3. Making aspirations for people who will review the world of education and the world of industry.

Methods

This study uses survey results from researchers and people related to researchers with the best ideas and opinions classified in several ranks or rather research data using ordinal data. The type of research used in this research is qualitative research with a case study method. So, the case method focuses on examining the background, interactions, and conditions of a particular community. The form of this case study is more suitable to be used to examine an event, activity, or program in a particular group of individuals. The advantage of this type of research is that it can be used to examine objects in the form of groups. As long as the group has the same goal. Data collection techniques in case studies can use observation techniques, documentary studies, and interview techniques.

The first step in this research is to get as much literature as possible regarding related research information. Then because the researcher is an educator, it is necessary to observe in this study to see and learn the state of education in Indonesia. After obtaining information based on observations, the next step is to make a research design with the types and research methods applied in this study. When the purpose of this research and the methods used are acknowledged, it is preferable to immediately begin writing a report using the suitable report framework for this research., it is better to immediately write a report with the reporting framework for this research. When writing a report, it is necessary to carry out an analysis about quantitative analysis and qualitative analysis, namely interviews and several assessments by question and answer with those who care about this research. If it is good when the qualitative analysis process is complete, this research report is complete, and if the qualitative analysis is not adequate, then it must be checked first to really get the conclusions from the research. This will be explained in Figure 3.

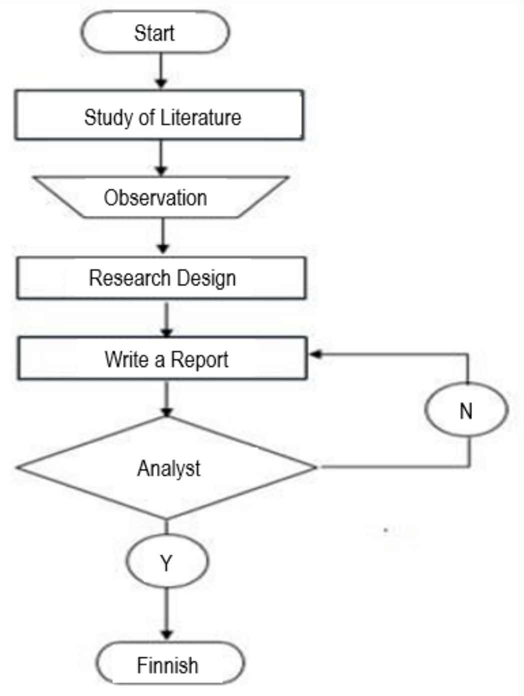

Figure 3 Research flowchart

Results and Discussion

The main goal of someone taking higher education in this modern industrial era is professional staff who are reliable in building the country's image and the nation's progress. Some factors that encourage staff to become professional are applied research, modern manufacturing technology, contracts from industry, and future demands. Applied research is a very much needed one that can be encouraged because this is a breakthrough for creating a reference for real objects. Modern manufacturing technology is a development of conventional manufacturing technology. Of course, in this era of development, industrial needs are increasing. For example, when in a village that sells metal needs such as pots, pans, and so on where the organization's management in selling is not good, knowledge in research and development is needed to make it easier to sell. There are also many other examples, if the lathe workshop or welding workshop is well managed so that there are many contributions from students who want to do internships, then employees' work will be more helpful. Another factor that does not go unnoticed is regarding contracts from the industry.

For employees to always uphold a dedication to science and technology, futures contracts are needed so that when they become employees, they continue to maintain their struggle and train the mindset of academic graduates to always feel satisfied easily. Future demands are needed because when we feel we don't care about the future, we are the same as suffering the interests of many people. In addition to the factors described earlier, several other things encourage progress to become a professional, including learning, education, experience, engineering, application, and production. Another thing that will become a single unit is education-based productivity (Beemt et al., 2020). The following will be explained in Figure 4.

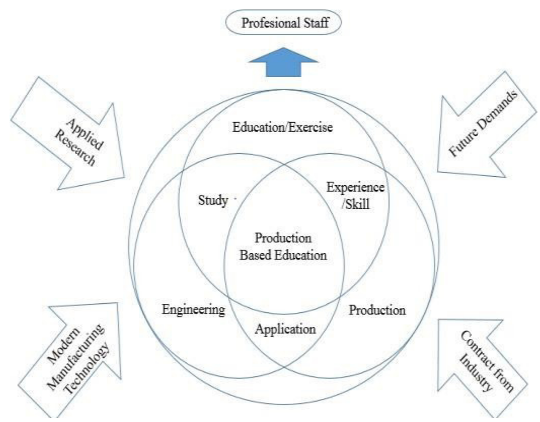

Figure 4 Systematics towards professional staff (Sopian & Santiago, 2021)

Some things are very helpful to success, one of which is education. Education forms human identity in determining obstacles in the journey of life. Therefore, it needs to be managed and handled with good unity. A good personality will certainly create critical thinking because it is all based on a wise attitude and does not demand perfection in life targets but tries without being too ambitious (ambitious) about this life. A person in his or her life needs to know what talent he or she actually can and is embedded in his/her life potential to create a person's characteristics or identify his or her life because by having the right identity, enjoying life will be smooth. Imagination is necessary because by imagining, someone will be more honest with their feelings because imagination cannot be formulated with logical things. All breakthroughs that encourage the potential of students who want to learn and know more about themselves will have a good impact until they slowly lead themselves in a professional direction (Reich et al., 2020). The following is the equivalent of things to unlock further potential, which will be presented in Figure 5.

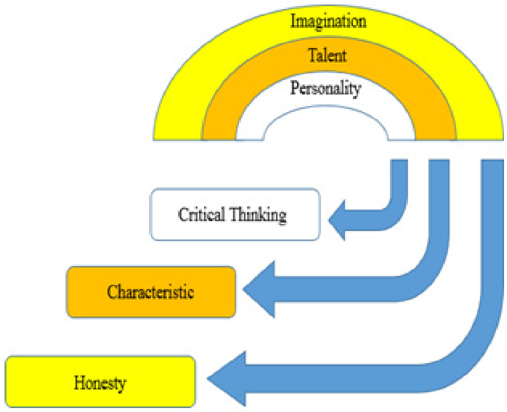

Figure 5 Knowledge is to know your potential (Butt& Ahmad, 2020)

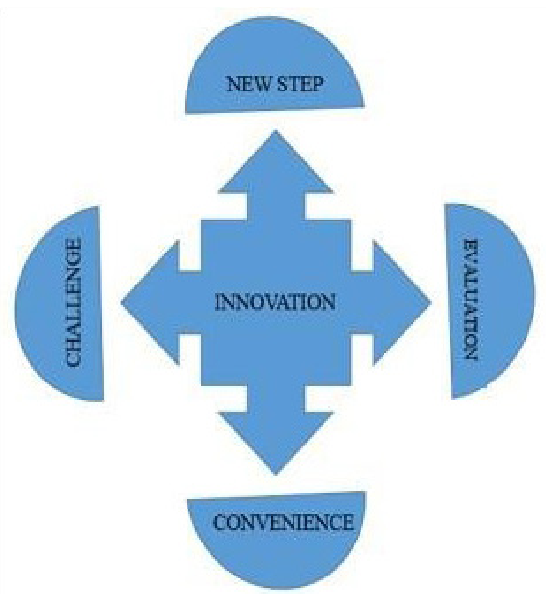

Figure 6 Positive impact of innovation (Broadstock et al., 2019)

Educational innovation is innovation in the field of education or innovation to solve educational problems. So educational innovation is an idea, item, or method, which is felt or observed as new for a person or group of people (society) either in the form of an invention or a contest, which is used to achieve educational goals or solve educational problems. Education is a system; thus, educational innovation includes matters relating to components of the education system, both systems in the sense of schools, colleges, or other educational institutions, as well as systems in a broad sense, such as the national education system. Because innovation can encourage new steps to be better than the previous steps, with new steps, the spirit of life for new directions is also getting better. Challenges also arise and are created because of innovation, and breakthroughs will create challenges for new things and further explore and study scientifically. Innovation can also bring comfort to many people because technology should not be slow and standstill. In addition, innovation can provide an evaluation of quality educational technology processes. What is meant by evaluation here is to provide a meeting point for the concerns of young people who have good potential in the future (Tolstykh, Gamidullaeva, & Shmeleva, 2021). The following is a positive impact of innovation in educational technology in Indonesia, and the schematic will be explained in Figure 6.

The series of one's journey to becoming a professional worker is indeed not as easy as one might imagine because professional workers are definitely needed to achieve the identity of a glorious nation. Education is not only in the academic sphere, but the most important thing is in the social environment, such as moral education which focuses on unity. Therefore, before entering the elementary school level, it is better to have some personality and aptitude test so that when entering elementary school, children already have an ingrained mindset about what the future should be like. During elementary school, at levels 4 to 6, children must be prepared for character-building materials. The purpose of this character development is to form noble values, especially character education, which helps strengthen the principles of each individual. When they have entered junior high school, the senior high school level, high school graduates or equivalent are required to continue the college level or if they cannot take courses. The capacity for high school graduates and the equivalent must certainly be accommodated by children who want to work there, the company can provide assistance or try to get them to enter the industry, they must attend lectures or training from government institutions. Even though workers who have graduated from high school and equivalent have not yet fully become industrial workers, even if their income is not equal to the income of permanent employees, the opportunity to join courses or college programs should not be lost. When they graduate from a course or college program, they must learn about management training. Every worker must own management training to be able to manage the company's needs properly as they should. When you understand that you already have a management training certificate, you will try to take part in soft skills training. Even though these soft skills seem trivial, big problems can occur because they ignore small problems. Soft skills training is rarely obtained from formal educational institutions. Most schools only focus on teaching hard skills. This is inseparable from the fact that to get a job, and a person must have certain hard skills (Loh, 2021).

Not many realize that soft skills are the most needed to achieve higher success. Some groups of soft skills are social skills, process skills, and generic skills. Social skills are very important with several skills benefits. Practice communication skills to convey the message to be conveyed without resorting to violence (Practical Assertive Communications). Skills in how to adjust communication style to achieve the desired thing (Effective Negotiations and Lobbying for Win-Win Situations). Negotiation skills can be trained; thus, this program hones your negotiation skills to lead to win-win decisions (Win-Win Negotiation Skills). This training aims to improve negotiation and lobbying skills for participants. The principles of negotiating (Negotiation Skill & Lobbying) will be introduced. Programs to improve speaking skills that affect other people. In training, they are given skills in public speaking, overcoming situations, and managing psychological conditions when speaking (Professional Public Speaking). Skills to improve the ability to build communication between the presenter and the audience to maintain the audience's enthusiasm until the end (Public Speaking & Presentation skills) (Leon, 2020).

A training program that combines two skills, namely time management and task delegation. One reliable way to increase self-productivity. Time Management and Self Productivity, a training program related to time management and self-productivity. Starting from managing priorities, managing interruptions, to overcoming procrastination. Building Motivation & Commitment, a training program that helps participants to be able to motivate themselves and the important aspects to build the totality of self-commitment. Conflict and stress management, productivity improvement program by dealing with stress and conflict in the workplace. Generic skills have several disciplines, namely Creative Thinking and Problem Solving. This program provokes you to be more creative in thinking and problem-solving oriented. Creative Problem Solving and Decision Making, namely the ability to master problem-solving techniques and methods to be able to increase capacity in making decisions (Avsec & Kowalczyk, 2021).

After understanding soft skills, it is necessary to train hard skills so that they are competent regarding the competencies that are taught when they become permanent employees in the industry later. The definition of hard skills is a learnable ability that is acquired and improved through practice, repetition, and education. Hard skills are important because they can increase employee productivity and efficiency as well as increase employee satisfaction. Hard skills are part of the skill set required for a job. A hard skill is a skill needed for an individual to do a job successfully. Hard skills can be acquired through formal education and training programs, including lectures, internships, short-term training classes, online courses, and certification programs, as well as on-the-job training. However, if only hard skills are needed, the business will not be successful, so employees who have other skills are needed, such as soft skills that contribute to customer satisfaction. In business, hard skills most often refer to the basics of accounting and financial modeling. In a broad sense, the notion of hard skills can refer to skills in complex tasks. Fluency in a language, knowledge of photoshop or PowerPoint, or carpentry skills are all hard skills that can be learned and improved with practice. Employers and recruiters most often look for these hard skills in a prospective employee's professional resume. Each hard skill a person possesses is supported by a certificate, degree, or other qualification that indicates the level of achievement. After you know an in-depth understanding of hard skills, the next is about examples of hard skills themselves. Hard skills include the specific knowledge and abilities needed to succeed in a job. These types of skills are learned and can be defined, evaluated, and measured. To develop business, of course, hard skills are needed. All jobs in business are mostly professional positions, requiring hard skills. As a business owner or company, you must choose employees who have good hard skills. This is intended so that the company will develop better and also get a lot of company income. The business will run if there are people who have hard skills in accordance with the developed business field. Without good hard skills possessed by employees, the business will be unhealthy. It could be a result of poor production or in the field of marketing that makes the business not grow. Business in graphic design, technology company business, as well as companies that produce food ingredients. For example, in the production of foodstuffs, companies need workers who have hard skills according to the required fields. Like a production machine operator. Before becoming a permanent employee in the industry, it is better to do work training in the related industry. When you become a permanent employee, you are competent and professional. According to research results released by the Journal of Business Administration, OJT greatly influences employee performance. Another benefit is that OJT is easy to implement because there is no need to gather employees in a special room to carry out training. OJT can be carried out while the employee is working. Another benefit of OJT is time effectiveness. Because OJT is generally carried out while employees are working, companies do not need to cut their employees' working time for training. In addition, OJT directly trains employees according to their needs. This makes hands-on training effectively focused. That's all about on-the-job training. Of course, now you understand how OJT is implemented (Karji et al., 2020). The following will describe the flow of the educational and technological innovation scheme in Figure 7.

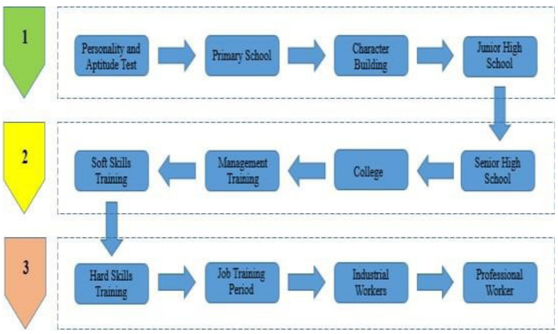

Figure 7 Flowchart of Educational and Technological Innovation (Vilela & Jerico, 2020)

Regarding the aspects of teaching and learning activities in this study, what is most urgently needed is the problem of passing grades which must be aligned with the current and future needs of the industry to reduce unemployment When students graduate, they should not be unemployed since the issue of grades is very minor. They should be encouraged to work because if this is not done, the unemployment rate in an era of global competitiveness may be higher.

Therefore, it is better in the learning process if students have no problem doing many remedies. In addition to sufficient value for an industrial scale, it would be nice to have additional value in teaching and learning, for example, between teachers and students as well as between lecturers and students can produce beneficial relationships. For instance, collaborative efforts in creating journals, books, and discoveries to expand possibilities as an added value in aiding employee selection in the industry .In a reasonably good category, teachers or lecturers and other instructors must be friendly because it is difficult when students are already stressed with problems of ideas or disciplines plus stress due to pressure from unfriendly teachers; therefore, this must be paid more attention to the direction of education better (Gyamfi et al., 2021). A good network also needs to be considered, in terms of integration it can also be, for example, teaching training programs for elementary school children, from high school students who are trying to learn to teach or the teacher exchange system. It can also exchange students at the regional, national and international levels (Szymkowiak et al., 2021). No less important is the encouragement for adequate workplaces; for example, each school must make innovations to beautify schools with an efficient budget. The following will describe the research results on teaching and learning activities needed for industry-related education in table 2.

Table 2 Research Results Regarding Teaching and Learning Activities Needed for Industry-related Education (Ghafar, 2020)

No	Explanation	Rank
1	The framework for a truly adequate learning place	5
2	An integrated network is required	4
3	The output value is quite high	2
4	All students graduate with grades according to industry needs	1
5	Educators have to be fun	3

When it is obtained and understood about teaching and learning activities, the next step is to review aspects of government regulations. The most important thing to review in this aspect is to look at the law in society (Solikhah & Budiharso, 2020). What is meant here is a crime or all forms of commendable acts which if the community environment alone cannot provide good education, then of course, in general, it will influence the daily life of children who if they grow up to form an identity in a good future The environment is one of the drivers of the growth of one's character (Hasan, Musyahid, & Wijaya, 2020). The next thing to note is that government the government must finance all schools. What is meant in this case is school equity. There is no school that is very grand, and there is no school that is very concerned about its condition (Jameson et al., 2020). Because Indonesia has entered compulsory basic education, it should be generalized regarding the rights of 12-year-old children to receive education, and therefore there is a need for subsidies. It is better to have a census or survey as research material where children cannot go to school to reduce unemployment and be accommodated comprehensively (Bhatta et al., 2020). This program is intended so that children can enjoy it fully without exception, even without being racist, because Indonesia is known as a country that is quite generous. There is also a need for cooperative collaboration between the government, instructors, educators and professional industrialists to build an idea that people need for the progress of many people (Cape Comorin Trust and Lavender Literary Club, 2020). No less important is the government's policy which, if necessary, for things that need to be criticized, for example, the dishonesty of students or students or writing that contains plagiarism, must be corrected if you want to do a project and so on (Sa'diah, Mujahidin & Hartono, 2020). The following will be presented in table 3 regarding the research results on government regulations needed for industry-related education.

Table 3 Research Results Regarding Government Regulations Required for Industry-related Education (Liu, 2021)

No	Explanation	Rank
1	The government, instructors, educators and profesional industry workers must be cooperative	4
2	All places of national compulsory education must be subsidized the government	2
3	There are no children who drop out of school until high school level	3
4	Government authorities should act more when there are indications of insignificant errors	5
5	Moral law applies in the public eye	1

In other aspects, it is also necessary to have aspects of cooperation. However, the title of educators in Indonesia, especially teachers, still has to be reviewed. This determines the mindset of thinking in teaching. In Indonesia, the average teacher still holds a bachelor's degree, while to score superior quality, you must have a Master so that an expert can go to the doctoral level (Mailool et al.,2020). Likewise, lecturers in Indonesia, on average, have a master's degree because they strived on average, to have a doctorate. A good team must be formed, and lecturers must become professors when they reach the doctoral level (Russell, 2021). The next thing is that the implementation of teaching and learning activities is not only on campus or in schools, but it should also be in several places to get a different impression and atmosphere, for example, in the laboratory or anywhere that is comfortable in carrying out learning (Ebrahim & Ben Naji, 2021). Then visits to places that can be used as knowledge material, one of which is museums, zoos, government laboratories and similar research institutions where these locations can be used as material to gain more knowledge and are not only related to the lessons taught but also to future needs (Suswati, Hutapea & Indrawaty, 2020). Next where educators and instructors must always be updated about current and future competencies and always increase the level that has been taught. The last thing is that educators and instructors must conduct investigations either through research, patents and so on so that science continues to develop and remain productive. The following is about the results of the collaborative research of teachers and lecturers needed for related education (Penuel et al., 2020).

Table 4 Research Results Regarding the Necessary Cooperation of Teachers and Lecturers for Industry-related Education (Oz & Ozdamar, 2020)

No	Explanation	Rank
1	Lecturers must have a doctorate and teachers must have a master's degree	1
2	Teachers and lecturers must do research	5
3	Teachers and lecturers must improve skills	4
4	Teaching and learning can occasionally be done anywhere as long as it is adequate	3
5	Industrial visits or other supporting objects	2

Conclusion

An industry-based curriculum is an important asset in more relevant innovation. On the part of private companies, the mechanism for determining work competency needs is based on the work in each division or department. The division is formed from the master plan in the organization's strategic planning. Each division will make an analysis of the work and workload as well as the needs of the workforce along with the competency qualifications that prospective workers must possess. Curriculum strategy development will involve stakeholders, especially on the user side, curriculum development has the aim of obtaining a match between graduate competencies and expected competencies. A curriculum that is more in sync with industry needs will provide a lot of learnings that awaken students' competencies.

Acknowledgment

A big thank you to Assoc. Prof. Dr. Raja Azis Raja Ma'arof, who has become the author's supervisor in presenting this scientific work and also to his colleagues, Mr. Andy, who has also dedicated his time and thought to this research. Hopefully, this journal will be of benefit to many people.

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EFFECTS OF MOVEMENT CONTROL ORDER (MCO) ON ANXIETY AND DEPRESSION AMONG MEDICAL STUDENTS OF ROYAL COLLEGE OF MEDICINE PERAK (RCMP) DURING COVID-19 PANDEMIC

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Introduction

COVID-19 cases are increasing globally, and this situation can affect not only the physical health but also the mental health of human beings. Movement Control Order (MCO) is a measure used in Malaysia to break the transmission chain and curb the spread of infection. Anxiety and depression statistics are at a worrisome level because of this crisis. Effects of MCO have been identified as a factor causing anxiety and depression amongst the medical students during this Pandemic.

While medical education is one of the most academically and emotionally demanding training programs out of any profession, the curriculum may contribute to the high prevalence of psychological ill-health among medical students. Furthermore, if they are unable to cope with the great level of stress of medical education, it may lead to a series of consequences at both personal and professional levels. Depression could affect students' ability to work, study, interact with peers, or take care of themselves, and the prevalence of depression and anxiety among the students would like to be assessed. A Canadian study focusing on the effects of quarantine after the Severe Acute Respiratory Syndrome (SARS) epidemic found an association between a longer duration of quarantine with a high prevalence of anxiety and depression among people. Hence, the association between anxiety, depression, and MCO during the COVID-19 pandemic was tried to study.

Objectives of the study *were to* determine the effects of MCO during the COVID-19 pandemic on anxiety and depression and to find out the association between sociodemographic factors and anxiety and depression status among the medical students studying at the University Kuala Lumpur (UniKL) Royal College of Medicine Perak (RCMP)

Methodology

This was a cross-sectional study that included all the medical students in University Kuala Lumpur (UniKL) Royal College of Medicine Perak (RCMP) from Year 1 to Year 5. Using a confidence level of 95%, 227 students were obtained as a sample size. The calculations were done using Open Epi, and the systematic sampling method was used.

Data Collection Method

It was an online survey questionnaire. The questionnaire consisted of 2 sections. The data was collected when Ipoh was in the Recovery MCO period.

To assess students' depression level, the Patients Health Questionnaire-9 (PHQ-9) was used and to assess students' anxiety level, the Generalized Anxiety Disorder-7 (GAD-7) was used. Self-constructed questionnaires were used to assess the anxiety and depression issues. This study was conducted within six weeks, from 19th October 2020 to 27th November 2020.

Data Entry and Analysis

All the data collected was tabulated and analyzed using Microsoft Excel and the Statistical Package for Social Sciences (SPSS).

Ethical Consideration

Ethical approval (approval number: UniKLRCMP/MREC/2020-2021/SRP-146) was obtained from the Ethics Committee of Faculty of Medicine, University Kuala Lumpur, Royal College of Medicine Perak, before the beginning of data collection. The participants responded anonymously to the online survey by filling up an informed consent letter in the first section of the e-questionnaire.

Results

The study population was dominated by females, which accounted for 68.7% (n=156), while males were only 31.3% (n=71). Among 227 respondents, most were aged between 21-25 years (56.8%), majority of the respondents were Malay (94.3%) and Muslim (93.7%). Among respondents, 16.7% (n=38) had anxiety and 30.4% (n=69) had depression. Regarding the distribution of MCO effects among respondents, 59.5% (n=135) of the respondents had MCO effects.

This study found that 16.7 % (n=38) of the respondents were having anxiety, while 30.4% (n=69) were having depression. MCO effects had an impact on anxiety in 24.4% (n=33) and on depression in 45.2% (n=61). The associations between effects of MCO and anxiety and depression were statistically significant with a p-value less than 0.001. Students who were exposed to the effects of MCO were 5.62 times (OR: 5.62, 95% CI: 3.03 – 7.77) and 8.65 times (OR: 8.65, 95% CI: 5.49 – 13.73) more likely to suffer from anxiety and depression respectively, compared to those who were not.

Discussion

Concerning the effects of MCO on depression and anxiety, the findings were consistent with previous studies around the world. Although the level of restriction due to lockdown/MCO was not associated with an immediate increase in psychopathological symptoms or fear of contracting COVID-19 infection, it might be a relevant factor that facilitates or moderates potential negative consequences for mental health. Those who have too much fear are putting pressure on themselves. As long as all people stay safe and obey the government measures, they shall be convinced of their physical health level. Those who have their loved ones at risk or infected by COVID-19 are continuously worried, which may lead to mixed feelings and risk for mental illness.

Moreover, during the movement control order period, the students were having difficulties with online learning, poor internet connection, need to complete household chores in between classes and long hours of online classes, which caused stress. For medical students, online learning could fulfill the theory part but they still needed hands-on clinical skills practice with patients at the hospital. In this regard, students suffer from sleep deprivation as they need to catch up with their assignments and assessments, which further creates complicated emotions such as anger, frustration and ultimately anxiety and depression. Our study was limited to only general results from the effects of MCO and we grouped people as those with effects of MCO present and those with effects of MCO absent. Thus, we could not know in-depth detail for individual factors. Relevant interventions are needed to combat the mental health problems in medical students, specifically during a pandemic.

Limitations

As this study was conducted during the COVID-19 crisis, there might be other confounding factors that impacted anxiety and depression issues.

Recommendations

For future study, the researchers would like to be suggested to include more than one institution so that the result would be more generalized and applicable to medical students in the community. Based on the finding, it was recommended that an online-learning friendly curriculum should be developed to reduce the potential anxiety and depression conditions among medical students, especially in the COVID-19 pandemic. The establishment of a relevant monitoring system on students' psychosocial well-being in medical universities might also be helpful and a suitable comprehensive approach should also be considered to achieve effective collaboration between stakeholders in the government and medical universities to improve medical students' psychological health.

Conclusion

This study showed that medical students who were exposed to the effects of MCO during the COVID-19 Pandemic had a higher chance of suffering from anxiety and depression than normal conditions. It could be concluded that the prevalence of anxiety and depression was high among female medical students, who were aged 21-25 years and Year 3 medical students' groups. This may need to necessitate measures for early identification and intervention to avoid these mental illnesses.

Acknowledgment

We wish to thank the Ethics Committee of the Faculty of Medicine for approval to conduct this study and acknowledge the medical students' cooperation as their contribution has been vital to the success of the study.

Funding and Conflict of Interest

There was no external funding in conducting this study and there was no conflict of interest associated with this manuscript.

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TECHNOLOGY ENABLED ACTIVE LEARNING (TEAL) TO IMPROVE STUDENT PERFORMANCE: A PILOT STUDY

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Introduction

Technological innovations are expected to drive the industries and life in the future. Yet, interest in Science, Technology, Engineering and Mathematics (STEM) courses is declining among students globally, raising serious concerns (U. S. Department of Education, 2017). The impacts have already been seen, as shown by the drop in students' enrolment and achievement.

In UTP, a similar observation can be made. Network Analysis known as Advanced Circuit Theory is one of the fundamental courses in Electrical and Electronics Engineering. However, the performance of previous students in this course is below expectations. Among those who struggle in the course, it can be observed that students' interests, motivation, understanding and performance are lacking.

Technology Enabled Active Learning (TEAL) is an innovative teaching approach that combines lectures with simulations, hands-on experiments and collaborative learning. First introduced by MIT in 2003 (OECD, 2010), it has been implemented by other top universities, including Yale, Melbourne University, University of New South Wales and many others. Many studies have shown the effectiveness and benefits of TEAL in improving students' achievements and interest across different technology-based courses across different levels of study (Shieh, 2012; Rutten, 2012; Shroff, 2019; Swandi, 2020; Alreiahi, 2020).

ADALM1000 Active Learning Module is one of the most versatile, affordable, small, and portable labs that can provide hands-on experimentation (Connor, 2017). With just the size of a credit card, it provides analysis of real circuits and practical engineering concepts. It is a powerful test and measurement platform that combines capabilities from signal generators and current/voltage source-measure systems. It also comes with visualization and analysis software that students can use to build and test their circuits (Analog Devices, 2021). It is easy to use and fun tool for students to explore and learn electronics fundamentals.

Therefore, the ADALM1000 based TEAL is implemented in this pilot study for the network analysis course. Its effectiveness in increasing students' motivation and performance is then investigated and analyzed.

Methodology

The pilot study is carried out based on the chapter frequency response of electrical circuits, which is one of the Course Outcomes (CO) in the course. Due to the pandemic, which did not allow any face-to-face (F2F) interaction with the students, and most students at their respective homes, the study must be adapted to a fully virtual mode. Initially, the pilot study was planned to be implemented for all students in the course. However, with the limitations of virtual mode, several kits, and costs to courier the kits, the pilot study was carried out with 5 students.

The TEAL hardware used is the ADALM1000 Active Learning Module, a personal portable lab that provides a hands-on experience to students. This is paired with the ADALP2000, the analog parts kit that includes many electronics components that students can use to set up their experiments. The hardware was successfully couriered to each student's residence.

The manual was developed, and the 1st session was an introduction to the TEAL components and getting students to install and get the ADALM1000 Active Learning Module up and running. In the 2nd session, an easy experiment, which is the RC circuit's transient response, was undertaken. It involved the construction of the RC circuit and connection to the ADAM board, followed by experimentation and results visualization on the PC. This was undertaken to get the students to familiarize themselves with all the steps required for the TEAL activity. Finally, in the 3rd and last session, the actual experiment on the low pass and high pass filters is undertaken. Students built the filters from RC and RL circuits and were able to obtain the actual frequency response of the filter circuits through the ADAM board. Figures 1 and 2 show the circuit implementation connection to the ADAM board and result in visualization on the PC, respectively.

The TEAL activity is fully aligned and linked to the chapter materials including lectures, tutorials and assessments. Pre, mid and post surveys were also undertaken and their results were compared. Feedback and students' reflections were also obtained for further insights into their experience. The data collected were a mixture of quantitative and qualitative. There were no assessments involved in order to be fair to all students in the course, as not all were involved in the pilot study.

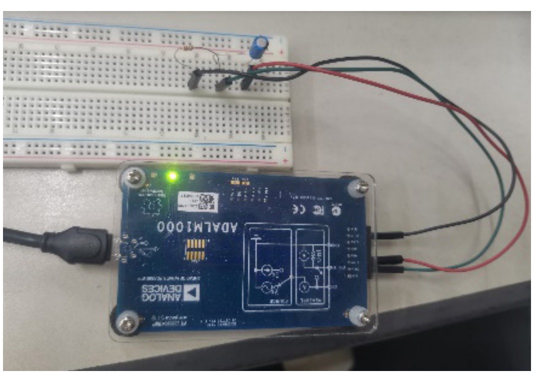

Figure 1 RC circuit implementation and its connections to the ADAM board

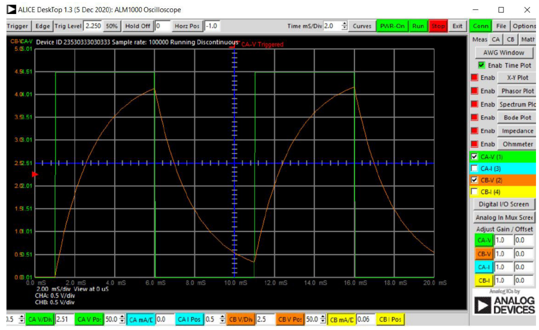

Figure 2 Results visualization on PC

Results and Discussion

Figure 3 shows the pre, mid and post surveys results. The questionnaires have been grouped into 4 domains that are the attention, relevance, confidence and satisfaction. Five points Likert scale is used: (1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree and (5) Strongly agree. The results show that students generally agreed with the benefits of TEAL before, during and after its implementation. They had scored highly across all domains, especially when they were in the middle of the pilot study. The slight dip in the post-surveys may be due to some technical issue that several students encountered due to different versions of the board, which only works with an older version of the software.

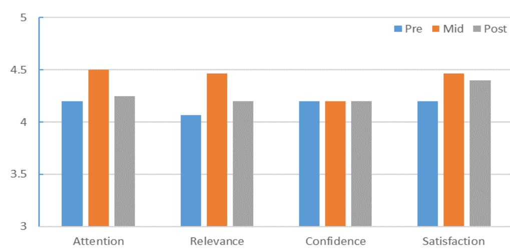

Figure 3 Pre, mid and post-survey results

The following are the students' feedback and reflections.:

"For me, TEAL is a successful program that needs to be continued and used in another subject also because I can see that I learn something and I can gain my experience by conducting an experiment by using the components and software given."

"The hands-on experience helps me to understand better."

"Able to experience more about frequency response and filter chapter."

"Give more students to participate."

"All of what we learned in TEAL were the good things."

"I love the experience that TEAL provides to the student."

The results from this study have shown an increase in motivation and understanding, which is a strong predictor of performance, among the students involved in the TEAL pilot study.

Conclusion

The current lack of motivation and performance in STEM subjects is an ongoing challenge worldwide and in UTP. Due to the pandemic, this pilot study has been designed and carried out among a small group of students. The results from the study have shown consistently high levels of agreement in all 4 domains of attention, relevance, confidence and satisfaction. Furthermore, the reflections from the students have shown increased levels of interest and understanding, which leads to increased performance. The insights and experiences gained through this study will be compiled and shared with the community of practitioners so that other courses can similarly adopt it. For future work, a full study with all the students in the course can be carried out after the physical restrictions are lifted, with comparisons of assessments performance, and study the customizations required for implementation in other related courses.

Acknowledgment

This research is supported by the UTP Scholarship of Teaching and Learning (SoTL) grant 015LF0-041.

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APPLYING THE COMMUNITY OF INQUIRY FRAMEWORK IN AN ONLINE TEAM-BASED PROJECT COURSE

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Introduction

Conducting online teaching and learning has been a challenge. However, institutions have no choice but to transform and conduct online teaching and learning practices due to the COVID-19 pandemic that has hit the whole world since 2019. Due to this outbreak, the best option is to continue classes in online mode with various transformations on teaching delivery styles.

The demand to transform from face-to-face to online teaching and learning is timely as not to compromise on students' health and wellbeing. Numerous courses have begun to innovate by conducting classes, laboratories, and tutorials entirely online or in a hybrid style. . This includes team-based project courses such as entrepreneurship and engineering design. Team-based project courses are introduced in higher education to develop students' competencies such as problem-solving, critical thinking, collaborative group work, time and group management (Koh et al., 2010). These courses lead students towards evaluating problems, generating ideas, following certain methods and creating creative solutions.

It is a challenge to conduct classes online and even more challenging for team-based project courses. The challenges include creating a sense of belonging among team members, solving conflicting issues, and understanding each other's emotions. This often can be solved through visual cues when members meet face-to-face during group discussions and meetings (Garrison et al., 2000). However, conducting team-based projects online has called for a different approach.

The need to have a better online team-based project supervision has called for this study to find answers to the following research question: *"What are the ways to conduct team-based project courses online?"* In answering this research question, this current study aims to provide evidence of how an online team-based project was conducted with a team of students of a selected course in a higher education institution.

This paper is structured as follows. The next section presents the theoretical background underpinning this work. Next, the methodology followed by this study is elaborated. The results are then presented and discussed. The conclusion is presented at the end of the paper.

Theoretical Background

The Community of Inquiry (CoI) (Garrisson & Arbaugh, 2007) framework was adopted as a guide to understanding ways to conduct online team-based project supervision among undergraduate students. The CoI framework has been influential for online teaching and learning practices, particularly in higher education settings (e.g., Kozan & Caskurlu, 2018). Previous research has found that this framework has resonated with the online learning community and provided insights and methodology for studying online learning (Rosser-Majors et al. (2021), Byrne et al. (2021), Pham et al. (2021). Therefore, this study has adopted this framework to study the ways to conduct online team-based projects effectively.

The CoI framework (Garrisson & Arbaugh, 2007) has three elements that are equally important: cognitive presence, social presence, and teaching presence, as shown in Figure 1. Social presence in online learning has been described as learners' ability to participate in online learning and be emotionally involved through online mediums (Garrisson & Arbaugh, 2007). Garrison et al. (2001) operationalized cognitive presence in terms of a practical inquiry model with four-phase process: (1) a triggering event: where some issue or problem is identified for further inquiry; (2) exploration: where students explore the issue, both individually and cooperatively; (3) integration, where learners construct meaning from the ideas developed during exploration. Garrison et al. (2000) also proposed that the integration phase typically requires enhanced teaching presence to probe and diagnose ideas so that learners will move to a higher level of thinking in developing ideas; and finally, (4) resolution, where learners apply the newly gained knowledge to educational contexts or solving real problems.

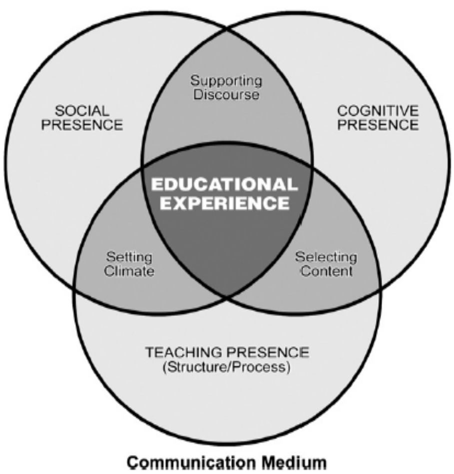

Figure 1 Community of Inquiry Framework

Referring to Figure 1, another element of the CoI framework is teaching presence. Anderson et al. (2001) conceptualized teaching presence as having three components: (1) instructional design and organization; (2) facilitating discourse (i.e., building understanding (Garrisson, 2001); and (3) direct instructions. Previous studies confirm the importance of teaching presence for successful online learning.

This framework has guided this study to craft ways to conduct online team-based project supervision.

Methodology

This study has adopted the action research method (Torrance & Pryor, 2001). The aim is to conduct action research throughout the semester (i.e., 12 action research cycles in 12 academic weeks) and implement the elements of cognitive, social and teaching presences with the team of students. The overall purpose of implementing the action research cycles is to determine if the CoI framework could be used for effective online team-based project supervision. At the end of each research cycle, CoI elements are reflected and improved for the next coming cycle. The action research was conducted in 12 cycles as follows:

Planning: Every week, there are activities planned for the team to conduct which are parts of a big project. The activities would require team members to apply the indicators shown in Table 1. Each activity is explained to the team and followed by an online discussion. Examples are given and the team can contact the instructor and arrange further online discussions when required.

Acting: The team is given six days to prepare, discuss and meet online to work on the activity given for every cycle. This continued for 12 cycles. During every online team-based project execution of each cycle, students are expected to apply the indicators shown in Table 1.

Observing: At the end of each cycle (i.e., for 12 consecutive cycles), the instructor conducts an online meeting. During each session, the team is expected to present their deliverables. This is when the indicators are observed. Team members are requested to switch on their video camera, answer questions, present their work as well as ask any related questions concerning the project. Each online session often started with a quick introduction by the instructor, presentation by team members, feedback from the instructor, discussions participated by everyone and final closure (by the instructor and project leader). Each online session often lasts between 60 minutes to 120 minutes. The online sessions are recorded for team references.

Reflecting: Reflections are performed by team members and the instructor. This is conducted during the online session at the end of every cycle. The reflection often involved the instructor highlighting achievements and room for improvements based on the indicators mentioned in Table 1 concerning the project activities being delivered and relating to project work/solution. The team is supposed to work on the reflections and improve on the deliverables set for the next activity. The expectation is to deliver better project outcomes that indirectly apply the CoI indicators in Table 1.

Table 1 Community of Inquiry (CoI) elements, categories and indicators

Elements	Categories	Indicators
Cognitive Presence	Triggering Events Exploration Integration Resolution	Sense of puzzlement Information exchange Connecting Ideas Apply new ideas
Social Presence	Emotional Expression Open Communication Group Cohesion	Emotions Rick-free expression Encouraging collaboration
Teaching Presence	Instructional Management Building Understanding Direct Instruction	Defining and initiating Discussion topics Sharing personal meaning Focusing discussion

In this study, one team-based project course was involved, and it is known as the Technoprenuership Team Project (TTP).

The emphasis of this course is on the aspect of nurturing technopreneurship among students so they can understand the concept of creativity and innovation to produce IT solutions to real-life scenarios. Students are expected to work in a team of four emulating a consulting group. The completion of this course is the team's proof of competency. A team of four final-year undergraduate students (i.e., three females and one male) and one instructor have been involved. These students are Computing and Technology students majoring in Information Technology and Information Systems. The demographic profiles of the participants involved in this study are presented in Table 2.

Table 2 Participants demographic profiles

Participants	Age	Gender	Roles in Team-based project
Member1	21	Female	Project leader & System Engineer
Member2	21	Female	Financial Analyst
Member3	21	Female	Marketing Director
Member4	20	Male	Business Analyst
Instructor	41	Female	Project Advisor

Throughout the 12 weeks (i.e., 12 action research cycles), the team's involvement, participations, discussions, deliverables and presentations are closely monitored and observed. Most weekly team meetings are recorded and kept for educational and research purposes (one of the recorded videos is shown in Figure 2). All research conducts and data usage are following the research ethics outlined by the institutions.

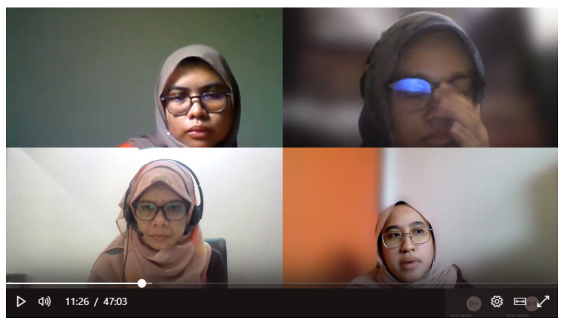

Figure 2 Sample of recorded team-based project online meeting and discussion

Results and Discussions

The 12 weeks of conducting the online team-based project have been embedded with the elements of CoI as follows:

Cognitive Presence

Sense of Puzzlement

Team members delivered work tasks according to their roles. Questions will be asked to clarify understanding. Members often asked questions during the online meeting if there was any confusion, misinterpretation, or vague topics.

The instructor answered questions and clarified any misinterpretations and confusion. Instructor also asked questions to members to ensure all of them understood the topics being discussed.

Sense of puzzlement is often detected when the members present conflicting answers in any part of the activities/deliverables. The instructor will then provoke any team members for better clarifications on the topic being discussed. The instructor will give feedback and clarify any misunderstanding during the closure with clear examples, as shown in Figure 3.

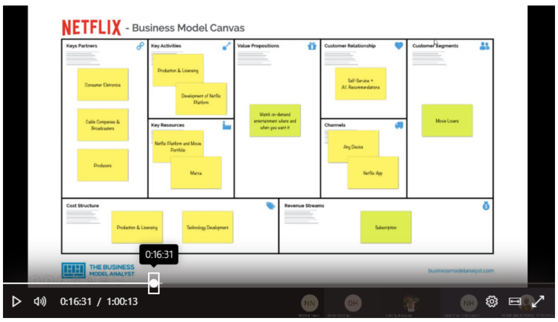

Figure 3 Online and real case examples are given for better clarifications of puzzlement

Information exchange

Both instructor and team members shared information during the online meeting. It is a 2-way communication that allows instructor and members to exchange information related to the project.

Team members often shared their research, deliverables and connected them to the knowledge they learned in class. The instructor shared knowledge based on previous experiences and readings. The 2-way sharing is largely related to the project and solution being worked on, as shown in Figure 4.

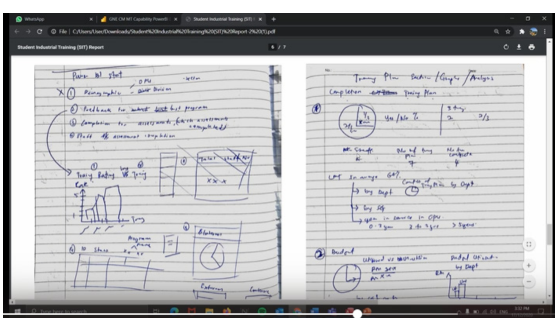

Figure 4 2-way information and knowledge sharing and brainstorming of ideas

Connecting Ideas

Instructor played a big role in helping team members to connect parts of the weekly activities into a complete project. Connecting the ideas into a system flow is an example of it, as shown in Figure 5. This often occur at the end of each milestone.

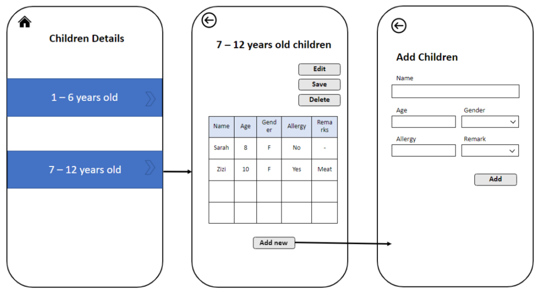

Figure 5 Connecting system functionalities into a complete system flow

Team members will present each weekly activity according to the topic given. Team members then include each deliverable into a complete project in a presentation, report and project demonstration.

Apply new ideas

Team members are pushed to apply knowledge and competencies learned in class to propose a solution to the identified problem. This includes skills to compare between available solutions and propose a hybrid or better end-product.

The instructor played a devil's advocate role to push members to think critically and suggest good ideas with unique values than those currently available.

Social Presence

Emotional Expression

Team members communicate among themselves during the weekly online meetings with the presence of the instructor. They also held other meetings besides the weekly meetings without the presence of the instructor. During these meetings, they showed some emotional expressions verbally and through emotions seen on camera. As shown in Figure 6, team members seem to be comfortable and at ease during the first cycle.

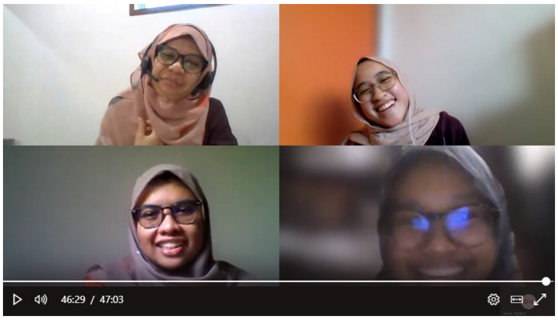

Figure 6 A sense of comfort with team members

Team members often showed frustrations, sadness, and feeling of tired both verbally and in written text and emotions detected on camera. They also showed their gratitude and happiness through this medium, as detected in Figure 6.

The instructor often gives support and motivation during the session or by sending written texts. Since the instructor is experienced in handling many other team-based projects, the online support and motivation were effective.

Open Communication

The team members and instructor practiced open communication throughout the 12 cycles with ethical boundaries. The first few weeks were awkward, but members communicated well.

The instructor often provoked team members with questions and small activities that made them communicated and reached out to other team members. The instructor also assigned each member to present their work to trigger open communication.

Group Cohesion

After a few weeks, it was observed that team bonding became stronger. The three female members have a strong bond, although the group did not meet face-to-face throughout the 12 weeks. From the observation, the male team member was seen not as close but preferred to work individually.

The instructor's role is rather indirect when it comes to this element. The instructor conducted and organized the meeting, gave instructions and allowed the group to work as a team naturally. The instructor also often ensured that everyone took part and had an important role in each activity. The delegation of work required everyone to work together as a team. Most of the deliverables demanded every role to be involved.

Teaching Presence

Instructional Management

The instructor gave instructions on what has to be delivered based on the course outcomes and activities that have to be submitted. There are summative and formative assessments that the team must submit and present at the end of each cycle. The formative assessments include comparative analyses, product testing, user requirement analyses and a few more deliverables. The summative assessment includes submitting progress reports, business idea, business plan, peer review, self-reflection, final presentation and product demo. The instructor took the responsibility to ensure that all submissions met the course learning outcomes.

Building Understanding

The instructor took the initiative to explain all summative and formative assessments before team members started each activity. The instructor also took the responsibility to review and give feedback and comments on all the summative and formative assessments submitted. The intention is to build a clear understanding of each topic being discussed such as financial strategies, market segmentation and revenue model. The goal is to ensure each team member understands the fundamental theory of knowledge.

Direct Instruction

The instructor provided clear guided instructions following the course outline. This includes milestones, datelines and assigning a focal person to take charge. This was to ensure equal opportunity is given to all team members. Delegation of work is divided based on roles, skills and strength of team members. Team members were allowed to give suggestions and justify a better solution at any point.

As mentioned, there were summative or formative assessments given throughout the course. The rubric was used to evaluate the summative assessments. The rubrics were indirectly assessing the CoI elements. Figure 7 presents one of the rubrics with a fair share of CoI elements needed to be performed by the team to achieve the intended outcomes. Although CoI indicators (refer to Table 1) are not explicitly stated in the rubric, they are required to be performed by the team to achieve the intended learning outcomes. For example, the team had to apply cognitive and social presence to integrate and present a business model canvas for the project. The instructor had to give examples, explain and finally provide feedback on the final business model canvas proposed by the team (i.e., teaching presence).

EXECUTIVE SUMMARY
B rief overview of the most important aspects of the business plan

PRODUCT AND SERVICE DESCRIPTION
Describe problems, solutions, uniqueness in non-technical language

TECHNOLOGY DESCRIPTION
Technical explanation of solutions (Eg: model, architecture, algorithm, technology)

MARKET AND COMPETITION
Identify market size, competitor and competitor comparison

BUSINESS MODEL
Business Model Canvas

MARKETING PLAN
Realistic and creative marketing plan

FINANCIAL PLAN & PRICING STRATEGY
Capital budgeting, financial forecast, pricing, break-even analysis

CONCLUSION AND RECOMMENDATION
- Summarize the opportunity, Expectation

APPENDICES
- team resumes, legal form supporting documents, legal agreements
- Other necessary information

STRUCTURE
- Formating - Font size, spaced, margins etc
- No typographical errors, Spelling, grammar, sentence structure

Figure 7 Sample of summative assessment elements that indirectly requires Community of Inquiry elements to be applied

Nevertheless, it is important to note that certain CoI indicators were found difficult to attain when a team-based project was conducted online. One of the obvious components that requires improvement is creativity.

Creativity
In this study, it is found that team project deliverables which were conducted fully online are lacking in terms of creativity. The instructor's written comment for one of the activities is as follows:

> "Overall, the business plan is complete and has been discussed a few rounds with me [supervisor]. However, the product itself could be more appealing, interesting, and innovative for future use. Future opportunities towards better innovation are vague."

The comment demonstrated that through the online team-based project, the team did not achieve the expected level of creativity. This is indeed in line with the work of Garisson et al. (2000) and Newman et al. (1997), which highlights one of the weaknesses of online team-based projects: face-to-face team projects seemed to facilitate more creative outcomes. It was found that face-to-face activities were slightly better at generating new ideas, supporting the work of this study.

Deep learning
Additionally, in line with Garisson et al. (2000) and Newman et al. (1997), this study has found that students adopted more serious learning in online team-based project courses. It was observed that the team took every activity seriously and presented each deliverable with great effort. In one of the activities, the instructor has commented as follows:

> "The work deliverables are on track and as planned. The team has completed the business idea and business plan. The financial strategies look good with few well thought sources of income and financial bursaries."

As demonstrated by the instructor's comments, this study found that team members were often found competent at browsing materials available online and linked them to the project idea and solutions. In line with previous studies, the seriousness and ability to integrate outside materials to knowledge being discussed encourages deep learning (Garrisson, 2000). This is indeed interesting to discover that embedding elements of CoI in an online team-based project course promotes deep and meaningful learning.

Based on the given elaboration, it provides evidence that course outcomes and learning objectives could be achieved with CoI elements carefully crafted into the execution of online team-based projects. More importantly, it produces deep learners and encourages meaningful learning.

Nevertheless, the CoI elements should be carefully planned and well thought by educators. The element of teaching presence and its indicators should be understood and creatively embedded in the course planner, rubric assessments, and teaching delivery.

Conclusion

Team-based projects can be effectively implemented online with CoI elements and indicators being planned and embedded in delivering these courses. The teaching, cognitive and social presence should be embedded harmoniously throughout the online team-based project execution. The action research approach allows instructors to plan, act, observe and reflect upon the execution of CoI elements to the online team-based project. The action research also calls for improvement after each cycle that allows the execution, communication, delivery and teamwork to improve from time to time.

One of the main advantages of conducting online team-based projects is the encouragement of deep and meaningful learning. It is also learned that creativity competency has to be refined when conducting online team-based project courses. Lack of creativity may be improved through active teaching presence and social presence. This has called for future studies to explore ways to improve creativity when conducting team-based project courses online.

It is important to note that this study was conducted with a limited number of participants. Although the intention is to achieve an in-depth understanding of a small team which can be thoroughly observed, having more teams and various courses involved will give more interesting findings. Therefore, this has called for future research to share evidence when implementing CoI in various online team-based project courses and with a bigger number of teams.

Acknowledgments

I would like to thank the students involved in this study who have been very instrumental despite the pandemic and emergency remote teaching and learning struggles that all of us have to go through. Thank you to the Center for Excellence in Teaching and Learning (CETaL) for the support, online trainings and online facilities provided.

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ENGINEERING STUDENTS' INTERNSHIP CHALLENGES IN TIMES OF PANDEMIC

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Introduction

The aim of an internship is to expose the students to practical knowledge and real-life working experience. This industrial exposure is vital to equip them with both technical skills as well as the soft skills needed for comprehensive engineering education. This paper examines the challenges and impact of the COVID-19 pandemic on UNITEN students undertaking Diploma in Mechanical Engineering (DME) who have completed their internship practices within 16 weeks. This internship program, abbreviated with the code EGND324, is a compulsory subject for DME students, requiring them to complete the training practices before they can graduate. Over the years, the internship training programs contribute to a large part of the student's physical and spiritual development process. Hence, the emergence of the COVID-19 pandemic has somehow affected their practical training procedures in engineering perspectives and has somehow ushered in a new kind of internship training program.

This paper outlines two main objectives:to identify the demographics, the internship categories as well as the necessary resources for an internship during the COVID-19 pandemic and to examine the challenges faced by the students, including the impact of the COVID-19 pandemic on their internship training performance.

Literature Review

According to Jesus and Urbano (2010), "Industrial training activities can be defined as periods of engineering education outside the university's geographical space that are oriented towards providing the students with knowledge and competencies not easily obtained in their classrooms". The main objective of an internship as outlined by the university's board is to expose the students to various aspects of industrial training practices and ethics, to apply the training knowledge for final year project, to allow students to integrate theory with practices, to introduce students to industry and its work culture, to provide an opportunity for students to work with industrial practitioners, to expose students to potential employers and to acquaint students with industry and its program [2]. This program is designed to expose students to various experiences in their related technical fields, such as providing them with on-site training, diverse collaborative work environments as well as quality systems that instill world-class safety standards and professional ethics. Industrial exposure provides students with the technical and transversal skills necessary for holistic development required by state-of-the-art engineering education [3].

In recent years, the emergence of coronavirus disease (COVID-19) has led to major economic and social disruption in the new decade of the 21st century.

People from all walks of life are aware of the severity of this COVID-19 pandemic and probably feeling exhausted from the anxiety of it all. This major outbreak brought significant disruptions to education worldwide. The UN's Educational, Scientific, and Cultural Organization anticipated that 107 states around the world had executed state school and university closures linked to the COVID-19 outbreak on March 18, 2020, influencing 862 million students worldwide [4]. According to UNESCO, numerous countries have postponed educational activities at educational institutes internationally, as of April 8, 2020, in around 188 countries [5]. To prevent widespread transmission of the COVID-19 virus among students and staff, higher-education institutions across the country have rapidly switched from physical class to online learning [6].

In a short period of time, university students' lives have dramatically changed as they have been asked to leave campus, adjust to new living circumstances, and adapt to online learning platforms. The switch to online learning, particularly in courses that were not originally designed for online delivery has brought challenges and impacts among students particularly on the courses designed to include high levels of interaction and hands-on experiences such as the internship programs. Majority of them undergo their internship during this pandemic era were exposed to the new norm of Work-From-Home (WFH) environment.

Research Methodology

Industrial training is a compulsory course for all diploma engineering students set by the Board of Engineering Malaysia (BEM) through the Engineering Technology Accreditation (ETAC). The ETAC was instrumental in ensuring Malaysia's ETAC accredited engineering technology bachelors' degree, engineering diploma and engineering technology diploma programs are substantially equivalent to the engineering degrees of the signatories of the Sydney Accord and Dublin Accord.

In May 2021, the duration of the industrial training for diploma in engineering programs in UNITEN was increased from 12 weeks to 16 weeks. This change is in line with the ETAC Engineering Technician Education Program Accreditation Standard 2019. Students are only eligible for the internship placement if they have completed a minimum of 50 Credit Hours (CH), completing 2 years (4 semesters) of studies and before completing their diploma studies.

Process of Industrial Training

Before Industrial Training

Before applying for the internship, students have been contacted by the Internship Coordinator to attend workshops and briefings regarding internship training. The Industrial training briefing was held three times.

The first briefing was intended to verify the eligibility and registration status of the students, introduced the industrial training committee to the students, as well as the process of internship application. After attending the briefing, students were expected to prepare their Curriculum Vitae (CV) and cover letter and apply for placement to any relevant industry or government sectors using a verification letter from UNITEN. Students may identify vacancies for internship by referring to the Industrial Training System (ITS), UNITEN intranet system, websites, advertisements, through notification from the UNITEN Career Unit or other means.

Students have been called for a second briefing to remind the students regarding the Industrial Training course registration and Industrial Training System (ITS) within a specified time. Students also have been briefed about the mechanism to monitor student performance during industrial training. The evaluation includes a logbook, final report, presentation during visiting lecturer visitation and host supervisor's evaluation.

The last briefing, OSH Talk, was held two weeks before industrial training started. The purposes of this talk were to make sure students get familiarized with accepted safety practices in the industry and aware of the ethics in the industry.

During Industrial Training

Students must report for duty to the training organization on the scheduled date and time. They must also adhere to the organization's dress code and dress appropriately for the working environment. Upon reporting, students were expected to complete the Report Duty Form validated by the organization's authorized representative or known as host supervisor. The completed form must be submitted to ITS within one week after report to the organization.

During the Industrial Training period, students are required to maintain a logbook. All training activities should be recorded on a daily basis. The logbook must be certified by the host supervisor either on a daily or weekly basis. A representative of the UNITEN, namely a visiting lecturer, was assigned by the coordinator to visit the student at his or her industrial training organization to monitor and assess the student's performance. Generally, the IT visit takes place starting from week 10th to week 12th of the industrial training period. The students were expected to present their industrial training outcomes during the visit and the presentation was assessed by the visiting lecturer and the host supervisor.

After Industrial Training

At the end of the industrial training, each student was required to submit a full report, which contains detailed job descriptions carried out by them. The students also need to submit a logbook, presentation Assessment for the industrial training is based on a logbook, industrial training report, industrial supervisors and evaluating lecturer evaluations. Figure 1.0 shows the flow of the industrial training process for diploma in Mechanical Engineering program at UNITEN.

Figure 1 Flowchart of IT Process

In Sept 2021, questionnaires were distributed to the students a week before they ended their industrial training. The research employs a Program Implementation Case Study with a mixed-method approach in which students' perception of industrial training implementation was treated as variables that can be measured through the usage of questionnaires. The distribution of questionnaires was done without compromising respondents' private information and locality. The target audience was strictly defined as engineering diploma students taking industrial training. To ensure conformance and impartiality, respondents had been made aware that the integrity of all the information is uncompromised and in no way would be relatable to them as individuals.

A set of questionnaires was created by an online platform and was segregated to the respondents through the blasting of e-mail. Detailed instructions were also incorporated in the notification e-mail. Responses then shall be recorded and kept confidential. The study employed quantitative and qualitative approaches through the dissemination of online questionnaires. Data are gathered from Diploma in Mechanical Engineering (DME) students at the end of their industrial training. The questionnaire consists of four Demographic parts, Resources, Challenges, and Health and Safety Concerns on industrial training during COVID-19. The questionnaire has two different formats (a yes/no format and a five-point Likert-scale format) provided as response options. A five-point Likert scale ranging from Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4) and Strongly Agree (5) was provided as response options.

Results and Discussion

Section A: Demographics

Data was gathered from a sample of 47 students from the Diploma in Mechanical Engineering program. 42 (89.4%) of them are male students, and 5 (10.6%) are female students as shown in Table 1

Most of the respondents are 20 years old (83.0%), followed by 19 (4.3%), 21 (8.5%) and 23 (4.3%) years old. Most of the students were on their final semester at 51.1% and another 48.6% will need to return to campus to finish off the study, having a few more subjects to graduate.

The Movement Control Order (MCO), in response to Covid-19 announced by the government, has led to the closure of public and private companies except for several essential services. Consequently, some students were instructed to work from home. In this survey, students were asked about their working mode during MCO, 18 (38.3%) of the students are Working From the Office (WFO), 15 (31.9%) of them experienced fully Work-From-Home (WFH) and 14 (29.8%) students experienced a combination of WFH and WFO or hybrid mode.

Table 1 Student's Demographics

Gender	N	%
Male	42	89.4%
Female	5	10.6%
Total	47	100%
Age	*N*	*%*
19	2	4.3%
20	39	83.0%
21	4	8.5%
22	0	0%
23	2	4.3%
Total	47	100%
Instruction level	*N*	*%*
Diploma, 3rd Year	23	48.9%
Diploma, Final Semester	24	51.1%
Total	47	100%

3.2 Industrial Training (IT)

All students who are undergoing IT and affected due to any forms of Movement Control Order (MCO), can continue the IT exposure after the completion of the final semester.

2

The IHLs may consider alternatives to IT which could give substantial equivalent outcomes such as:

- in-house repair and maintenance, properly supervised by the qualified person, and
- virtual industrial attachment supervised by industry players and/or complemented by guest lectures, sharing of practical experiences and/or demonstration by industry experts.

Figure 2 Guiding Principles on Teaching-Learning and Assessment Implementation During Covid-19 Pandemic

For students WFH, 8 out of 15 students were not given any task or received a very little task from their company, 3 webinars and 1 Industrial Advisory Panel (IAP) talk were organized to make sure that the Programme Outcomes (POs) mapped to the Industrial Training are not jeopardized. The The department took these actions by referring to the ETAC Guideline No. 005 published on the 5th of June 2021, item 3.2, as shown in Figure 2.

Section B: Resources

Table 2 represents the findings on essential equipment and remote tools to perform daily tasks during the industrial training period. More than half of the students (68.1%) stated that they are fully equipped with the essential equipment. Students also were asked about the resources that they already have and received from the company during the IT, 57.4% of the students stated that they do not receive any hardware assistance for IT from the company. However, 63.8% confirmed that they do not have to purchase additional electronic devices to perform daily tasks and have a stable internet connection to communicate with their supervisor (66.0%).

Table 2 Essential equipment and remote tools to perform daily tasks

		Percent	Valid Percent	Cumulative Percent
Valid	Yes	68.1	97.0	97.0
	No	2.1	3.0	100.0
	Neutral	29.8		
	Total	100.0	100.0	

Section C: Experience Gained

In Section C, the students were asked to rate their satisfaction with the IT on a 5-point Likert scale as in Table 3. Most students gave mainly positive feedback or rated the statements at the highest scale (Strongly Agree). Based on Figure 3, 61.7% of the students stated that they managed to improve and enhance their skills during IT despite the pandemic situation. Item 8, majority of the students (51.1%) agreed that their supervisor helped them a lot to learn new skills during the internship. 59.6% of the students were strongly satisfied with the way IT was being conducted in terms of skills and knowledge development.

Table 3 Questionnaire Items on Experience Gained During Internship

Number	Questionnaire Items
1	The industrial training tasks given by my supervisor are relevant to the course I am taking.
2	I received enough guidance from my supervisor to complete the tasks given.
3	I received a reasonable volume of work tasks to be accomplished within a given timeframe.
4	I was able to complete the tasks given by my supervisor.
5	I am motivated to learn new skills during my internship.

cont... **Table 3**

Number	Questionnaire Items
6	I managed to improve and enhance my skills during my internship.
7	I regularly receive feedback or discussions about my performance with supervisors during the internship.
8	My supervisor helps me to learn new skills during the internship.
9	The implemented industrial training course has achieved its objectives.
10	I am satisfied with the industrial training conducted in terms of skills and knowledge development.

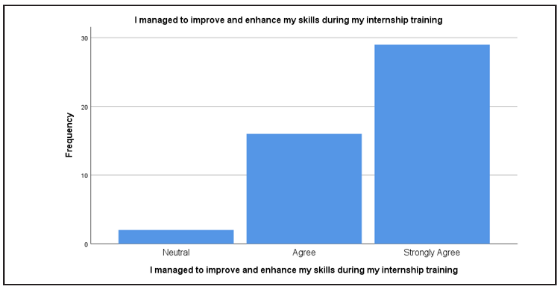

Figure 3 Improvement and Skills Enhancement during IT

Table 3 Questionnaire Items on Wellbeing During Internship

Number	Questionnaire Items	Yes	No
1	Do you communicate regularly with your team and supervisor?	46 (97.9%)	1 (2.1%)
2	Do you work in a conducive and ergonomic working environment?	44 (93.6%)	3 (6.4%)
3	Do you have a balanced and healthy work-life during your internship?	44 (93.6%)	3 (6.4%)
4	Are you in control of managing your time when working during the internship?	43 (91.5%)	4 (8.5%)
5	Do you feel stress or burnout during your internship?	8 (17.0%)	39 (83.0%)

Students were asked questions (listed in Table 4) with options Yes or No as the answer. Based on the responses, students were able to maintain their well-being during the IT and did not feel stressed or burnt out during their IT.

Students were also asked open-ended questions. They were allowed to write and share the challenges that they were facing during IT. Below are some of the experiences or difficulties shared by the students.

"In my early phase of the internship, I've been facing the problem when my technician asks me to take the spare part where I did not familiar with the place yet but at last, i have encountered this problem."

"Getting used to the hardworking environment and heavy task as a technician at a workshop."

"Since I am Working-From-Home from the staring of my internship until now, I have faced noise pollution only most of the time like motorcycle ramming. Next, I have not gained knowledge on handling practical hands-on work and working environment though I did learn a lot of other skills."

"Working during MCO, we need always to follow SOP"

Section D: Health and Safety Concerns

Students were questioned about their health and safety concerns in Section D, including COVID-19 and non-COVID-19 issues. For the non-Covid 19 issues, 10 (21.3%) students had to seek medical help. 28 (59.6%) students had to take the COVID-19 swab test during their IT. This is because certain companies have made it compulsory for the students to do a swab test before reporting for duty as a preventive measure of Covid-19. 10 (21.3%) students were identified as close contacts during the IT and 6 (12.8%) students were tested positive for COVID-19 during IT and one of them has been sent to Malaysia Agro-Exposition Park Serdang (MAEPS) Covid-19 treatment center. She was released after 10 days of quarantine in MAEPS. All the affected students, their names have been sent to the UNITEN Covid-19 task force and monitored by the team on a daily basis. Most of the students (68.1%) received two doses or complete doses of COVID-19 vaccines, 14 (29.8%) students have partial vaccination or 1 dose of the vaccine, and only 1 (2.1%) student has not received their vaccinations appointments during the IT period.

Section E: Feedbacks and Suggestions

In this section, students were asked to give suggestions on the implementation of IT to improve its effectiveness. Most of the students felt that the IT duration should be extended more than the allocated 16 weeks and their job scope was limited due to Covid-19.

"It was an amazing experience to feel and view the jobs of an engineer in a construction site. However, the site had to hold progress due to the lockdown, so my supervisor gave me more of a theoretical andhands-on explanation of everything. The site removalist on 23rd of August."

"I think industrial training should be longer rather than 16 weeks because there Is still a lot to learn and like this short duration only helps a bit with the experience."

"I had technical training and workpaper job that i do during my internship and it helps me to gain my interest more in Mechanical Engineering. "

"The internship has really taught me how to deal with real-world problems and how to overcome and get a solution."

"Need more technical skills learning. Due to Covid-19, we cannot work face to face and work with machines and equipment."

"Feel lucky to work at the good and positive environment in the office, but feeling sad because of covid-19, the work is limited."

"I am suggesting, the company can give a sufficient and a right work based on students' course to make sure they learn and gain more experience during their internship. So that, they can easily write a nice report about their industrial training. Also, need some improvement on supervisor communication skills and give them an appropriate work so that they can implement their engineering knowledge."

"I have no experience and knowledge on the hands-on practical site and industrial exposure since my company is strictly following the Work from Home method from the beginning of the internship until now. Nevertheless, I have gained as much knowledge as I can by joining the meetings that were held every week and doing the assessments given by my mentor to me on time and presenting them. My mentor and my team have shared the knowledge as much as possible with me to understand what I was learning. I hope to have the face-to-face practical industrial work in the future."

Conclusion

The purpose of this study is to analyze the challenges and impact faced by UNITEN students undertaking Diploma in Mechanical Engineering during their 16 weeks internship period. This internship training is compulsory for those who have completed a minimum of 50 Credit Hours (CH), completing 2 years (4 semesters) of studies and before completing their diploma studies. In recent years, the emergence of the COVID-19 pandemic has affected how this internship training has been conducted. Most of the students were exposed to the new norm of a Work-From-Home (WFH) environment. This paper outlines several challenges faced by the students, including their concerns about their health and safety during the internship, especially since now the internship training is conducted based on SOPs (Standard Operating Procedures). From the analysis done on the data obtained, it is proven they are aware and satisfied with the internship training program that they went through despite the obstacle, and they are also able to gain valuable experience from working in the industry. This research should be implemented in the future to keep track of the internship training program conducted by the university from time to time.

Acknowledgment

We are thankful to the Department of Engineering Foundation and Diploma Studies, College of Engineering, and Universiti Tenaga Nasional for their support in assisting us in completing this paper.

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RELATIONSHIP BETWEEN SERVICE QUALITY TOWARDS STUDENT'S SATISFACTION: CASE STUDY ON UNIVERSITI KUALA LUMPUR

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Introduction

Service quality has always been essential to organisations (Shamsudin et al., 2019). According to previous literature in the service marketing sector, service quality is the primary construct of customer purchase intentions (Gronroos, 1984; Parasuraman et al., 1988; Kotler, 2006). University needs to make frequent communications with their target market and conduct customer engagement sessions to allow students to feel comfortable and satisfied. Many exploratory studies have shown the influence of service quality on student satisfaction that may lead to or influence their satisfaction (Shamsudin et al., 2019). The challenge in the support team in universities is to provide their excellent services, which was found to be equally important to satisfy overall student expectations.

Literature Review

Student Satisfaction

Today the competition between higher learning institutes is getting tough. In Malaysia, there are 20 public and 494 private universities. High numbers of higher institutes lead to more choices among the potential students. A large number of industry players, especially in the private segments, also leads to a creative campaign and promotion to attract new students. In general, there are about half a million students completed their secondary schools every year. Those students are among the potential target markets for all the higher institutes. Besides having more bargaining power, students also have an additional option in TVET institutions. Such situations lead to fiercer competition among the industry players.

Past research claimed that attracting new customers is much more expensive than keeping the current one (Belver-Delgado et al., 2020). As such, servicing and enhance the service level towards the existing customers will lead to a higher chance of retention (Smith, 2020) mediated by attitude-to-brand considering the fierce competition and the fast industry growth. Design/methodology/approach: The study used a cross-sectional design and a survey of mobile service customers. For the empirical analysis, the structural equation models were applied (partial least squares. Social media has been an alternative platform for students to express their feeling to the rest. Among the common sharing of students' negative experiences is about the support staff. For instance, support staff are not accommodating students in solving problems but leave students in unsolved situations. Apart from that, support staff was claimed to be not cooperating in assisting the students. Another report also claimed that support staff did not show their empathy while dealing with students' problems to seek help, clarifications, or confirmations (Weerasinghe & Fernando, 2018). A combination of all the complaints from students leads to negative word of mouth and dissatisfaction among the students (Galletta et al., 2017).

It is vital for private institutes especially to look at the situations since students are important to survive over the long run. Hence, all the universities must keep their customer by offering high service quality.

Service quality

Service quality is a centred assessment representing how an individual viewed various aspects of a service, such as efficiency, responsiveness, assurance, empathy, and tangible benefits (Fraser et al., 2018). Studies addressed variations in terms of items assessed. The value of the SERVQUAL dimension can vary depending on the industry. The current research uses the extended version of the SERVQUAL model to test consumer expectations about the quality of service. According to Parasuraman et al., the SERVQUAL model may be used in all forms of organisations (Pena et al., 2013). The survey instrument was adapted from several studies on service quality (De Guimarães et al., 2019; Mohamad et al., 2018; Southwell et al., 2018). In the context of this analysis, three main factors related to support staff, namely the response, empathy and support, were used to assess the quality of service (Ganesh & Haslinda, 2019). Past research concluded that poor support from the admin leads to student dissatisfaction and reduce the retention level (Ntoyakhe & Ngibe, 2020). At the same time, the role of support staff was recorded as important towards keeping customers loyalty many past studies related to the service industry. Many studies recorded that administrations and support staff were among the reasons students feel dissatisfied and share their negative experiences with others (Dicker et al., 2017; Gamlath, 2021; Hazzaa et al., 2018)Measuring service quality in students' is the most appropriate way to assess student preferences and choices. Additionally, MacInnis & Hoyer (2010) noted that calculating expectation is insufficient to determine student selections. Although Sultan (2011) states that an impressionistic measure of service quality can provide a better outcome, the product always offers options even though there is no prior expectation even if the output meets standards. This meant that the customer choices level depended on the perception of the service by customers.

Methodology

The researcher distributed the questionnaires using an online survey, with support from student affairs executives at selected campuses. The target respondents are current students in their bachelor's degree between the ages of 20 to 24. The respondent was informed that the participant was voluntary. Full data collection was carried out within 14 days, and the online method primarily supported the exercises. End of the two weeks, 351 data were received. Out of that, 23 data were deleted upon Mahalanobis distance exercises for outlier assessment.

Descriptive studies

The following table shows the mean and standard deviations of each item. The mean for items ranges from 3.376 to 4.382, while the standard deviation is 0.641 to 0. 954.Kurtosis and skewness within the acceptable range value. According to Brown (2006), permissible values of skewness should fall between -3 and +3, and kurtosis is appropriate from a range of -10 to +10 when utilising SEM.

Table 1 Descriptive and normality

	Mean	Median	Min	Max	Standard Deviation	Kurtosis	Skewness
SS1	3.376	3	1	5	0.641	0.749	0.135
SS2	3.594	4	1	5	0.699	0.427	-0.080
SS3	3.594	4	1	5	0.732	0.178	0.078
SS4	3.594	4	1	5	0.778	0.520	-0.280
SS5	3.847	4	1	5	0.854	0.855	-0.671
RAS1	3.176	3	1	5	0.814	0.349	-0.468
RAS2	3.612	4	1	5	0.729	0.153	0.110
RAS3	3.600	4	1	5	0.747	1.288	-0.390
RAS4	3.194	3	1	5	0.954	-0.233	-0.276
RAS5	3.194	3	1	5	0.909	0.240	-0.538
ASS1	3.671	4	1	5	0.750	0.271	-0.218
ASS2	3.629	4	1	5	0.773	1.126	-0.479
ASS3	3.665	4	1	5	0.743	1.588	-0.581
ASS4	3.765	4	1	5	0.883	0.725	-0.605
ASS5	3.729	4	1	5	0.817	0.394	-0.375
ACFB1	3.671	4	1	5	0.853	0.808	-0.516
ACFB2	3.465	3	1	5	0.729	0.277	0.124

cont... **Table 1**

	Mean	Median	Min	Max	Standard Deviation	Kurtosis	Skewness
ACFB3	3.571	4	1	5	0.773	0.925	-0.239
ACFB4	3.606	4	1	5	0.784	0.953	-0.430
ACFB5	3.594	4	1	5	0.778	1.028	-0.506
EMP1	3.612	4	1	5	0.820	0.562	-0.267
EMP2	3.624	4	1	5	0.774	1.043	-0.382
EMP3	3.671	4	1	5	0.810	0.836	-0.465
ADMIS1	3.676	4	1	5	0.816	0.837	-0.517
ADMIS2	4.294	4	2	5	0.700	2.008	-1.104
ADMIS3	4.329	4	2	5	0.621	2.591	-0.963
ADMIS4	4.376	4	2	5	0.641	2.373	-1.081
ADMIS5	4.382	4	1	5	0.651	6.674	-1.616

Measurement model

Figure 1 indicates the measurement model consists of 3 independent variables, namely admin support (5 items), staff empathy (3 items) and staff support (5 items) towards the student satisfaction (5 items). There is no deletion of any items as all loading values were found to be > 0.70.

Outer model (path coefficients and p-value), inner model (loadings), constructs (Cronbach Alpha).

Reliability and validity

Table 2 below indicates the internal consistency and convergent validity. Value for loadings, Cronbach Alpha and CR was found to be more than 0.7 while AVE was more than 0.5.

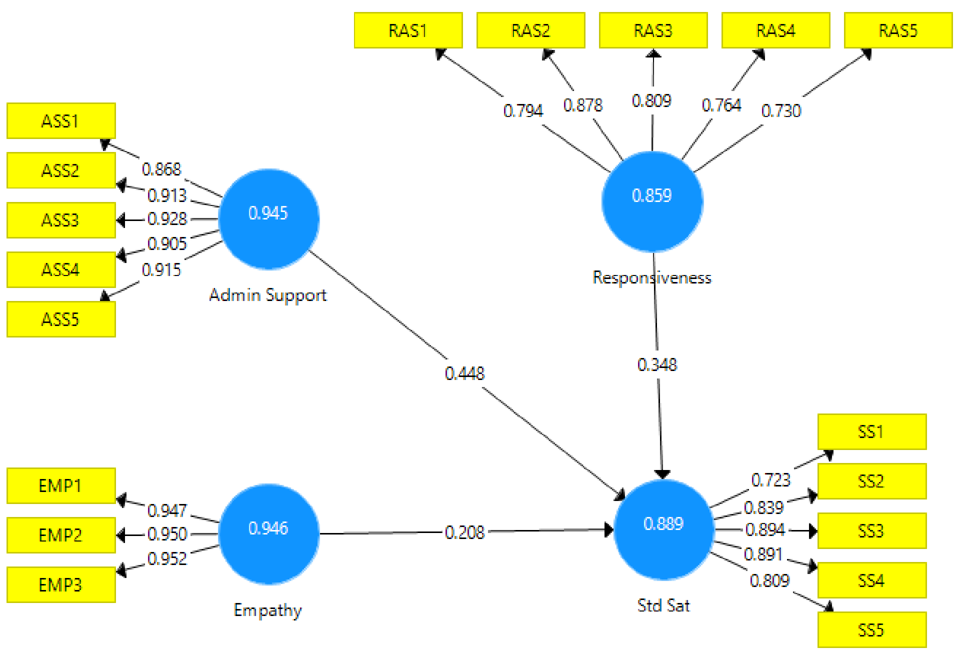

Figure 1 Measurement model

Table 2 Internal consistency and convergent validity of the theoretical model

Constructs	Items	Loadings	α value	CR	AVE
Admin Support	ASS1	0.868	0.945	0.958	0.821
	ASS2	0.913			
	ASS3	0.928			
	ASS4	0.905			
	ASS5	0.915			
Staff Empathy	EMP1	0.947	0.946	0.965	0.902
	EMP2	0.950			
	EMP3	0.952			
Staff response	RAS1	0.794	0.859	0.896	0.634
	RAS2	0.878			
	RAS3	0.809			
	RAS4	0.764			
	RAS5	0.730			
Student Satisfaction	SS1	0.723	0.889	0.919	0.695
	SS2	0.839			
	SS3	0.894			
	SS4	0.891			
	SS5	0.809			

Table 2 above revealed that the value of factor loadings of the model ranging from 0.723 to 0.952 (> 0.70). The result also indicates that the AVE is greater than 0.5 with the score ranging between (0.634 to 0.902) while composite reliability ranging from 0.896 to 0.965 (>0.70) and finally, the Cronbach score were also greater than 0.7 ranging between 0.859 to 0.946. Hence we can conclude that the study met the convergent validity and composite reliability and validity (Hair, Hult, Ringle, & Sarstedt, 2017; Nunnally, 1978; Uma Sekaran & Bougie, 2016)

Table 3 R Square

	R Square	R Square Adjusted
Student Satisfaction	0.828	0.825

The result for R square revealed that the independent variables influenced 82.8% of the student satisfaction. Such a high percentage indicates that the independent variables are important for meeting customer expectations and satisfaction.

Table 4 Result for Fornell-Larcker

	Admin Support	Empathy	Responsiveness	Student Satisfaction
Admin Support	0.906			
Empathy	0.753	0.950		
Responsiveness	0.781	0.545	0.796	
Student Satisfaction	0.877	0.735	0.811	0.834

Table 4 shows the correlation coefficients of constructs, and the square root AVEs positioned along the diagonal line for interpretation (Fornell & Larcker, 1981). The correlation is validated by comparing the square root AVE. It should be relatively higher in determining the discriminant validity. For Fornell-Larker's criterion, this study confirmed the discriminant validity of the constructs and items.

Table 5 Model fit

	Saturated Model	Estimated Model
SRMR	0.080	0.080

In this study, the SRMR revealed that the goodness of fit model value is 0.08 for the complete main effects or theory testing, which meets the cut-off value of less than 0.08 for the model to achieve the fit of interaction as hypothesised (Hair et al., 2017).

The result shows that all hypotheses testing was accepted with a significant positive impact. Admin support was found to positively influence student satisfaction, bringing a 44.8% effect towards student satisfaction. Any changes in admin support will lead to a change in 44.8% at the satisfaction level. The result (t value = 7.740 and p < 0.05) confirmed that hypothesis 1 is accepted.

Hypothesis 2 is about the direct relationship between staff empathy towards student satisfaction. The result also revealed that staff empathy did play a role in influencing student satisfaction at 20.8%. The result also indicated that t value = 4.508 and p-value < 0.05. Based on that, H2 is accepted.

Hypothesis 3 also indicates a significant positive result where β = 0.348 and p-value < 0.05. Based on that, H3 is also accepted.

Table 6 Hypothesis testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Admin Support → Student Satisfaction	0.448	0.443	0.058	7.740	0.000
Empathy → Student Satisfaction	0.208	0.210	0.046	4.508	0.000
Responsiveness → Student Satisfaction	0.348	0.351	0.044	7.851	0.000

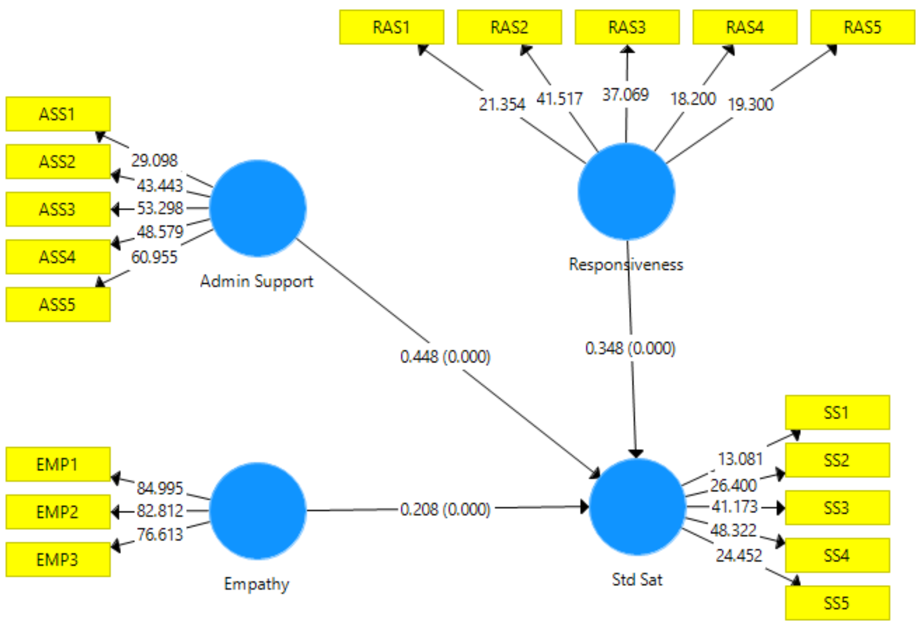

Figure 2 Final measurements model

Overall we can have considered that out of the three variables, admin support is the most important factor, followed by the staff's responsiveness. Staff empathy, although is positively significant but being categorised as the least priority by the student for this topic.

Inner model (path coefficient & *p*-value), Outer model (*t* value)

The results indicate that all relationship is positively related to student satisfaction. It shows that factors within the service quality plays an important role in their evaluation for student satisfaction.

Conclusion

Every customer or student desires and needs a high service quality. They had high expectations and believed they deserved a good service. Positive customer experiences by a student may lead to a more positive impact on the university. Students will share their experiences through e-WOM and helps to promote their universities to their social networks. Indirectly, it promotes getting more new students within the current student social circle and community. Dissatisfaction among students will create an unnecessary gap between them and administration offices. Negative experiences will lead to unnecessary remarks that will tarnish the good name of the university.

Based on the results, the university should put more attention on the overall service quality to provide positive customer experiences that eventually strengthen the relationship between the customer (student) and the service provider (university)

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INTEGRATED PROJECT BETWEEN CORE COURSES IN ELECTRICAL & ELECTRONICS ENGINEERING PROGRAMME

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Introduction

For most engineering students, working on class projects has been a fragmented and disparate experience. In a particular semester, students may have to undertake a project for each core course attended. They may even have to work in different groups with different team members in each project. Since each project is assigned and assessed in separate courses, students were also not able to relate how materials from these separate projects are linked to each other and how each can intertwine and contribute to better understanding and more improved prototype. Furthermore, the second year EE Engineering students require teamwork and project management skills essential for their multidisciplinary Engineering Team project (ETP), industrial internship and capstone projects in the following semesters.

To address the above issues, an Integrated Project is organized between two Semester 5 core courses in EE Engineering for second year students. The project activities were spread out across 10 – 12 weeks and student groups were assessed continuously. Through survey and interviews, students have responded well to the Integrated Project initiative and reported attainment of cognitive knowledge, soft skills and future internship opportunities.

Literature Review

Many engineering programs around the world has either established or exploring the right structure of integrated project in their curricula. The program administrators recognised the need to integrate students' learning experiences among disciplines and the application of these experiences in diverse situations that the graduates will face in their working career.

The implementation of integrated project in these programs could either be vertically across the years of study or horizontally across courses of the same semester. For engineering programs in Taylor's University, Malaysia, integrated project allows engineering students to work iteratively on a research project offered by faculty members supported by eight design modules using the CDIO concept (Al-Obaidi, 2013). Vertical integration across years of study is also implemented in Inha University, Korea where student groups work on multidisciplinary projects across six semesters before their capstone projects (Choi, 2017). During the Vertically Integrated Projects (VIP), the project teams are assessed each year through project diary, oral presentation, report and peer evaluation. Students reported satisfaction in attainment of teamwork skills and the recognition of convergence of disciplines through project work.

Meanwhile, administrators in Universidad Nacional, Costa Rica were exploring the challenges of integrating the courses of Semesters 5 to 7 in Systems Engineering using projects (Mora, 2014). Through focus group discussion among staff, major obstacles were identified including increasing workload for teaching staff, different standards in assessment and leadership dependence in implementation. This may also impact student experience of the projects as they have also reported concerns of workload and lack of coordination between project supervisors if such a plan is implemented.

The impact of integrated project and open-ended laboratory on learning outcomes among second and third year Chemical Engineering and Biochemical Engineering students was investigated in Universiti Kebangsaan Malaysia (Rahman, 2016). Survey among students has shown that the integrated project and open-ended laboratory allowed students to improve their skills in teamwork, planning and conducting experiments and data analysis.

Methodology

The Electrical & Electronic Engineering Department at Universiti Teknologi PETRONAS (UTP) organized an Integrated Project for second year students undertaking two Semester 5 core courses. For the first 2 semesters of this initiative, an IoT project under Instrumentation & Measurement and Data Computer Network courses are organized for two student cohorts. However, due to change in curriculum structure, the Integrated Project is offered in its third version between Instrumentation & Measurement and Microprocessor & Computer Architecture courses for the third student cohort of 31 students.

For all versions of the integrated project, students are assigned to a team of 3-4 members to work on an IoT or sensor prototype in a theme of their choice. Previous themes offered include Smart Car, Environment, Healthcare and Smart Farming. The same team assignment is maintained for both courses and extended to other class activities, such as tutorial and laboratory sessions.

Each team was continuously supervised, monitored and assessed throughout the 12-week semester in 3 stages: 1) problem identification and component selection, 2) assembly and programming and 3) final demonstration and report. Each team member is also requested to participate in an auto-rated peer assessment of their teammates in Stages 1 and 2. Instructors are responsible not only for technical supervision, but also as advisor on team dynamics, project management and in some cases, conflict resolution.

Results and Discussion

Student responses were gathered through a survey at the end of the project and a series of semi-structured interviews. The survey was conducted for the third cohort in September 2019 Students responded to survey statements using a Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree), with the average response shown in the middle of each figure. Responses to cognitive attainment from the project are shown in Figures 1-4.

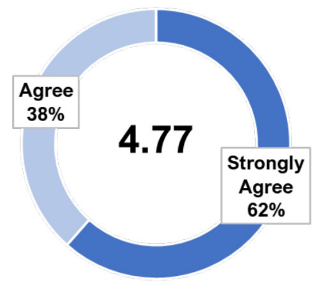

Figure 1 Student response to survey Question 1 - I was able to explore the use of sensors in a real-life application

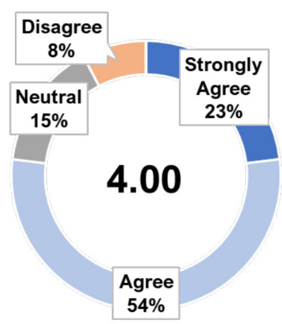

Figure 2 Student response to survey Question 2 - I can observe limitations of sensors and embedded systems

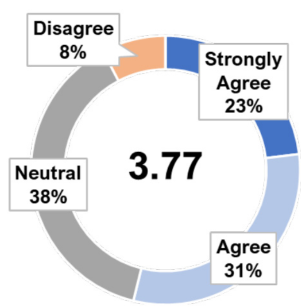

Figure 3 Student response to survey Question 3 - I can relate how sensor data is processed and used to change the state of a microcontroller

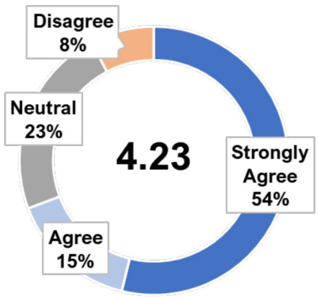

Figure 4 Student response to survey question - I would like to use the skills and experience from Integrated Project in Engineering Team Project (ETP) next semester

Students have responded well to the Integrated Project initiative with average response of 4.00 and above for Questions 1, 2 and 4. From the point of view of cognitive attainment, students were able to apply the materials learnt in both courses in real-life applications and the emphasis on prototype design allows them to explore various sensors and consider the merits of several wireless communication protocols and/or microcontroller interfacing. They were also very eager to implement their newfound skills in future courses (Figure 4). These are course outcomes that the instructors intended for the students at the outset of the Integrated Project. However, an area of concern from Question 3 with an average response of 3.77 shows that the crucial link between the two core courses was not apparent to the students. This may be a result of rushed integration of sensor and microcontroller at the end of the project.

In terms of the ability to work in a team, average student response is an encouraging 4.31 shown in Figure 5. During interviews, some students have reported the advantage of working outside of their circle of friends and learning good work ethics from team members. On the other hand, there are also reported cases of student's piggy-riding on the work of their team members. This is where the peer assessment can be a means to moderate the individuals scores and to resolve conflict.

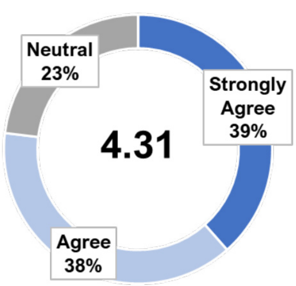

Figure 5 Student response to survey Question 5 - I was able to work as an effective team player

The students were also asked about their overall experience and the support provided by the instructors throughout the duration of the project. They responded with an average of 4.38 (Figure 6) that the amount of guidance from instructors was sufficient during the project. This batch of students were also the first to present their project results using a website and they found it highly useful for their demonstration and future use in resumes as shown in Figure 7. On implementations of Integrated Projects in other semesters, the students cautiously agreed that the initiative should be extended to other semesters in the EE programme (Figure 8).

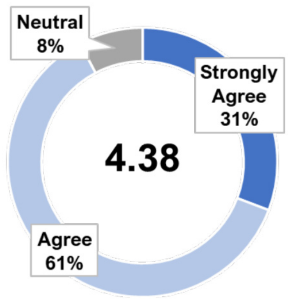

Figure 6 Student response to survey Question 6 - The team received sufficient guidance and support from the instructor(s)

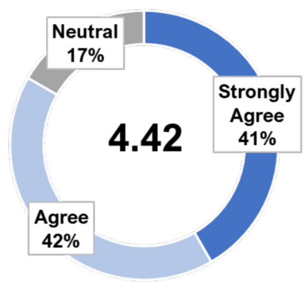

Figure 7 Student response to survey Question 7 - The project website was a useful tool during team presentation

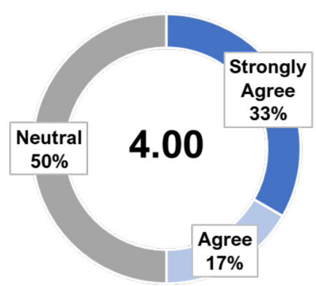

Figure 8 Student response to survey Question 8 - Integrated Projects should be introduced in other semesters

Looking at the benefit for future internship opportunities, students were also able to leverage the Integrated Project experience in their resumes for internship placement in their third year of study. Many students have reported that they received multiple calls of interest from potential employers on the strength of their project experience.

Conclusion

An Integrated Project initiative was introduced in Semester 5 for three separate cohorts of second year EE Engineering students. The students have undertaken an IoT project which combined the knowledge from courses in instrumentation and data network/microcontrollers. Student responses were encouraging on attainment of cognitive and soft skills. Many reported this experience on their internship application and received multiple offers from prospective employers.

Suitable project identification, joint supervision and commitment are crucial for the success of this initiative and the results have also been disseminated in the EE department. As a result, another Integrated Project has been offered in two core courses for Computer Engineering students. There is also effort under way in the department to review the EE curriculum structure so that integrated projects can be introduced in other semesters of study. However due to the amount of time and effort expanded for the initiative for both staff and students, it is suggested that only one integrated project is conducted in a particular semester.

Acknowledgement

This research is supported by UTP Scholarship of Teaching and Learning (SoTL) grant 0152AA-A83.

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SUBJECTIVE NORMS AS MEDIATOR BETWEEN THE RELATIONSHIP OF UNIVERSITY IMAGE AND STUDENT'S CHOICE

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Introduction

Higher education image and marketing are considered among the most vital factors that indicate Higher Education Institutions' success (Mitić & Mojić, 2020). The increasing number of industry players lead to tough competition over limited market share (Hung, 2021). Based on that, the Education Marketing Division was established in Malaysia's Ministry of Higher Education to promote Malaysia Higher Education Institution locally and internationally (Bernama, 2020). The new division is also focused on seeking international recognition and collaboration for Malaysian higher education programmes. In this day and age, many Higher Education Institutions find themselves in a highly competitive environment and are pooling all the efforts to present a crystal image of what they are offering (Rughoobur-Seetah, 2019).

Literature Review

Student Choice

The decision-making process involves determining whether to go to university or not, i.e. school (Hossler & Gallagher, 1987). Higher education institutes need to consider the relationships between factors contributing to the student's choice. Education has become an industry for those who sense buyers and candidates' value and development (Hassan & Shamsudin, 2019).

It is necessary to understand the factors that affect a student's decision to pursue higher education (Shamsudin et al., 2019). Previous research on university admissions decisions suggests that various factors affect whether or not someone chooses to pursue a higher education degree, such as cost, venue, availability of programs, and reputation (Hung, 2021). These things eventually impact students' decision to engage in postsecondary education (Krezel & Krezel, 2017).

Different schools and organisations are starting to realise how to enrol students in higher education institutes, especially TVET educations. Enrolment management is essential to understanding the overall student decision-making process. Hossler regarded enrolment management as a spectrum spanning from an individual's willingness to attend university to the consistency of the educational results of attendance (Afaq Ahmed et al., 2017). Enrollment management is a method where an institution uses a systematic collection of activities to encourage students to enrol (Hossler, 1994).

University Image

A discussion on brand and image has different perspectives. There are two main perspectives, which are financial and customer-based. The customer-based brand equity is targeted to the customers' mindset. In contrast, brand equity's financial aspect considers the cash flow advantage, similar to how brand products/services have over unbranded products/services (Saiti et al., 2017). Customer-Based brand image is more on the market's perception of the brand. However, it mainly focuses on the monetary value in which a brand contributes to a firm (Paulino & Castaño, 2019). Christodoulides (2006) discusses the perceptions, knowledge, and attitudes of a company's customers about the brand.

The brand image provides a competitive advantage for an institution by allowing the Higher Education institutions to differentiate themselves (Aghaz et al., 2015; Chandra et al., 2019; Kasalak et al., 2019; Manzoor et al., 2020; Schlesinger et al., 2021). According to marketing literature, brand image is an intangible and subjective brand by its (Chandra et al., 2020a; Chandra et al., 2020b; Lafuente-Ruiz-de-Sabando et al., 2018). Such brand evaluation allows customers to distinguish it from other brands based on their strengths (Baturina et al., 2019; Irfan & Sulaiman, 2020).

The study aims to measure the degree of customer interest with TVET HLI. The university image is the best construct to use for this research. According to Kotler (1991), the university image refers to students' overall perceptions towards the HLI based on their emotions, thoughts, behaviours, and experiences. The picture that the student identifies with a definition is stored and later remembered positively or negatively. It is then retrieved from memory when the institution's name is heard, named or brought to mind (Erkan et al., 2021). Besides, Kuo & Ye (2009) illustrate the spectrum of university image. Its coverage examines the reputation of the organisation or its future legitimacy.

Many HLIs recognise that corporate reputation is a significant problem. To succeed in a competitive market, these HLIs must provide better quality educational services (Amin et al., 2020; Ramdan et al., 2021; Shehzadi et al., 2021). Juana & Edgar (2016) focused on university image value for companies that want to be competitive and guarantee their survival for the short, medium and long term, and an increasing market for their goods or services. The sector continually encourages administrators to engage in marketing and branding practices. The main reason for doing this is to create better university credibility, which will increase university ranking.

Subjective Norms

Subjective norms lead to social and internal pressure (the need to conform to others' views essential to their behaviour). According to (Wang et al., 2017), subjective norms are defined by assumptions about the degree to which significant others wish that others execute the action. Past researchers have used subjective norms as a mediator (Bhuyan & Pathak, 2019).

In most research, subjective norms contribute to a significant relationship between customer decision-making factors (Sadat & Lin, 2020; Wong et al., 2016). According to Ajzen (2002), what is considered "desirable" and "undesirable" is usually sanctioned by significant others. Thus, Ajzen (2002) proposes that the concept of norms [which further includes behavioural and group norms] as well as norms [so the idea of subjective norms] are appropriate for examining whether significant others behave the same.

According to (Imari et al., 2020), Significant others' attitudes and behaviour are subjective norms. The customer tends to follow the social pressures within their contact circle, especially family and friends (Utami, 2017). Other studies have found medium to moderate subjective norms–intention associations in a different research scope that might involve a long term commitment at the customers' ends (Wong et al., 2019). They felt that this relationship was not meaningful (Hohmann & Kavookjian, 2018). Subjective norms increase the explained variation when controlling for key predictors (Aarssen & Crimi, 2016). Past research (Stephenson et al., 2016) also claimed that results demonstrate subjective norms contribute a strong influence than a direct relationship between factors towards customer decision making.

Methodology

The researcher distributed the entire questionnaires using an online survey, with support from MESRA executives at selected campuses. The target respondents are first-year students, and the ages are 18 years to 24 years old. The respondent was informed that the participant was voluntary. Questionnaires consist of two sections. Section A is more in collecting respondent profile with six questions whereas section B consist of 27 items. All items were sent for content validity to selected prominent subject matters for their comments. Some minor changes were made in grammar and sentence structures based on the comments from 3 subject matter experts. Two were from the academic sectors, and the other one was in marketing.

In the context of this research, first-year students were selected as samples for several important reasons. First-year is suitable because they have just gone through decision-making as compared to their seniors. It is important to gather accurate responses based on the students' recent experiences to obtain the best results. (Edward, 2013).

The first year answer should be the best category for these survey questions as it will be more effective. Besides, it would ensure the homogeneity of respondents.

Full data collection was carried out within 45 days, and the online method primarily supported the exercises. Overall the questionnaires were distributed to 200 target respondents; however, only 173 were returned completely. Out of that, only 23 were removed during the outlier assessment using the Mahalanobis distance with SPSS. As a result, only 150 were used for the data analysis.

Data analysis was done with the outlier assessment followed by the descriptive analysis of all the constructs in this study. A normality test was conducted using SPSS to assess the kurtosis and skewness output. The next result was to check for the value of outer loadings of every item based on the SmartPLS. Two items were deleted due to poor value.

Findings

Data were analysed using SmartPLS 3.0, and the results indicate that University image is positively significant towards student choice. Apart from that, subjective norms were also found important as mediators between the two main variables. Figure 1 indicates the revised measurement model upon the deletion of the item. One item each form university image and student choice was deleted.

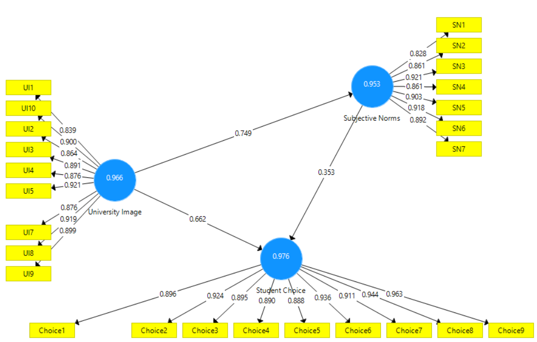

Figure 1 Measurement model upon deletion of items

Inner model (path coefficients), Outer model (outer loadings), constructs (Cronbach Alpha)

Table 1 Constructs reliability and validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Student Choice	0.976	0.977	0.979	0.841
Subjective Norms	0.953	0.958	0.961	0.781
University Image	0.966	0.967	0.971	0.788

Based on table 1, the internal consistency result was derived using SmartPLS 3. Each construct is evaluated by referring to the standard cut-off values of Cronbach's alpha coefficient of 0.7 that applies to the confirmatory research study (Hair et al., 2017; Nunnally, 1978; Uma Sekaran & Bougie, 2016). Table 1 summarises the internal consistency outcome of coefficient alpha.

All the values were above the cut-off value of the coefficient alpha of 0.7; thus, this particular examination confirmed that the constructs had a good internal consistency as they ranged from alpha 0.953 to 0.976.

Table 2 R Square

	R Square	R Square Adjusted	Predictor
Student Choice	0.913	0.912	Strong
Subjective Norms	0.560	0.557	Moderate

The result of R square revealed that university image has 91.3% towards the student choice. The result indicates that university image is very important to be used in the students' evaluation and decision making. At the same time, subjective norms contribute 56% of the effect between the relationship of independent variable towards dependent variable.

Table 3 Result for Fornell Larcker

	Student Choice	Subjective Norms	University Image
Student Choice	0.917		
Subjective Norms	0.849	0.884	
University Image	0.926	0.749	0.888

Table 3 shows the correlation coefficients of constructs, and the square root AVEs positioned along the diagonal line for interpretation (Fornell & Larcker, 1981). The correlation is validated by comparing the square root AVE. It should be relatively higher in determining the discriminant validity. For Fornell-Larker's criterion, this study confirmed the discriminant validity of the constructs and items.

Table 4 Model fit

	Saturated Model	Estimated Model
SRMR	0.079	0.079

In this study, the SRMR revealed that the goodness of fit model value is 0.079 for the complete main effects or theory testing, which meets the cut-off value of less than 0.08 for the model to achieve the fit of interaction as hypothesised (Hair et al., 2017).

Table 5 Relationship measurement

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
University Image → Student Choice	0.662	0.658	0.038	17.347	0.000
University Image → Subjective Norms	0.749	0.751	0.034	22.166	0.000
Subjective Norms → Student Choice	0.353	0.357	0.042	8.480	0.000
University Image → Subjective Norms → Student Choice	0.264	0.268	0.033	8.033	0.000

Based on the above result, It was also reported that university image positively influences student choice at 0.662 or 66.2%. Higher university image will lead to higher student choice. An increase in university image will increase student choice by 66.2%. The result (t value = 17.347, P-value < 0.05) confirmed that university image is positively significant towards student choice. As a result, hypothesis 1 is accepted.

It was also revealed that university image was positively significant towards subjective norms. University image contributes 74.9% towards subjective norms. The higher the university image will lead to greater subjective norms. The result (t value = 22.166, p <0.05) confirmed a significant positive relationship between the two variables. Hence H2 is accepted.

Apart from that, the result also highlighted the role of subjective norms towards student choice. The result revealed that subjective norms influence student choice at 0.353 (35.3%). The results show that subjective norms and student choice have a positive effect. An increase in subjective norms will increase student choice by 35.3%. Based on that, hypothesis 3 is accepted.

The final measurement is related to the role of subjective norms as a mediator. The result indicated that subjective norms are positively significant towards the relationship between university image and student choice. However, the result revealed that subjective norms contribute to a partial mediator function and the direct and indirect relationship were much higher than the mediation roles.

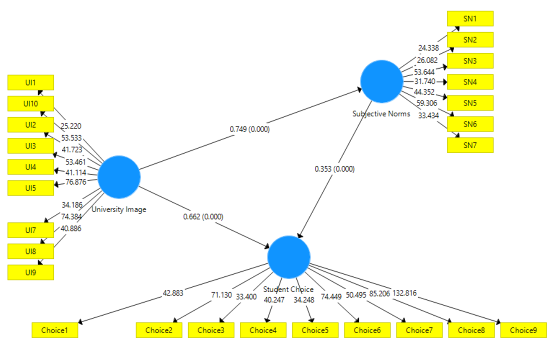

Figure 2 Final measurements model

Conclusions

The study revealed that university image is important from the potential students perspective. Each student does have their criteria of evaluation based on their specific needs and wants. University, especially the recruitment unit, need to evaluate the current student preferences and trends and match the findings with their future action plan. It is also interesting to know that subjective norms play an important role in influencing student choice. Subjective norms were reported that critical students were fond of listening to their friends' suggestions rather than other people.

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ENHANCING DELIVERY, TEACHING AND LEARNING EXPERIENCE OF ENGINEERS IN SOCIETY (EIS) COURSE USING MASSIVE OPEN ONLINE COURSE (MOOCS) MODE AT UNIVERSITI TEKNOLOGI

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Introduction

The EIS course is a common course which is compulsory for final year students from all engineering programs at UTP. Due to this, the number of students range from 300 to 500 students per semester with 4-5 instructors from all engineering departments. The delivery mode consists of traditional face-to-face lectures, adjunct lecture with speakers from industry and occasionally EIS projects sessions.

Nevertheless, there are several issues that have arose which calls for drastic measures for future sustainability of the course. Firstly, managing many students becomes challenging especially when organizing lecture timetable, test and examination venues and mass adjunct lectures. Due to the fact that the course involves students from all engineering programs, finding suitable time and venue to slot students to attend classes can be a difficult task. Evaluation has also been a big challenge due to the large number of students to manage.

In terms of delivery, lectures are conducted the conventional way in lecture halls and leave little room for student-instructor engagement to happen. This may cause students to feel less involved in class and may breed boredom for the course.

In addition to that, instructors also find monitoring of attendance in class a difficult task as it is done manually, and students may record attendance on behalf of friends who are absent. Calling out the attendance roll is also not an option due to the large number. Thus, the EIS course faces various concerns and problems and is in dire need of a transformation to ensure that the delivery, teaching and learning experience is enhanced. This study suggests that the course incorporates the MOOCs concept to address the concerns and problems faced. MOOCs has been successfully implemented globally and caters for massive number of participants [Kolowich, 2012]. Evaluation process can also be conducted online through the various available applications. Active interaction between instructors and students are also part of the MOOCs structure that fits the need of modern-day learners who are comfortable using social media for interaction [Masters, 2011].

Method/Literature Review

In this study, MOOCs will be conducted using the Open Learning online platform, similarly used by other universities in Malaysia [Yuan & Powell, 2015]. The introduction of the MOOCs mode will be conducted in stages, beginning with several topics at a time. The mixed-mode teaching and delivery will continue over the stages, increasing in percentage of online mode throughout the study. Surveys and interview of instructors and coordinators will be conducted to measure the efficacy of delivery and teaching experience in MOOCs mode. The learning experience will also be assessed based on the attainment of course learning outcome (CLO) survey and conducted to measure the efficiency and suitability of the EIS course to be conducted in a MOOCs mode.

The recent research on the development of open education reports that MOOCs have emerged as a popular mode of learning in the year 2012 [Kolowich, 2012]. When the concept of MOOCs was initially introduced, the format did not totally focus on posted resources and video lectures but rather used mix-mode, incorporating open web resources with available teaching and learning management systems [Yuan et al., 2014]. Over the years, as more and more open-learning platforms became free for all, many institutions began to adopt full MOOCs mode for their courses.

In 2008, a course led by Siemens and Downes at the University of Manitoba attracted 25 paying students and over 2200 online students studying free of charge. The course content were available for all through the Rich Site Summary (RSS feed) which is a format for constantly changing content in the web. Students interacted though collaborative tools, held active discussion on open-source learning platforms such as Moodle [Masters, Ken, 2011]. From then on, other MOOCs courses rapidly developed and adopted more interaction between students and instructors. The concept of distance learning was suddenly adopted and has now expanded all over the world offering free and open online courses [Yuan, L & Powell, SJ, 2015].

According to Downes (2008), MOOCs consists of two types; connectivist MOOCs (cMOOCs) and xMOOCS, which are more traditionally structured. cMOOCs which was developed in the early years had used the concept of 'innovative pedagogy' where it is more focused on education and learning as well as digital storytelling rather than a video-lecture format [Cormier,2013].

The more recent cMOOCs are based on principles of 'connectivist pedagogy' where course content are more dynamic and is constantly combining, remixing and evolving for future learning and learners experience. Other scholars viewed cMOOCs as a good support towards collaborative dialogue and knowledge building [Siemens, 2011].

xMOOCs on the other hand, have an identified syllabus of recorded lectures and self-test problems. Interactions between student and instructor are also limited to asking for assistance and difficulties from time to time [Andrew Ravenscroft, 2011]. Comparatively, cMOOCs provide the better option as innovation and connection is the focused pedagogy, and its dynamic nature will be much more effective for the learning experience of the current generation.

There are many schools of thought when it comes to online learning pedagogies. Pelz (2004), for example, gave three principles for effective pedagogy as below,

Principle 1: Let students do the work
Pelz believes that for the learning experience to be effective if has to be student centered. Student-led discussions should be the focus where students find and share web resources and help each other to learn.

Principle 2: Interactivity is the heart and soul of effective asynchronous learning,
Interaction between students such as conducting collaborative research paper or team projects can allow students to find common grounds and make the learning more synchronized

Principle 3: Strive for social presence
There are at least three types of social presence which are affective, interactive and cohesive presence. An affective presence is when there are expressions of emotions, feelings and mood. Interactive presence refers to reading, attending, understanding and thinking about other's responses. A cohesive presence on the other hand refers to building and sustaining a sense of belongingness, group commitment, or common goals and objectives.

Pedagogies in MOOCs as cautioned by Downes, should not be campus classroom-based learning pedagogies which has been adopted by several institutions. Downes criticized this philosophy and considers it to be too didactic and defeats the purpose of online learning. One of the key areas of online learning pedagogy that was suggested was peer-to-peer study which has shown to improve learning outcomes instead of the conventional self-study [Parr, 2013].

In the case of massive participation, Downes recommends a philosophy that is focuses on contribution from all to allow integration of each other's ideas, experiences, and views to become a learning experience. This is similar to that of Pelz's Principle 2 on interactivity [Pelz, 2004]. Herrington et al. (2010) may also provide the basis of the framework that can be implemented for online learning that focuses on authentic learning pedagogy.

Since 2014, there have been more than 900 MOOCs courses offered by universities and colleges in the United States alone [Koller, 2012]. In Asia, the Hong Kong University of Science and Technology was acknowledged as Asia's first MOOC. The university has so far registered around 20,000 students since offering a course 3 years ago. In Malaysia, MOOCs has attracted a massive 187,000 students from all over the world since it began less than 3 years ago with approximately 63 open online courses offered by 20 local universities. One of the pioneer institutions, Taylor's University uses the OpenLearning platform and has recorded higher completion rate compared to the popularly known online learning platform Cousera. OpenLearning is Australian's leading learning platform with a philosophy 'to delight our students, make learning a pleasure'. It also has higher records of student interaction compared to another popular online platform, Open2Study [Shahar., 2016].

There are now over 20 active institutions in Malaysia offering MOOCs such as Universiti Teknologi Malaysia (UTM), Universiti Putra Malaysia (UPM), Universiti Utara Malaysia (UUM), to name a few. The Ministry of Higher Education (MOHE) acknowledges that MOOCs will be able to reduce the duplication of learning and in return recognizes lessons gained outside the conventional classroom which is vital for students' overall learning experience. It plans to encourage flexible learning by awarding the 'MOOCs plus credit recognition and transfer initiative' to be implemented by the Malaysian Qualification Agency (MQA) [Shahar., 2016].

The MOOCs mode which contains elements that are more student centered and have greater flexibility may finally be able to transform common courses such as HSE and provide the enhancement needed in the improvement of delivery, teaching and learning experience at UTP.

Results and Discussion

The methodology for this study focuses on the interventions to be conducted, evaluation and finally the design of a UTP EIS MOOCs framework. Participant feedback and instructor (facilitator) reflections from the first cycle will be analyzed to identify areas for improvements in the next cycle. Recommendations for improvement will be incorporated before the next cycle is implemented. Qualitative methods will be used to allow detailed information to be collected from participants about their experience with the new EIS MOOCs mode.
The data collection methods includes a participant background survey (pre-evaluation before the course), a participant instructors perspective survey (after the course), participant comments made on the normal progression of the course, and facilitator reflections and an anonymous online course evaluation questionnaire completed by participants at the end of the course. Course learning outcome of EIS will also be used as basis to measure the effectiveness of delivery and learning experience.

All transcripts of interviews, data, researcher notes, and other documentary evidence will be coded and analyzed using Glaser & Strauss's (1967) constant comparative method of qualitative analysis. This joint coding and analysis method will allow data to be systematically categorized and analyzed using standardized measures so that participant responses could be grouped into relevant themes to facilitate comparison and analysis.

The course learning materials will be reviewed by existing relevant and expert resources available either on campus or on the web. The usage of open educational resources (OER) will be accordingly accessed, modified and reused. This is because all OER are materials that are made available to anyone in the world to support education.

The overall framework will closely follow the elements as suggested in Herrington's elements of authentic learning and elements of authentic tasks framework.

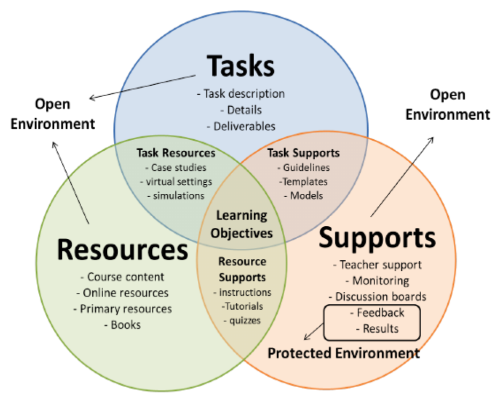

Figure 1 Herrington et al. (2000) elements of authentic learning and elements of authentic tasks framework [14]

The overall action research cycles will involve gradual introduction of EIS MOOCs summarized as below,

1. Cycle 1: Year 1
   a. Pre-Evaluation on effectiveness of delivery, teaching and learning experience of conventional EIS
   Pre-evaluation will be conducted on the current experience of instructors and students. Data

will be collected using online survey forms and candidates representing all programs will be selected for interviews. Observations in conventional classes will also be conducted with focus on delivery methods as well as evaluation and attendance. As EIS is offered on every semester, there will be continuous availability of data throughout the duration of study.

b. Training on MOOCs
Facilitators (research members) will attend training at MOOCs master class to understand the pedagogies behind online learning and the fundamental philosophies of MOOCs. The training will also provide the members with the knowledge of using available tools and techniques to enhance the delivery of the EIS MOOCs.

2. Cycle 2: Year 1
   a. Constructing of EIS MOOCs framework
   The EIS Course content will be re-evaluated by experts on campus and from OER. The content will be re-constructed in various MOOCs mode such as filmed lectures, videos and other interactive software that is available. The construction of EIS MOOCs content will take approximately around 7 months.

   b. Pilot Run 1 and Survey
   EIS MOOCs facilitators will identify one learning outcome from the EIS course (approx. 25%) to be introduced to two groups of students (approx. 300 students) to experience EIS MOOCs. Both groups will experience EIS MOOCs and conventional EIS class to be able to provide comparison. The learning experience will be captured on surveys and interviews.

3. Cycle 3: Year 2
   1. a. Data Analyses
   2. Data from Pilot Run 1 will be analyzed and the results will be used to improve the delivery for Pilot Run 2.
   3. b. Pilot Run 2 and Survey
   4. At this stage, two learning outcomes will be MOOCs mode ready. With improvement done based on survey for Pilot Run 1, a Pilot Run2 will be conducted on two group of students (approx. 200 students).

4. Cycle 4: Year 2
   a. Data Analyses
   Data from Pilot Run 2 will be analyzed and improvements identified. Based on the analyses, a framework of EIS MOOCs implementation can be constructed and designed to suit the needs of the institution.

   b. UTP EIS MOOCs Framework Construction
   Based on the analyses of delivery, teaching and learning experience, the EIS MOOCs framework for UTP can be constructed. Course learning outcome of EIS will be used as basis to measure the effectiveness of delivery and learning experience. The constructed framework will pave the way for a structured transformation exercise for other common courses at UTP into the MOOCs mode.

Conclusion

The main expected outcomes from this study are as follows;
Delivery, Teaching and Learning Improvements and Innovation in term of,

1. The delivery, teaching and learning experience of both students and instructors will be improved.
2. The UTP EIS MOOCs will be developed based on surveys and improved test runs.

Acknowledgement

The acknowledgement for Scholarship of Teaching and Learning (SoTL) Grant Universiti Teknologi PETRONAS (Ref: 015LF0-047) for funding this study.

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VISUALIZING MULTIPLE LINEAR REGRESSION USING MATLAB: AN INNOVATIVE APPROACH FOR STATISTICS & APPLICATION

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Introduction

During COVID-19 pandemics, teaching and learning (T&L) activities are quite challenging since all T&L and assessments must be conducted through online platform. The common practices are that the lectures are given through BigBlueButton (BBB) or Microsoft Teams. From there, students will try to get the better understanding on the subject matters. In addition, an effective teaching method would involve active two-way interaction between teachers and students. In this case, students play an active part by answering questions and discussion, explaining and teaching their peers (Sulaiman et. al., 2010). Studies have indicated that teachers need to equip themselves with more flexible approaches in the teaching of mathematics and sciences (Galton & Eggleston, 1979). However, at some stages, it is quite difficult for the students to get better understanding because, they are unable to meet up with the lecturer to discuss some problems they are facing. Furthermore, some subjects require that the student to visualize 3D surfaces in certain subjects. In this study, MATLAB software is used an innovative approach to teach Statistics & Application through analyzing and visualizing multiple linear regression in 3D environment.

Methods

Due to COVID-19 pandemics, our T&L have been lying on online platform instead of common face to face (FTF) T&L. With many challenges in dealing with online T&L, it is very important for us as lecturers to innovate in the way we teach the students. There are many techniques that can be used such as flipped classroom, educational games, teacher-student forum discussions, problem-based learning (PBL), virtual lab etc. Karim & Husain (2021) provide latest T&L advancements in dealing with COVID-19 pandemics.

Despite of the above techniques, there are other problems associated with the students' learning and understanding. One of the main problems in the current T&L is that it is very difficult for the students to understand conceptually 3D surfaces (Silen et. al., 2008)). In our research study, we found that students find it very difficult to visualize multiple linear regression since it involved more than one variable, compared with simple linear regression which is quite easy to visualize. To tackle the problem, we have used MATLAB software as a tool to visualize the response surface.

The main educational theories are that mathematical software can be used in improving the understanding of the students (Husain et. al., 2001) through visualizing the response surface. This will improve the cognitive thinking among the students. The main innovation in this study is the application of MATLAB software as a tool in T&L of multiple linear regression. Through MATLAB software, we manage to solve one very important problem in T&L multiple linear regression, that prevents the students to get better understanding on the subject matters. It's very hard to imagine what is a multiple regression and how do we visualize the problem.

From the survey conducted at the end of the lectures, all students have agreed that the proposed T&L innovation approach using MATLAB have improved their understanding on multiple linear regression. Indeed, they are more ready to answer Extended Assignment (EA) at the end of the semester later.

Data Collection

The data are collected by using sets of questionnaires with Likert Scale 1 (Strongly Disagree) until 5 (Strongly Agree). There are 33 students participating the online survey conducted via Microsoft Office form. Average time the students to complete the survey is about 8 minutes.

Ethical Issues

This study is complied with the ethical protocols and issues at Universiti Teknologi PETRONAS (UTP) and the Ministry of Education, Malaysia. The respondents are remained anonymous.

Results and Discussion

We conduct the study on 33 engineering students who were taking Statistics and Application subject in May 2021 semester. There are four hours lectures per week. For multiple linear regression topic, we have allocated four hours lectures. The first two hours are for lecturing, while the remaining two hours are dedicated for MATLAB session. As a case study, we discuss the application of multiple linear regression in predicting the number of dengue cases in Perak State, Malaysia. The details are described below:

Dependent variable: number of dengue cases in Perak (y)

Independent variables: rainfall (x1), humidity (x2), and temperature (x3)

Multiple linear regression model:

```
y=beta(1)+beta(2)*x1+beta(3)*x2+beta(4)*x3+
beta(5)*x1.*x2+beta(6)*x1.*x3+beta(7)*x2.*x3+
beta(8)*x1.^2+beta(9)*x2.^2+beta(10)*x3.^2;
```

The hypotheses are given below:
H0: beta(2)=beta(3)=…=beta(10)=0
H1: at least one beta(j), j=2, 3,…,10 does not equal to zero

After implementing the MATLAB programming, we obtain the following results:
The regression coefficients with their respective confidence limits (95%),

-929450.2565 <= beta(0) = 21967.9921 <= 973386.2408
-601.1610182 <= beta(1) = 185.791053 <= 972.7431247
-14690.45945 <= beta(2) = -1774.03151 <= 11142.39643
-57188.0231 <= beta(3) = 2233.10073 <= 61654.22456
-7.380283705 <= beta(4) = -1.0244091 <= 5.331465499
-25.66217986 <= beta(5) = -3.91485726 <= 17.83246533
-270.779277 <= beta(6) = -12.2565798 <= 246.2661174
-0.1524908502 <= beta(7) = 0.00458506624 <= 0.1616609827
-52.91014425 <= beta(8) = 14.8913328 <= 82.69280987
-1107.407853 <= beta(9) = -11.7310287 <= 1083.945796

Coefficient of determination R^2 is 0.96808.

Figure 1 shows the example of response surface on the dengue cases based on two independent variables x1 and x2. Clearly there is no relationship between both independent variables.

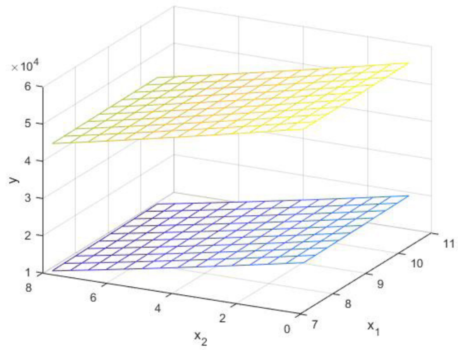

Figure 1 Response surface between x1 and x2

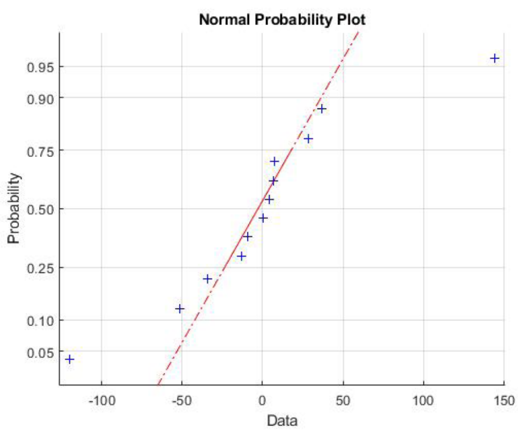

Figure 2 Normal probability plot

Figure 2 shows the normal probability plot for the multiple linear regression model. From the graph, we found that, all points except two residual points fall close to the line representing the normal distribution. Therefore, the model is adequate and can be used for prediction etc.

In term of statistics, R2 is quite high i.e., the model can explain about 98.81% on the variance in the response variables. Consequently, based on F-statistics and p-value, the null hypothesis H0 is rejected. Thus, we can conclude that the model is adequate and reliable.

Later, the students are requested to simulate the results by using different multiple linear regression model. Once they have done, they are requiring presenting their results through MS Teams. They also can screenshot their solution to the chatting box. The students really enjoyed with the activities.

From Microsoft Forms, we analysts the collected data based on all questionnaires with the respective Likert Scale. There are 33 questions. However, the main spot highlighted here is the following question:

Mathematical software i.e. MATLAB and Microsoft Excel have improved my understanding on the subject matter

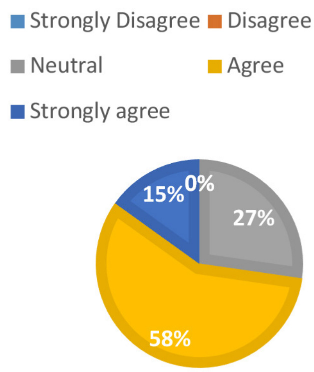

Figure 3 MATLAB and Microsoft Excel survey

A total of 24 students (85%) have strongly agreed and agreed that MATLAB and Microsoft Excel have improved their understanding on the subject matter. Meanwhile, 9 students (15%) have chosen neutral. Figure 3 shows the pie chart. This study suggests that teaching methods using a software combining practice and getting students' feedback can be an effective way to improve the accuracy of judgement (Stuart, 2004). Thus, the methodology using MATLAB software will improve the students' understanding.

However, the students are more preferring to have T&L via face to face (F2F) rather than online T&L. It is understandable since all assessments are conducted online, some students may not be able to perform better because of the internet connection, lack of smartphones or laptop etc. Future works will be focusing on the implementation of online cooperative learning to improve students' understanding on the subject matter, in which students can discuss the solutions and understanding the topic together within the groups (Diković, 2016).

Conclusion

In this study, we have implemented an innovation approach on T&L for multiple linear regression topic. MATLAB software is used as a tool. From our finding, visualizing the response surface through MATLAB have improved the understanding of the student on the subject matter. They can manipulate interactively the independent variables to obtain various types of surfaces. Perhaps the implementation of peer helper or mentor-mentee will be benefited to all students. We can extend the idea in Karim and Azman (2018) and Karim et al. (2018) by integrating the MS Teams into the mentor-mentee framework. Hence, exploring and finding the most effective teaching methods that are compatible to both teachers and students is imperative to deliver a high quality and accurate knowledge of learning, whilst nurturing students' achievements.

Acknowledgement

This study is fully supported by Universiti Teknologi PETRONAS (UTP) through a research grant YUTP: 015LC0-315.

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UNIVERSITI TENAGA NASIONAL

The Energy University

TRACK III

SOFT SKILLS IN TEACHING & LEARNING

EMPOWERING STUDENTS IN A VIRTUAL PLATFORM USING SANDBOX METHOD

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Introduction

Individuals were used to having knowledge directly given to them, and they have the perception that they need to be educated to learn something (Eliason, 2017). Due to the current pandemic, most students were required to use virtual platforms like Google Classroom, Google Meet, and Zoom to attend classes. Students were also exposed to online learning platforms like Microsoft Teams, WhatsApp, Quizizz, and Kahoot, which required both teachers and students to learn these tools on their own immediately (Vasugi, 2020). With that, students need to adopt self-learning and be more independent. Students paying attention in virtual classes and teachers paying attention in class is another big challenge that will always deter teaching and learning. This study will be discussing the Sandbox method that will be implemented in the virtual classroom to empower students. According to Eliason (2017), the sandbox method does not require individuals to remember any information formulas or other technicalities. Eliason (2017) also mentioned that students would be exposed to a wide range of information that motivates them to improve themselves. This sandbox method allows students and teachers to “play” while learning, collaborating, and sharing ideas online.

In the same way, student empowerment is equally important as student engagement. According to Broom (2015), empowerment refers to a person’s self-efficacy, which is their belief in controlling their own lives and making changes around them. For example, if students were creative and became independent learners, they would have empowerment (Spencer, 2019). Based on a past study, empowering students to help them in their learning process consist of social, political, and academic areas (Indrianti, Sasmoko, Yossy, Suprapto & Hartono, 2017). Indrianti et al. (2017) also highlighted that empowering students believes that students could do something constructively. In brief, students will have the flexibility to decide their learning style, significantly impacting their academic performances. This is proven accurate, especially when teachers are attentive, appreciative and create an empowering learning environment.

Educational theories or references underlying the innovation

Constructivism theory is used as the method’s foundation to empower students in virtual platforms using the Sandbox Method. Constructivism theory refers to a learning method that allows individuals to create their knowledge based on their experiences or prior knowledge. A study conducted by Olusegun (2015) found that active teaching and learning such as real-life scenarios were used and assigned to students. As a result, students could use their prior knowledge to solve the teacher’s task, which is aligned with the Sandbox method.

Besides that, Peshal (2014) stated that individuals manage their learning by initiating their own learning goals and styles. This contributes to students having the freedom to create new ideas and be creative in solving specific issues. In particular, the Sandbox method highlights how individuals learn and process information. Using this method, students will have to set their goals before they "play" in the Sandbox. The style of discussion and brainstorming depends on each individual/group style. There will be no restrictions as we want to make sure we give them a sense of empowerment. This can be observed through virtual platforms when students have group discussions and personal records of their learning experiences (Peshal, 2014). Based on experiences shared by several lecturers, they noticed students started to feel comfortable sharing their personal experiences when they presented their ideas.

Constructivism theory, which acts as a pillar for implementing the Sandbox method, will enable students to generate new ideas fully. Indeed, a study conducted by Jemberie (2021) stated that when students were exposed to question-answer and individual work methods, they could develop different levels of understanding. Based on the activities, teachers were required to provide feedback to know the right way to learn, especially on virtual platforms. This is one of the reasons the Sandbox method uses the foundation that lays in this theory to be part of the pillar. Besides that, Solano, Gruning & Gallardo-Alba (2021) mentioned that this theory would create a space for individuals to gather knowledge rather than being spoon-fed. This will allow the students to find information rather than just listen to lectures and later drift away.

Problems or issues faced in teaching & learning in higher education that called for the innovation

There are three main issues that this paper aims to discuss. The first issue is the implementation of traditional teaching methods in a virtual platform. Teachers were said to use the same method as in physical classes whenever they conduct online classes. The past study stated that the teaching method was teacher-centered, whereby teachers determined and provided learning materials (Dimitrios, Labros, Nikolaos, Maria & Athanasios, 2013). Due to that, students feel bored and will not have the opportunity to think critically. As a result, students will be too dependent on teachers, resulting in poor quality of academic performances. Undoubtedly, the Sandbox method should develop both teachers and students in the teaching and learning process. Teachers should form teaching through play, whereas students will have the chance to set their academic achievement level (Heick,2017). This study suggests that teachers use effective methods or platforms to guide the students in their academic journey.

Furthermore, there is a second issue that refers to students feeling demotivated in virtual classes. Daugherty (2020) stated that 76% of undergraduates, 56% of graduates, and professional students were demotivated in virtual learning. Kolarova (2018) mentioned that students were demotivated because of the mood in the virtual classes, the student's environment, the set of instructions given by teachers, and even the students themselves

The third issue is that students easily lose focus during online classes. This can be observed when students are in the comfort of their homes or rooms and distracted by the condition of their house environment. For instance, noises from vehicles, constructions in their housing areas, or even bad internet connection. Also, inadequate study space and the inability to attend scheduled online classes were the reasons students lost their focus in online classes (Daugherty, 2020). Similarly, Turner (2020) also stated that the absence of physical area and many other distractions would lead to students losing focus. On top of that, students easily get distracted and lose focus when teachers do not have well-implemented strategies to keep them focused (Claudio, Laurentiu, Gabriel Tiru, et al., 2021). As a result, the lack of engaging activities and communication with the teachers will demotivate students, create boredom and eventually lose focus in class.

Literature review

The conceptual background of Sandbox Method

The Sandbox method refers to a virtual space that allows individuals to investigate or evaluate in several ways (Lyngstad, 2017). Adding to that, Lyngstad (2017) also stated that sandboxes are adaptable according to the requirement of students to grasp the opportunity of learning. According to Rosman, Aziz, and Osman (2018), the Sandbox method is custom-made to necessitate students' learning and, at the same time, act as a perfect mechanism to improve students' performances further. Besides that, the Sandbox method is also known as a continuous approach for self-education as individuals will be determined to improve themselves further (Eliason, 2017). Eliason (2017) suggested that the Sandbox Method can be practiced or implemented with the presence of a teacher at any period. Notably, some students will feel motivated to share their ideas and at the same time develop self-confidence whenever there is a presence of a mentor.

The Sandbox Method and Empowering students

Building a sandbox is the first essential step that individuals must take to implement it in their learning environment. Sandbox can be created by identifying the place to gain information and the meaning (Ho, 2021). Eliason (2017) stated that by building a sandbox, students will try out new skills. Not only that, students will feel empowered as they realise that they are in control of their learning. Adding to that, Eliason highlighted that the sandbox should be accessible or affordable, less risky, and should be visible to the public.

Empowering students are quite essential, especially when lessons are now being taught online. Students found it challenging to adapt to the new learning environment, which somehow affected their well-being. For example, an inconducive home environment for learning, lack of motivation, connectivity problem, or insufficient interaction with their peers were part of the challenges (Daugherty, 2020). Indrianti et al. (2017) suggested that students' empowerment should form students' well-being. It was assumed that the Sandbox Method would succeed when students' well-being is considered in virtual learning. This has been proven when students were given a chance to have self-empowerment. They transformed into exemplary learners (Indrianti et al., 2017).

Currently, most schools or educational organisations must be 'forced' to shift to virtual learning platforms for teaching and learning. It remains a challenge up to today to maintain positive interaction with teachers and classmates. Samuel (2020) has suggested using a learning experience tool called "Be the Boss" to keep students empowered and interactive during online classes. In line with the Sandbox Method, it will help students continue learning as if they were in a physical classroom.

The Sandbox method implementation journey

This study had suggested using the Sandbox Method as one of the tools to manage teaching and learning in virtual classrooms to close the gap between teachers and students or students and peers. This can be proven when Heick (2017) mentioned that the Sandbox Method help saves education as learners will empower their learning, especially in a virtual environment. The University of New South Wales (UNSW) (2021) created a program that focused on the Sandbox Method, empowering teachers and students to create better learning experiences. They added that by using the Sandbox Method, industry, teachers, and students could have new perspectives on certain issues, obtain appropriate skills, and create integration between the education field and industry (University New South Wales (UNSW), 2021). As a result, when students realise they can recognise their learning capabilities, learning in virtual environments will not be as dull as before.

Besides that, Pittayapongsakorn (2018) highlighted that Thailand's education system should be exposed to the Sandbox method to improve students' outcomes innovatively. As for Universe Sandbox (2020), the implementation of this method obtained great feedback from educators – for example, it promotes learning efficiency, engagement, and entertainment for students to learn. On the contrary, the Sandbox Method was integrated into game-based learning as several studies have shown the rate of success of using this concept (Pixowl games, 2014; Heick, 2017; Lyngstad, 2017; Sun & Chen, 2017). For example, Pixowl games (2014) had implemented the Sandbox Method by giving students the experience to be rewarded for thinking critically, solving problems, or even freedom to self-explore. Due to that, when students learn to think critically, it will indirectly increase their level of maturity. The past study also found that the Sandbox Method was integrated into augmented reality to allow learners to participate in the learning environment (Nawaz, Kundu & Sattar, 2017).

Consequently, students will feel motivated and remain focused during online classes as they find their teachers' teaching is interactive. Besides that, upon implementing the Sandbox Method, Sandbox Learning Australia (2018) collected testimonials from students – for instance, students were more diligent, obtained higher grades, and were more confident. It closes certain gaps in students' understanding.

The Sandbox Method implementation journey in Introduction to Personal Finance virtual class

Most virtual classes used Google Meet as a platform for teachers to conduct their teaching and learning activities. It has also been used for Introduction to Personal Finance, which consisted of 45 Foundation Studies students. However, conducting this virtual class is different as the Sandbox method has been integrated into it for two semesters. The Sandbox method was included in the subject mentioned above to enable students to understand the subject from another perspective. Students will realise that challenging subjects like finance can be easy when learned differently – in this case, the Sandbox method. With that, Google Meet can represent the concept of a sandbox whereby it will become a space for learners to share their ideas or to ask questions regarding subjects taught. Referring back to the sandbox concept, it needs certain tools to ensure that the objective can be achieved. Due to that, tools like Jamboard, Kahoot, and Quizziz have supported the suggested concept. These tools allow students to share their perceptions towards certain topics in the subject and even test their knowledge or level of understanding about the subject. Questions about the subject were given to the students so that they would be able to share their ideas which later will be discussed in class. Figure 1 and Figure 2 were examples taken from one of the Jamboard sessions conducted with Foundation Studies students who took Introduction to Personal Finance subject.

Besides that, team-based learning was also used to support the Sandbox method as it represents the 'borders' for the sandbox. This ensures that when students are in the sandbox, they will sustain their interest in contributing new ideas or sharing their opinions about topics covered. For example, Figures 3 and 4 were part of the team-based learning activity based on the Introduction to Personal Finance subject chapters. The team application questions were given by providing students with a question related to the chapters covered. Students were required to state their answers and present them as a team. This activity will help students brainstorm their ideas and share them with their peers during lecture sessions. With that, the Sandbox method will be further strengthened with the support of various online tools together with the willingness of teachers to use the recommended method.

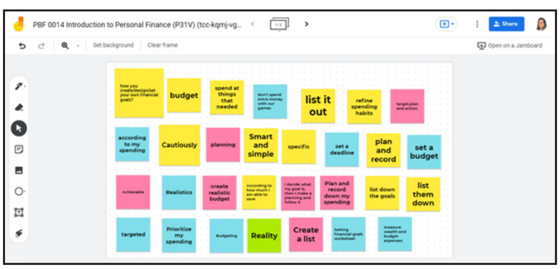

Figure 1 Jamboard session

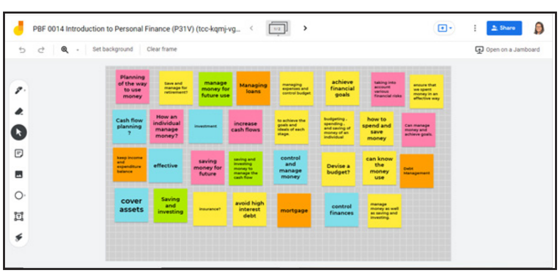

Figure 2 Jamboard session

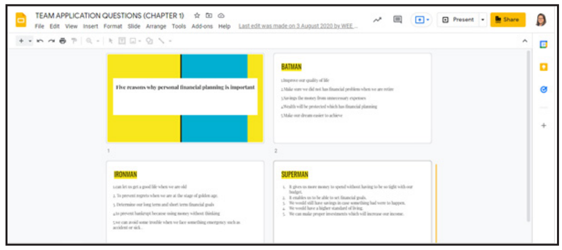

Figure 3 Team-based learning activity

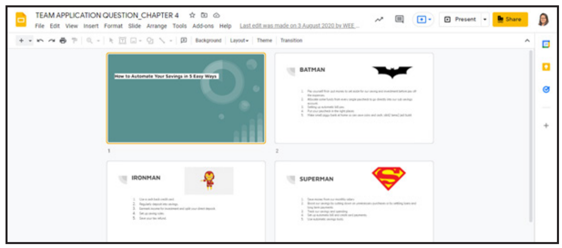

Figure 4 Team-based learning activity

Methodology

A Likert Scale questionnaire is used to identify the problems faced by students in virtual classrooms and what can make more fun and engaging virtual class. The students in Multimedia University (MMU), Infrastructure University Kuala Lumpur (IUKL), and International Medical University (IMU) are regarded as the target population for this research. The sample size is 128 respondents from Melaka and Kuala Lumpur. The respondents are students taking courses at all levels of the programme (Foundation, Diploma, and Undergraduate), consisting of Business and Management, Engineering and Medicine & Health Science academic discipline. Convenience sampling was applied for this research.

The survey questionnaire consists of three parts. Part A shows the respondent's demographic (4 items). Part B relates to the feedback about the problems faced by students in virtual classes (7 items). Part C aims to know students' perceptions about the ways to make virtual classes more fun and engaging (7 items). Data collection was done using Google Form due to time constraints.

Results

This study found that students felt demotivated on one or more occasions in class and easily lost focus during virtual classes. Besides that, students rarely have problems when they find that their learning environment at home is inconducive or even feel isolated and lonely as there is a lack of social interaction. This study also discovered that lecturers rarely have issues when lecturers provide lecture notes and tutorial questions without discussion sessions. On top of that, they claimed that they rarely felt bored when their lecturers used the traditional method (physical class method) in virtual classes. Furthermore, when the students were questioned about the activities and group discussions conducted in virtual classes, the majority mentioned that they experienced this at least once in their class.

Discussion and Conclusion

Based on the feedback obtained from the students about situations faced in virtual classes, it was found that 80.5% of students felt isolated and lonely due to lack of social interaction at least once in almost a year teachers and students involved in virtual teaching and learning. Teachers should not take this situation lightly as it will prolong if teachers are not aware of this. This is deemed true when Daugherty (2020) found that students complained about experiencing lesser interaction with other students, being unable to learn online effectively, and having inconducive home environments. Besides that, Cooper (2016) and Hobson (2020) mentioned the importance of social interaction among peers and related online learning, with many students feeling isolated. With that, the Sandbox method was recommended to be adopted as it will encourage students to take charge of their learning process despite the situations they were experiencing. Students feeling lonely will result in stress and demotivation, affecting their studies and involvement in class. The Sandbox method can create a conducive and safe place for discussion and freedom to share their thoughts.

Acknowledgement

The completion of this study could not be possible without the help from associates and colleagues, financial support, and permission to publish.

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UNDERSTANDING THE IMPLEMENTATION OF PROJECT-BASED LEARNING IN PROGRAMMING COURSES TOWARDS UNDERSERVED COMMUNITY

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Introduction

In dealing with 21st Century learners and ensuring equality in education, educators face many challenges in managing diversified learners in one classroom. Different effective teaching strategies were designed to accommodate students with various backgrounds, learning styles, and skills. Incorporating technology in the education system plays a fundamental role in achieving significant improvements that offer better students' engagement and learning experiences. Diverse student learners include underserved learners categorised as those with learning disabilities, minorities, and those from rural areas or low-income families. With the increased number of underserved students enrolled in the university, choosing a suitable teaching approach is crucial in ensuring every student successfully learns. Thus, project-based learning was implemented in a programming course that focuses on application development. This approach illustrates the ability of students to unleash their creativity and teamwork while applying the programming skills in creating an application (apps) that can benefit the underserved communities. Thus, the authors opt to initiate research with the main objective to analyse students' awareness of the underserved community through digitalisation.

Literature Review

Project-based learning is a student-centered pedagogy that gives in the dynamic teaching approach that allows students to gain knowledge by working within a stipulated time to investigate a complex problem or question. It is believed that it is one way to encourage students to learn by applying knowledge and skills through an engaging and interactive learning experience. Through this implementation, students are directed to create an artifact (or artifacts) to present the knowledge that they have obtained. The teacher plays the role of facilitator, works with students to frame worthwhile questions, meaningful structure tasks, coach knowledge development and social skills, and carefully assess what students have learned from the experience. The learning process is a meaningful journey for the students. They are given the freedom and opportunity to explore real-world problems, hence developing a deeper and more enriched understanding. The students will appreciate the knowledge more as they will find that education is more fun and accessible in their learning preference. Indirectly, since the voice and choice come from the students to drive in the task, ownership comes in as the students are responsible for setting in their learning paths. Positive attitudes towards peers from different backgrounds were changed to an acceptable level after completing the project as the students were working in a team.

With the demand in education and the growing number of Higher Education Provider (HEP) in Malaysia, the need to consider the quality of the graduates produced comes together with the academic achievement. This is important to ensure that the graduates produced are among the best of the breed representing the university's reputation. The preparation towards these high-quality graduates starts from selecting students throughout their university life and until they have graduated from the university. In making a good quality graduate, student background plays a vital role in their survivability in university life. HEP worldwide has been trying to understand the students who enroll in their university, especially underserved learners. According to a study conducted by ACT, underserved learners are identified as students who portray the lack of access to high-quality educational and career planning opportunities and resources with the following characteristics: minority, low income, and first-generation in college. A different institution might have a different definition of the underserved learner. Still, the majority agree that from understanding the learner's background, a university could help the learners ensure a successful journey in the university and eventually in their future career.

Method

In conducting the research, a programming course with 75 students, including underserved learners, was selected. Students got into 15 groups of their own choice and were assigned to develop an application to assist the underserved community. In 12 weeks duration, each group was expected to plan their team, analyse the problem, design and develop the application prototype, test it, and then exhibit it to the panel of judges in a one-day competition named Oh My Code Programming Competition (OMC). In this project, there are 3 main phases (Figure 1). The teaching team has continuously monitored the progress for each group through periodic progress meetings, continuous observation, and scaffolding of the ideas. Also, peer evaluation at the end of the competition is conducted.

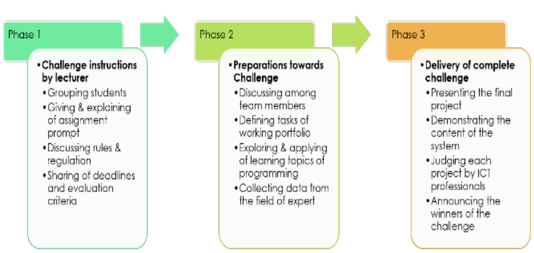

Figure 1 Details of activity

Results

Figure 2 shows the number of project submissions from a different category of constraint. From the tabulated results, it is found that around 47% out of 15 groups have chosen to understand and develop an application for people with disabilities. Another 27% opt for people with income constraints, 13% are looking into people with geographical constraints, 7% are looking at the welfare of healthcare staff, and another 7% are working on a prototype of refugee.

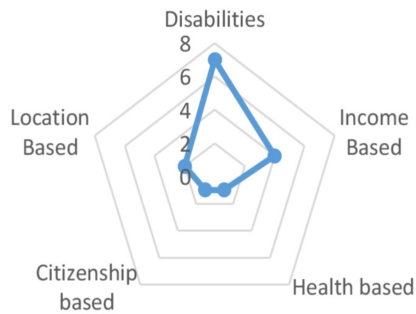

Figure 2 Number of prototypes developed from a different category of constraint

Figure 2 shows the number of prototypes developed under disabilities, the highest constraint category the students chose. According to Disabled World (2019), a disability can be defined as a condition or function judged to be significantly impaired relative to the usual standard of an individual or group. The term refers to individual functioning, including physical impairment, sensory impairment, cognitive impairment, intellectual impairment, mental illness, and various types of chronic disease. From the results shown, autism disorder gains the most highlighted and choice of concern in this assignment, followed by a slow learner, down syndrome, dyslexia, and cerebral palsy under the same category.

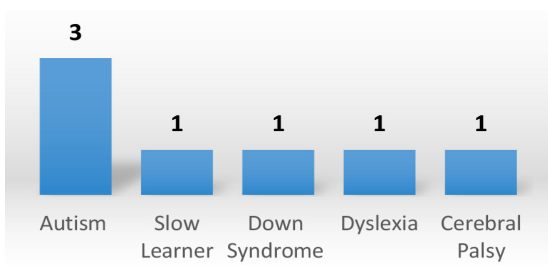

Figure 3 Number of the prototype developed for a different type of category under disabilities

Discussion

Based on the findings, it is observed that the student's awareness is more towards autism disorder. The increase in autism awareness is due to several factors. According to Richard Solomon (2020), In every two seconds, a child is diagnosed with autism. Centres for Disease Control and Prevention (CDC) has determined that 1 out of 54 people or 2% of males have autism spectrum disorder (ASD). The overwhelmed information about autism found on the websites has greatly helped in promoting this type of disability. In addition, various initiatives that the NGO and government take to help this category of people have raised society's awareness.

Moreover, autism has been recognised worldwide when we are having an autism day. Autism, by definition, is a lifelong developmental disability that could affect how a person communicates with other people, which could also be affecting their behavior. Thus, we need to identify the trait early so correct treatment can be introduced.

On the opposite, lack of information on other disabilities such as cerebral palsy, slow learner, dyslexia, and down syndrome cause a drawback in terms of awareness. Disability awareness among society is crucial to increase understanding and acceptance of adults and kids with disabilities. From the awareness itself, it could be beneficial in early recognition, hence indirectly, we can improve the support of affected families. This awareness could also develop empathy for disabled people and remove society's stereotypical mindset, which allows them to have equal rights.

Apart from it, based on the observation made by the teaching team and group peer evaluation:

1. All groups have successfully completed their prototype.
2. Students comfortably worked together with team members who were underserved learners.
3. Students can share a lot of information on underserved learners under their concern based on the prototype produced.
4. Students have better interaction among the members in the group omitting their background.

Conclusion

In conclusion, students who have participated in the competition are aware of various underserved categories. It is well supported by the information and the ideas presented in the prototype. Students are also able to complete the task, and the tasks are well presented to the panel of judges, and they manage to come out with a range of applications to serve the underserved community of interest. Through PBL, students can apply their programming skills, and at the same time, they can put empathy in their learning process. It is hoped that the initiatives towards supporting and creating awareness of underserved communities should be expanded to the other categories to collect more data and evidence to support the initiatives.

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AN INVESTIGATION INTO VOCABULARY BENCHMARKING OF BUSINESS STUDENTS: EMPOWERING CUSTOMISED CORPUS INTO EDUCATION DESIGNS

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Introduction

Lexis, or vocabulary, refers to the reception comprehension of a target language, specifically the comprehension of words and their meanings, which is central to the language learning experience. The term "word knowledge" refers to a person's ability to comprehend a word's structure, meaning, and context. The phrases "word knowledge" and "vocabulary" are used synonymously throughout this study, with no discernible meaning difference. As a result, responsive vocabulary may be used interchangeably with receptive knowledge. Learning technical material such as business in English might be frightening for students who speak English as a second or foreign language. The size of the learners' vocabulary and the extent to which the needed resources are covered lexically in terms of word families are frequently associated with success in context or text comprehension

According to Hsu (2018; 2014), word or lexical knowledge comprises the progressive accumulation of degrees of information about the most often used words and the ability to use them freely, or what we refer to as productive vocabulary. Nation (2006) added that a learner's capacity to recognise a term and differentiate it from words with a similar form or derivatives proves that they possess a receptive vocabulary. Additionally, it involves the ability to judge whether the form of a word is proper in appearance and sound and the ability to forecast the grammatical pattern that best matches the word.

Lexical coverage shows if a text is easily or sufficiently comprehensible (Laufer & Nation, 1995) and whether a text has been adequately taught or comprehended (Hsu, 2018; 2014). It is crucial to grasp the extent to which a broad receptive vocabulary is required for daily or usual language use, such as reading fiction, academic books, newspapers, conversing, or even watching a movie. Vocabulary size is usually used to refer to the quantifiable number of words required to comprehend a specific text or activity. A vocabulary's size is established by the number of word families engaged in or required for text comprehension.

One strategy for increasing students' chances of learning and acquiring the target lexis necessary for effective communication, particularly in writing and speaking, is to offer the target vocabulary or lexical items in an appropriate context (Gilmore and Millar,2018). A strong foundation in a specialised field is vital. Acquiring a working grasp of technical words can be challenging, as their meaning is very context-dependent (Mukundan & Ng, 2014; Nation, 2001).

The term "vocabulary threshold" refers to the bare minimum amount of vocabulary required to grasp a given proportion of a text. When a reader retains a significant level of second language understanding, usually referred to as the vocabulary threshold, general reading skills can be performed optimally. The vocabulary threshold specifies the bare minimum amount of vocabulary necessary for "adequate" reading comprehension). For example, if a vocabulary size of 5,000-word families is created, children are required to achieve this level of proficiency to engage in "fairly well" reading academic literature. Another aspect of threshold vocabulary to consider is "sight vocabulary" (Laufer & Ravenhorst-Kalovski, 2010).

This study set the threshold for "sufficient" or "fairly well" text comprehension was set at 98 percent in this study. It is very subjective and is determined by the various contexts' lexical threshold requirements. Depending on the educational level or field, specific amounts of lexical coverage may be necessary to reach the requisite level of reading and even writing competency (Chen, 2020). Additionally, a student may be expected to complete stricter reading requirements to advance academically (Coxhead, 2000). Knowing 95% of the terms in a document is required for minimal comprehension and accurate context-dependent word guessing (Ng et al., 2020).

Hsu (2018; 2014; 2011) adopted the 98 percent standard or criterion for her sample as a more attainable goal. Similarly, the researchers propose that students and teachers strive for a lexical percentage of 98 percent, given Malaysian students' restricted vocabulary (Sarimah Shamsudin, Noraini Husin & Amerrudin Abd. Manan, 2013). As a result, it is thought that a text's lack of 2% lexical coverage can be accepted without impairing or impairing the text's comprehension process.

Learning technical disciplines such as business in English might be intimidating for students for whom English is a second or foreign language (Ng et al., 2019; Gilmore & Millar, 2018; Thiruchevam et al., 2018; Todd, 2017; Mudraya, 2006). Contextual understanding, or text comprehension, success is frequently correlated with the size of the learners' vocabulary and the amount to which the desired resources are lexically covered in terms of word families. Recognising the vocabulary threshold of specific resources facilitates course design, lesson planning, and disciplinary literacy advancement (Green & Lambert, 2018; Bi, 2020).

Vocabulary knowledge is a necessary but not sufficient condition for language ability. It is consequently critical in determining second language (L2) learners' ability to express themselves effectively. This is especially true in academic writing when there is an expectation to conform to a set of carefully defined terms that are often used in academia. (Higginbotham & Reid, 2019). There is no exception in business studies, where students must comprehend the meaning of words in textbooks, journal articles, and even everyday dialogue. This study aims to identify the vocabulary size needed to comprehend the students' business writing texts in terms of percentage of lexical coverage compared to those of the required standard in reading business journal articles based upon Hsu's (2011) findings of 8,000-word families.

Furthermore, this work offers a corpus-based investigation of the customised business student writing corpus generated in collaboration between the University of Multimedia and Universiti Tenaga Nasional. The first step was to conduct a vocabulary threshold analysis to identify the extent of lexical coverage in terms of word families found in students' writing texts. These were then matched to external wordlists, namely the New General Service List, NGSL (Browne, Culligan & Phillips, 2013a) and the New Academic Word List, NAWL (Browne, Culligan & Phillips, 2013b), to classify keywords into those that frequently appear in general English and those that frequently occur in academic English respectively. In addition, the essays were analysed against the Business Service List, BSL (Browne & Culligan, 2016). These are the 1,700 most frequently dominant words in general business English. Business students are expected to have these words to associate themselves with the business community. The research intends to distinguish if these word lists presented in this study suffice to bridge the gap in the business discourse community.

Method

Different educational levels or fields may require different lexical properties or coverage (Chen, 2020). Furthermore, a student's reading standards may be higher for a higher academic level even within the same discipline. Laufer (1989) was the first to try a study to link reading comprehension to lexical coverage by assessing learners' self-reports and underlining unknown terms. The approach used in this study is to look at the coverage of different words based on the frequency levels assigned to texts in specific or representative corpora. For this investigation, the text coverage threshold value was established at 98 percent text comprehension. Nonetheless, not many such studies have been conducted in a Malaysian context.

The lexical coverage analysis was measured using the built-in RANGE BNC-COCA software (see Nation, 2005) to assess the number of word families required to grasp texts. There are 25,000-word family lists in the BNC-COCA word family lists in the software. The 25 lists are made up of 1,000-word families that were chosen based on frequency and range information, and it could be accessed via Compleat Lexical Tutor (Compleat Web VP). The software also has pre-loaded collections of proper nouns, abbreviations, and marginal words, used widely in various fields. These words are relatively easy for students to learn, and excluding them would raise the lexical threshold for understandable reading. These word lists were also utilised to examine the vocabulary demand of the research papers, using the study methodologies proposed by Ng et al. (2019); Kaneko (2015), Hsu (2014; 2011), Coxhead, Stevens & Tinkle (2010), just to name a few.

Results and Discussion

According to the findings of Hsu (2011), all business journal articles required at least 8,000-word families to achieve 98 percent coverage, which is much greater than the other fields of study, taking into consideration its non-scientific or technically inclined discipline. In addition, the writing of the students was examined for vocabulary benchmarking. The students' vocabulary was reported at 5,000-word families, with the New General Service List accounting for most of their vocabulary capacity. It is implied that the business students ideally require a larger vocabulary capacity to meet the 8,000-word families suggested by Hsu (2011) to cope with understanding the texts in research articles, especially in dealing with academic or even technical vocabulary.

The computation was performed using the Compleat Web VP, indicating that the total vocabulary tokens in the business students' writing texts (237,794 tokens) with almost 98 percent vocabulary coverage were 5,000-word families. It is assumed that English as a second language (ESL) business students would require a vocabulary of 8,000-word families in addition to proper nouns, marginal words, and abbreviations to command or comprehend 98 percent of a business text's vocabulary. The minimum vocabulary level for acceptable reading comprehension is thought to be 98 percent. Compared to the students' 5,000-word vocabulary, learning and memorising 8,000-word families (an additional 3,000) in two to three years may be difficult and impractical for ESL business students in Malaysia. Figure 1 depicts a screen capture of the software's output.

The same discussion would ensue regarding the fundamental concepts of determining these kids' genre of word lists. Reading business texts can be extremely difficult for students whose first language is not English, particularly those who are language-impaired but must comprehend complicated business principles. Table 1 summarises the lexical coverage data for all word lists derived from the students' writing texts

As shown in Table 1, it can be implied that the vocabulary genre or words possessed by the students are mainly found in the NGSL, frequently used English words. Thus, learners should focus on learning from the suggested word lists, those of the NGSL and NAWL, in line with the results reported by Hendry and Sheepy (2018), advocating that these word lists could cover up to 90% of the 5,000,000-word corpus. This yields better vocabulary coverage per word family and learning the words from the BSL to better associate themselves with their discourse community.

Conclusion

For this study, the text coverage cut-off value is set to 98% text comprehension. According to the analysis, business texts have a high vocabulary demand of 8,000 words. This is unsurprising, given that this discipline is widely regarded as one of the most difficult. Thus, the suggested word lists would provide meaningful alternatives and a format solution for preparing students and teachers for these complex business texts. Students will need to create a larger and more varied vocabulary and incorporate learning academic vocabulary to boost their reading comprehension and acquire far more effective comprehension and delivery of the ideas.

Having a guideline or a series of word lists to follow would facilitate acquiring the necessary vocabulary and aid in visualising the process of 'vocabulary viewing' (Durbahn, Rodgers, & Peters, 2020). Thus, teachers who are required to teach English for Business Purposes (EBP) should prepare pedagogically to meet the vocabulary needs of their students in terms of vocabulary word lists. Students are expected to learn the suggested word lists using the Vocabulary Self-Collection Strategy (VSS) (Difa et al., 2020).

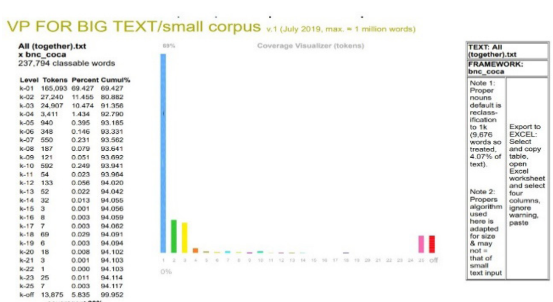

Figure 1 The Cumulative of Vocabulary Coverage in Achieving the Vocabulary Threshold (Screenshot)

Table 1 Vocabulary Coverage of the Business Students' Writing Texts

Selected Word Lists	Word Families	Tokens	Percentage (%)	Cumulative Percentage (%)
New General Service List (NGSL)	2800	222338	93.4	93.4
New Academic Word List (NAWL)	960	2616	1.1	94.5
Business Service List (BSL)	841	8085	3.4	97.9
Off-Lists		4994	2.1	100.00

Acknowledgement

We are sincerely grateful to YCU RESEARCH GRANT 2021 (YCU 2021) (Ref: 202101020YCU funded by Yayasan Canselor UNITEN).

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IMPACT OF DESIGN THINKING APPROACH ON ENTREPRENEURSHIP COURSE TOWARDS STUDENTS' LEARNING SATISFACTION

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Introduction

Entrepreneurship has become a driving force behind economic and social development, productivity, and, in certain environments, innovation. Given this scenario, international policy concentrates some of its efforts on promoting entrepreneurship, but particular importance is placed on preparing entrepreneurs whose activity will support economic sustainability (Porter, 1990; Wennekers et al., 2005; Huq and Gilbert, 2016). Universities all over the world, for their part, have been taking on their third role that of the Entrepreneurial University adding this to their role as a centre of education and as an environment for research (Commission of the European Communities, 2007; Iglesias-Sánchez et al., 2014; Dasar Pembangunan Keusahawanan Institusi Pengajian Tinggi (IPT), 2017). Additionally, the new models of higher education, particularly the European higher education area at a European level, have contributed to the incorporation of entrepreneurship as an unavoidable part of academic programs. Gradually, more and more qualifications specifically include a course on setting up a business. This knowledge is imparted across the curriculum in other subjects and in supplementary programs to foster the entrepreneurial spirit throughout university studies.

Entrepreneurship education in the new economic era

Over the past 20 years, universities are increasingly being held accountable for the student experience, treating students as consumers, and producing work-ready and entrepreneurial graduates (Darlaston & Jones et al., 2003; Rae, 2010; Cable, 2011; Millican, 2014; Huq & Gilbert, 2016). The skills that employers have identified as most important in the UK, USA, and Australia are communication, teamwork, critical thinking, problem-solving, initiative and enterprise, self-management, and learning through technology (Casner-Lotto and Barrington, 2006; Australian Industry Group and Deloitte, 2009; Lowden et al., 2011; Gilbert, 2012). In the context of the changing role of universities, a debate has reopened around the extent to which the focus on employability conflicts with a holistic approach to learning (Giroux, 2010; Ramsden, 2011; Millican, 2014). Nonetheless, the increasing demand for entrepreneurship education globally is well recognised (De Faoite et al., 2003; Finkle, 2007; West et al., 2009).

While there is little debate about these expectations within the domain of entrepreneurship education, it is important to recognise that its outputs cannot be delivered by a "one size fits all" approach to entrepreneurship pedagogy. They are the collective result of various learning approaches within the entire entrepreneurship program experience where graduate attributes are systematically and progressively developed through well-designed curricula. The success of such a program calls for educators in foundational entrepreneurship courses to adopt learner-centred teaching skills and strategies that support students not only to achieve a successful academic and social transition to higher education (Parker et al., 2004) but also to develop a sense of ownership of their learning while building a community of learning (Chory & Assad, 2002; Summers & Svinicki, 2007).

Educators thus play a central role (Seikkula & Leino et al., 2010) by shaping attitudes and providing knowledge for affective learning (Kearney, 1994), enabling students to be enterprising in their approach and sending them out to industry as entrepreneurial agents (Anderson & Jack, 2008). According to Hannon (2006), Hytti & O'Gorman (2004), and Seikkula & Leino et al. (2010), entrepreneurship educators are now at a crossroads where several transformations about entrepreneurship education are coming together. Furthermore, entrepreneurship educators need to view entrepreneurship education as a method that requires many different approaches to teaching and learning – some of which have not yet been applied in entrepreneurship curricula (Neck & Greene, 2011).

Approaching entrepreneurship education as both a "process" and a "method" enables students to go beyond understanding, knowing, and talking to using, applying, and acting. This requires entrepreneurship curricula to be inclusive and effective; facilitate a learning community where students can observe the world through a different lens and create opportunities; and include businesses as course work, serious games, roleplay, and simulations, design>based thinking, and reflective practice (Blenker et al., 2008; Neck & Greene, 2011; Fayolle & Gailly, 2008; Pittaway & Cope, 2007).

The university enterprise context

Stanford University's contribution to the development of Silicon Valley that led to what has been described as "inventing the entrepreneurial university" calls for universities to harness increased collaboration with industry, particularly since both federal and state funding is being cut to support the operation of the university (Nelson et al., 2001). A range of studies that explore how universities can act in "entrepreneurial" ways (Poole & Robertson, 2003), including those that argue that universities are already at the forefront of innovation and hence should act entrepreneurially (Conceicao & Heitor, 2002; Jacob et al., 2003) and encourage academic entrepreneurship (Shane, 2004); affirm that the university leadership, Organisational culture and strategy; the existing university-business interface; and the interaction between students and entrepreneurs all create important contexts within which entrepreneurship education is applied (Pittaway & Cope, 2007). Despite this general consensus around the context in which entrepreneurship education takes place, business schools are still being criticised for their "persistent deficiencies in certain non-technical graduate skills" (Jackson & Chapman, 2012, p. 96). Crebert (2002) and Jackson & Chapman (2012) argue that outdated curricula, inappropriate pedagogical techniques, and inadequate opportunities for work-integrated learning are some of the major reasons for such deficiencies.

Application of Design Thinking in the Context of Entrepreneurship Curricula

Huq & Gilbert (2017) reflect on Neck & Greene's (2011) observation that, while entrepreneurship is an applied discipline, it is taught and researched more often than not as natural science. They argue that entrepreneurs "think and to some extent act like designers" (p. 65), highlighting alignment in the way both diverge and converge around identifying and then acting on realising what could be, in response to an opportunity or problem. This requires skills in "observation, synthesis, searching and generating alternatives, critical thinking, feedback, visual representation, creativity, problem-solving and value creation" (p. 65) – quite a range and depth of skills for educators to enable and facilitate.

Design thinking is fundamentally concerned with human needs. Proponents of design thinking such as Tim Brown, Chief Executive Officer of IDEO, highlight that it is not a "linear, milestone-based process". Instead, it is an interaction between three spaces: "inspiration, ideation and implementation" (2008, p. 88). Brown argues that design tools can be effectively utilised in other disciplines, such as business and education, to overcome the "we know the solution" approach.

The use of empathy and engagement in designing and delivering experiences that are different and more effective is a critical aspect of the co-design process. This approach engages end-users and other key players in the service value chain and sees concept iteration as starting with the concrete and analytical mindset by looking at what does not work, then diverging into the abstract by reframing the problem and analysing what this reveals. Such synthesis leads to a clearer definition of options and applications. This design thinking approach to course design and development in an entrepreneurship program was first trialled in 2007 at RMIT in the program's capstone course: Fastrack Innovation Program (Gilbert, 2012). The design and development utilised the British Design Council (2005), which addresses four key iterative cycles in the design process: "Discover, Define, Develop and Deliver". This model also underpinned the later development of a social entrepreneurship course in which problem-based learning was matched to design thinking tools such as rapid prototyping, proof of concept via co-design, service-blueprinting and roleplay to enhance student's capacity to think analytically, intuitively, and divergently (Huq & Gilbert, 2013).

Results and Discussion

The method used in this research is quasi-experimental. Samples of this study are 143 students from various programs (Engineering and Information System/ Technology) in UTP for two continuous semesters. This study was conducted because the first 45 students learned this Entrepreneurship course with the non-design thinking method for one semester. The rest of the respondents learned the course using the design thinking method. Open-ended questionnaires were distributed to gather data as open-ended questions require complex thinking and various solutions (Badger 1992). Details of respondents are shown in the following table:

Gender Distribution
The number of male respondents is higher compared to the number of females. Out of the 145 useable responses, 108 were male, and 37 were female (Table 1).

Table 1 Gender Distribution

Gender	Frequency	Percentage
Male	108	74.5%
Female	37	25.5%

Program of Study
Table 2 below shows the program and year of study of all respondents. It shows the analysis of the questionnaires, which suggests that more respondents were from the engineering background of 81.4% while Information System/Technology was only 18.6% from the total respondents.

Table 2 Program of Study

Program	Frequency	Percentage
Information System/ Technology	27	18.6%
Engineering (Civil, Chemical, Electrical, Mechanical, Petroleum, Petroleum Geoscience)	118	81.4%

Year of Study
Table 3 indicates that most of the students were final year students (87.6%); meanwhile, only 12.4% were from Year 3. This shows that applying design thinking was easier as the respondents were in the final years of their studies.

Table 3 Year of Study

Year of study	Frequency	Percentage
3	18	12.4%
4	127	87.6%

The findings from the cluster of students who have been applied with design thinking method in their Entrepreneurship course can be presented as per items below:-

Item 1: Perceived change of qualities
Many respondents perceived that design thinking had enhanced their creativity and innovativeness level in generating and giving ideas they became more creative, which supports the findings by Choi & Kim (2017). It also helped them to be meticulous and detailed-oriented when discussing and analysing given issues in class. Other than that, they can rationalize possible outcomes in a more structured way.

Item 2: Acquired skills
Respondents could apply more skills by applying the design thinking method and thinking outside the box. They also developed other important skills such as making proper and detailed planning, critical thinking and other soft skills and developing personal attributes.

Item 3: Learning satisfaction
Respondents were satisfied with adapting the design thinking method in the Entrepreneurship course by stating their enjoyment of taking the course. They also stated that the class was very interactive and conducted in a fun way

to gain entrepreneurial knowledge. They had perceived to have gained a great learning experience and gained a lot throughout this course. This is in line with the findings of Lee and Jung (2020) that the design thinking class did have positive effects on the students' satisfaction in class.

Item 4: Team dynamics
Teamwork and collaboration among the team was a typically significant challenge for many students. However, by applying this design thinking method, many students noticed their abilities to work together in a team have increased and their team cohesiveness. It has also increased their leadership skills and ability to work well in a team, even though they are diverse and have different competencies from different engineering, IT, and business management programs.

Item 5: Communication skills
Respondents highlighted that they had developed better communication skills when communicating with others in their team. They were able to discuss and brainstorm their ideas before coming to a consensus. As a result, this has boosted their confidence level while doing their final presentation in class.

Conclusion

Design thinking has received scant attention in entrepreneurship course delivery. In addition, the design thinking element as the basis of the pedagogical approach in imparting entrepreneurial skills and mindset has yet to be identified in terms of its effectiveness in delivering Entrepreneurship courses in UTP. Hence, this study has demonstrated how design thinking intervention can enhance student learning satisfaction. In this study, design thinking became part of the classroom learning environment in diverse ways. Students were able to explore different aspects of design as they went through ideation phases until project creation. They were energized, excited, and challenged by their design tasks as they brainstormed with their peers. The best part of design thinking is that it allows students to create their projects and solve the relevant issues or problems.

Acknowledgement

The authors would like to thank Universiti Teknologi PETRONAS for funding this research under the Scholarship of Teaching and Learning (SoTL) research grant.

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KNOWLEDGE AND ATTITUDE TOWARDS THE USE OF CONTRACEPTION AMONG MEDICAL STUDENTS IN A PRIVATE MEDICAL UNIVERSITY, PERAK, MALAYSIA

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Introduction

Contraception provides many benefits, including spacing of pregnancies, postponing pregnancies in young girls at higher risk of health problems from early pregnancies, and avoiding pregnancies among older women at higher risks. Unwanted pregnancy and childbearing have significant impacts on maternal and child health because of the declining usage of contraception and the increased incidence of premarital sexual activity.

Around 44% of all pregnancies worldwide are unplanned, and 56% of unforeseen pregnancies lead to an induced abortion. In Malaysia, A study in 2007 showed that a baby is abandoned every ten days in Kuala Lumpur. Almost all abortion death and disability can be avoided through sex education, use of effective contraception, access to safe, legal induced abortion, and prompt care for complications. Hence, reproductive health services such as unmet contraception, emergency contraception, and abortion are still addressed. In a study of 1,200 mostly single adolescents aged 15-21 years in Kuala Lumpur city, knowledge on virginity, pregnancy, and contraceptive methods was low. Their sources of information were mainly from books, friends, and parents, and there was an unmet need for such information, and this topic appears as a taboo topic to be discussed. Most of the information they knew about contraception and abortion was based on what they heard from parents, partners, and peers and some information from schools; information mainly comprised fundamental knowledge of the most standard methods. Generally, Family planning, contraception, and abortion information and services are more accessible and acceptable among married people than single adolescents.

Considering the future role of medical students as family planning advisers and consultants, their understanding and attitude on contraceptive use need to be obtained sufficiently and up to date even during the undergraduate program. Hence, this is pivotal to carry out this study to assess the level of knowledge and attitude towards the usage of contraception among medical students studying in Universiti Kuala Lumpur (UniKL), Royal College of Medicine Perak (RCMP), and the association between sociodemographic factors with the level of knowledge and attitude on the usage of contraception.

Methodology

The cross-sectional study design was chosen as it was the best way to demonstrate the relationship between the knowledge and attitude towards contraceptives among medical students of UniKL RCMP. This study was conducted within six weeks, from 19th October 2020 to 27th November 2020.

According to the article of A Web-based Epidemiological and Statistical Calculator for Public Health, OpenEpi was used to calculate the sample size, and 240 medical students studying in UniKL RCMP were selected by simple random sampling technique. Since the simple random sampling technique was used, all the participants' names from Year 1 up to Year 5 were collected, and their names were labelled with identification numbers accordingly. Then, the participants were selected by using a number generator.

Data was collected by using an online questionnaire which was adapted with slight modification from previous research. The questionnaire consisted of 3 parts, namely Part A, Part B, and Part C. Part A consisted of 4 statements on demographic information of the respondents. Part B consisted of 10 statements regarding knowledge on contraception usage, while Part C consisted of 10 statements about the attitude of medical students towards the use of contraception. Knowledge questionnaires were asked in the nominal measurement scale (Yes, No, and Not sure), and attitude questionnaires were asked using an ordinal measurement scale (Likert scale). The questionnaire was distributed among both male and female medical students. A clear explanation was given to the students regarding the study, and informed consent was taken before administering the questionnaire. Microsoft Excel was used for the preliminary data entry stage, and the Statistical Package for Social Sciences (SPSS) was used for data analysis. Both Descriptive and Inferential statistics were performed, and the Chi-Square test was carried out. Hence, the knowledge towards contraception usage was categorised into good knowledge, moderate knowledge, and poor knowledge, whereas for attitude towards contraception usage was categorised as good, moderate, and poor attitude.

Ethical Consideration

Ethical clearance from the Institutional Ethics Committee was obtained, and the questionnaire was administered to the students. All identities and respondents' responses were kept confidential from any public domain.

Results

Most of the respondents in this study comprised Malay (93.36%), female (68.05%), and lived in the urban district (70.95%). The study showed that more than half of the students (65.6%, n = 158) had good levels of knowledge. In comparison, the rest of them (34.3%, n=83) had moderate levels of knowledge, and there were no students categorised under poor levels of knowledge towards the usage of contraception. Half of the respondents (51.5%) had a moderate attitude towards contraception, and 44.8% had a good attitude towards contraception. However, there were 3.7% of the respondents had a poor attitude towards contraception. There was a significant association between gender, place of birth, year of study, and level of knowledge ($p<0.05$), and there was also a significant association between place of upbringing and the attitude towards contraception ($p=0.004$).

Discussion

Based on the results, it was observed that although the majority of both male and female gender had good knowledge on contraception usage, the female gender had a higher percentage of good knowledge on conception than the male. This might be because males were less likely to discuss sex than females, allowing women to gain more information regarding contraception than men. The influence of gender, place of upbringing, and year of study on the level of knowledge and attitude towards contraception might be due to their perspective, social norms, difference syllabus between pre-clinical and clinical years of the medical curriculum, and the accessibility of family planning services between urban and rural area.

Conclusion

From this study, it was found that although the knowledge of the respondents towards contraception was good, their attitude might not very comply with their knowledge. To increase the attitude level towards contraception among medical students, collaborated and comprehensive training and reproductive health education program might be needed to implement among the students as the attitude level of a person is generally related to the level of their dispositional optimism.

Acknowledgement

We wish to thank the Ethics Committee of the Faculty of Medicine for approval to conduct this study and acknowledge the cooperation of the medical students as their contribution has been vital to the study's success.

Funding and Conflict of Interest

There was no external funding in conducting this study, and there was no conflict of interest associated with this manuscript.

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ENGLISH PROFICIENCY SKILLS: FACTORS OF MISUNDERSTANDING CRITICAL INFORMATION AMONGST AIRCRAFT MAINTENANCE PERSONNEL AND SUGGESTIONS TO IMPROVE COMMUNICATION IN ENGLISH

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Introduction

Background Information
The problem of misunderstanding critical information during aircraft maintenance work can be a significant factor in aircraft accidents. It will also affect major airline companies if the problem is not solved.

There was approximately 50 percent of a significant increase in contract maintenance experienced by major airlines, with the fastest-growing segment of the worldwide market for maintenance repair and overhaul (MRO). An MRO is a Maintenance and Repair Organisation. Therefore, an aircraft MRO is naturally a company specialising in carrying out maintenance actions on aircraft and their components. In this aviation maintenance world, English is the medium for communication. All the workers in this field need to earn English Language Proficiency (ELP) based on the International Civil Aviation Organisation (ICAO) descriptors.

English Language Proficiency is the ability of a person to use English in the way of their communication. It will cover the ability to speak, write, read, and listen while completing their tasks or jobs. Although English is the aviation language, it is not the mother tongue in most of the world. As more maintenance work is outsourced to countries outside English, language error can be a concern as it can lead to many unwanted accidents. As safety is the priority, the misunderstanding of critical information needs to be prevented.

Problem Statement
English is the common language for all pilots, air traffic controllers, and aircraft dispatchers wishing to operate at any international aviation operation. However, several incidents were caused by a misunderstanding of critical information among aircraft maintenance personnel due to human error and document error.

According to Alan (2018), English is commonly portrayed as the most recognised worldwide language for aviation. When it comes to industries where safety is a top priority, effective communication is crucial. Unfortunately, misunderstandings between speakers of a second language can happen, playing a major role in aviation catastrophes. Chatzi et al. (2019) pointed out that miscommunication has been identified as a major human element leading to errors in aviation. Still, considerable effort has to be made to minimise this risk and offer the industry error-free communication. Virovac et al. (2017) highlighted that poor communication between departments, mechanics, shifts, and managers and workers. According to Suhailah et al. (2017), poor language skills, inexperience, lack of expertise, misinterpreted or underused information, and a time restriction contribute to human errors. Meanwhile, inaccurate, inadequate, or unavailable information might be blamed for documentation mistakes.

According to Krejčíková (2019), there are numerous regional dialects, English dialects, and worldwide accents. Miscommunication issues may result as a result of these factors. Goemaere et al. (2018) pointed out that long instructions caused feelings of dissatisfaction, reduced the relative worth of the instructions, and hampered the efficacy and quality of the work being done. Atinga et al. (2018) convinced that those poorly written instructions were another aspect that affected communication. Because of bad handwriting, people confessed to being confused when they struggled to understand. Therefore, this study will look into the factors that lead to misunderstanding critical information and recommend solutions to improve English language proficiency amongst aircraft maintenance personnel.

Research Objectives
Based on the title and the problem statement, two objectives shall be considered as follows:

i. To identify the factors that lead to misunderstanding critical information amongst the aircraft maintenance personnel.
ii. To recommend solutions to improve English language proficiency amongst aircraft maintenance personnel.

Research Questions

i. What are the factors that lead to misunderstanding critical information amongst aircraft maintenance personnel?
ii. What are the solutions to improve English language proficiency among the aircraft maintenance personnel?

Significance of the Study
Findings will help highlight the factors that lead to misunderstanding of critical information amongst aircraft maintenance personnel and recommend solutions to prevent English language errors amongst aircraft maintenance personnel. Hopefully, the results will prevent any unfortunate incidents or accidents due to miscommunication through strategic interventions to improve aircraft safety.

Scope
For this research, the scope will be on the factors of misunderstanding critical information. The respondents are aircraft maintenance personnel at Maintenance, Repair, and Overhaul (MRO) companies in Subang.

Methodology

Research Instrument
This research utilised a quantitative research methodology. The data were collected quantitatively using a Google form survey questionnaire in which the questions were designed to meet the research objectives. The first section of the questionnaire was the Demographic information such as the gender, age, role, department, knowledge on the ICAO Language Proficiency Test, and awareness on achieving the Operational Level 4 in ICAO Language Proficiency Test for Aircraft Maintenance License. The questions in the second section were on the factors of misunderstanding critical information. They were divided into two criteria: Verbal (Speaking & Listening), which comprised of 10 factors, and Non-Verbal (Reading & Writing), which consisted of eight factors. The final section was the respondents' recommendations to prevent English language errors amongst aircraft maintenance personnel. As for the reliability of the Likert scale questions, Cronbach Alpha was used after the respondents completed the survey questions to test the survey questions' accuracy and reliability. Cronbach Alpha was obtained using Microsoft Excel, Data Analysis key feature of "Anova: Two-Factor Without Replication".

Respondents of the Study
The respondents of this study were taken from purposive sampling. They were the experts in the aircraft maintenance field, such as engineers and technicians from Maintenance Repair and Overhaul (MRO) department in Subang. Their knowledge and experience in aircraft maintenance work would allow them to give responses to the survey questions. There was 1200 aircraft maintenance personnel in Subang, but only 10% of the survey responses volunteered.

Research Procedure
A proposal is made to generate ideas for the research. There will be a title, background information, problem statement, research objectives, research questions, the significance of the study, and scope in the research proposal. These ideas are the kick-starters for proper planning on conducting the whole research. The preliminary research was done by reading reports, articles, journals, and data from previous research within the scope of the study. The data from the literature review is used to develop survey questions. It was divided into 4 sections that will fulfil all the research objectives. The completed questions are later converted into Google form online platform. This is to ease the respondents' way of answering all the questions and reaching as many targeted respondents as possible. The Google form is distributed amongst 120 aircraft maintenance personnel. The link of the Google form is passed through Whatsapp to friends working at MRO at various companies. The

results from 120 respondents were tested by Cronbach alpha to test the reliability of the questions. The results were also analysed by presented figures, percentages, and graphs. Sharma (2016) stated that Cronbach Alpha might be used to determine the method's reliability for large-scale results. Suggestions and further study were concluded at the end of the research.

Data Analysis

To analyse the data, nine variables were taken into consideration: non-native English speaker, the usage of a complex word, language barrier, lack of vocabulary, dialects, long verbal instructions, complicated instruction in task cards and manuals, direct translation, and informal words. The data gained from the survey were analysed by using Microsoft Excel Software and Cronbach Alpha. Results were presented through frequency counts and percentages.

Results

Demographic Information

There was a total of 120 respondents responded to the Google Form. Based on Table 1, 90 (75%) male respondents and 30 (25%) female respondents. In the term of age, there were 37 (31%) of the respondents were in the range of 18 to 23 years old, 58 (48%) respondents were in the range of 24 to 29 years old, 13 (11%) respondents were in the range of 30 to 35 years old, and 12 (10%) respondents were in the range of 36 years old and above. Next, in the term of their role in the aviation industry, there were 29 (24%) aircraft maintenance engineers, 68 (57%) aircraft maintenance technicians, 12 (10%) on-job training students, and 11 (9%) of them were from other related aviation industry personnel. In terms of the department, 37 (31%) of the respondents were from the avionics department, 75 (62%) of the respondents were from the mechanical department, and 8 (7%) of the respondents were from other related aviation industry personnel. Next, with regards to the respondents' knowledge of the ICAO English Language Proficiency Test, 7 (6%) of the respondent did not know at all, 80 (67%) of the respondents did not have much knowledge on it, and 33 (27%) of the respondents knew a lot about the ICAO English Language Proficiency Test. Lastly, in terms of respondents' awareness of the need to achieve Operational Level 4 in the ICAO Language Proficiency Test for Aircraft Maintenance License, 88 (73%) answered yes, and 32 (27%) answered no.

Table 1

CHARACTERISTIC	ANSWERS	QUANTITY (%)
Gender	Male	90 (75%)
	Female	30 (25%)
Age	18-23 years old	37 (31%)
	24-29 years old	58 (48%)
	30-35 years old	13 (11%)
	36 and above	12 (10%)
Role	Aircraft Maintenance Engineer	29 (24%)
	Aircraft Maintenance Technician	68 (57%)
	On Job Training Students	12 (10%)
	Other related aviation industry personnel	11 (9%)
Department	Avionics	37 (31%)
	Mechanical	75 (62%)
	Other related aviation industry personnel	8 (7%)
Knowledge regarding ICAO Language Proficiency Test	Not at all	7 (6%)
	Not much	80 (67%)
	I know a lot.	33 (27%)
Awareness on the needs to achieve Operational Level 4 in ICAO Language Proficiency Test for Aircraft Maintenance License	Yes	88 (73%)
	No	32 (27%)

Respondents' demographic background based on Gender, Age, Role, Department, Knowledge regarding the ICAO Language Proficiency Test, and awareness of the need to achieve Operational Level 4 in the ICAO Language Proficiency Test for Aircraft Maintenance License. (n=120)

The Factors of Misunderstanding of Critical Information

English Language Proficiency was divided into two parts. The first part was verbal, which was speaking and listening, and the second part was non-verbal, which was writing and reading. These two parts identified six factors of misunderstanding critical information for verbal communication and seven factors of misunderstanding critical information for non-verbal communication.

Verbal English Communication

Figure 1 shows the result of the most common factors for misunderstanding verbal communication (listening and speaking). The highest factors of misunderstanding critical information claimed by the respondents were when complicated words were used and difficult to understand English dialects (53%) each. The next most common factor of misunderstanding critical information misunderstood long verbal instruction with 59 (49%). 55 (46%) of the respondents said that language barriers such as aircraft noise are the third common factor. The fourth factor of misunderstanding of critical information was lack of vocabulary with 53 (44%) respondents. 47 (39%) of the respondents claimed that English was not their mother tongue as one factor in misunderstanding critical information. Lastly, the respondents added factors of misunderstanding critical information: when talking too fast, ignoring the instruction, confusion in interpreting instruction, and lack of practice by one (1%).

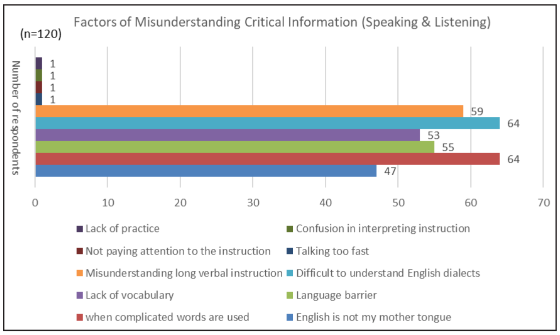

Figure 1 The factors of misunderstanding critical information in verbal English communication

Non-Verbal English Communication

Figure 2 shows the result of the most common factors for misunderstanding non-verbal English communication (reading and writing). The most common factor of misunderstanding critical information for non-verbal communication was the usage of complex words claimed by 65 (54%) respondents. Next, 61 (51%) claimed that poorly written instructions in manuals were the factor. The third factor of misunderstanding of critical information was the written instructions were not specific to the task, 52 (43%). 49 (41%) of the respondents said that complicated instruction in the task card was the factor of misunderstanding critical information.

In comparison, 39 (33%) of the respondents believed that vocabulary was the factor. 33 (27%) of the respondents claimed that direct translation is a factor in misunderstanding critical information. Using informal words was the least claimed factor by the respondents with 27 (22%) respondents. Only one (1%) respondent added in the misunderstanding of critical information for non-verbal communication, which was misinterpreted information due to time pressure.

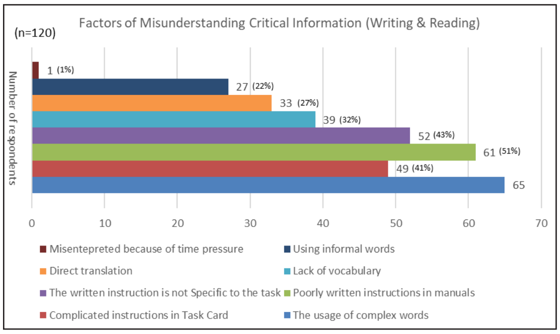

Figure 2 The factors of misunderstanding critical information in non-verbal English communication

Ways to Improve Aircraft Maintenance Personnel's English

Language Proficiency

There were six suggestions on how to improve Aircraft Maintenance Personnel's proficiency for verbal English communication (listening and speaking) and eight suggestions to improve Aircraft Maintenance Personnel's proficiency for non-verbal English communication (reading and writing).

Verbal English Communication

Figure 3 shows ways to improve Aircraft Maintenance Personnel's proficiency for verbal English communication (listening and speaking). All 120 (100%) claimed that providing training could enhance the level of English language skills of the personnel. 117 (97%) of respondents said that using simple English could improve English proficiency. The respondents third most claimed was that providing an introductory course of Aviation English for maintenance personnel by 115 (96%) could improve English proficiency. Next, 101 respondents suggested encouraging mechanics and engineers to speak English all the time to improve their speaking in English. 95 (79%) of the respondents recommended that bilingual coaching to the aircraft maintenance personnel could improve verbal English communication. Lastly, 93 (77%) of the respondents mentioned that teaming up with native English speakers to carry out tasks could improve English language proficiency.

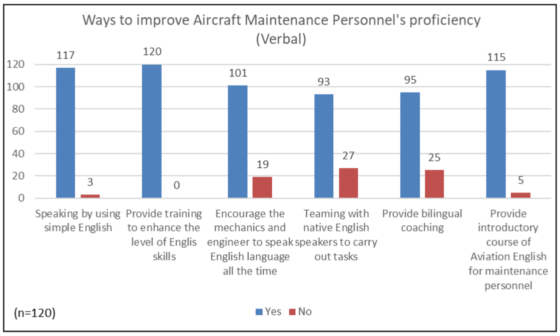

Figure 3 Ways to improve Aircraft Maintenance Personnel's proficiency (Verbal)

Non-Verbal English Communication

Figure 4 below shows ways to improve Aircraft Maintenance Personnel's proficiency for non-verbal English communication (reading and writing). A total of 116 (97%) respondents claimed that providing an introductory course of Aviation English for maintenance personnel could improve non-verbal English communication amongst aircraft maintenance personnel. Next, there were 114 (95%) of the respondents claimed that providing diagrams to enhance understanding of the written text and providing training to enhance the level of English language skills could enhance non-verbal English communication. 111 (92%) of the respondents believed that by providing Standard Technical English (STE) guidelines to write technical reports could enhance English skills in writing and reading. To provide a glossary in the manuals was claimed by 107 (89%) of the respondents to improve non-verbal English communication. 92 (77%) respondents claimed that providing bilingual coaching could improve English language proficiency in non-verbal communication. Lastly, only 55 (46%) respondents believed that translating technical documents to Bahasa Malaysia could improve non-verbal English language proficiency amongst aircraft maintenance personnel.

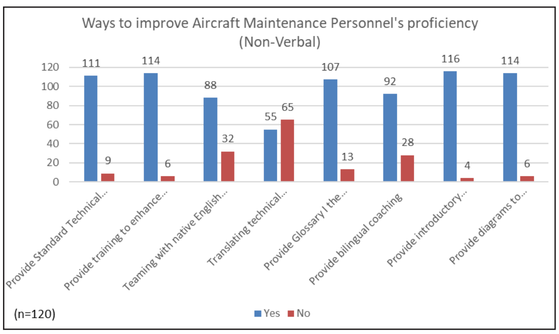

Figure 4 Ways to improve Aircraft Maintenance Personnel's proficiency (Non-Verbal)

Discussion

The Factors of Misunderstanding Critical Information

Verbal Communication

From Figure 1, there were three most common factors of misunderstanding critical information in verbal communication: speaking and listening. When complicated words were used, and difficulty understanding English dialects was claimed by 64% of the respondents as the factors of misunderstanding critical information in verbal communication. 49% of the respondents stated that misunderstanding long verbal instructions could be the factor that led to misunderstanding English verbal communication. This may be because not all personnel have the same level of vocabulary and comprehension skills. Next, there were many dialects from many nations or districts in the world and Malaysia, respectively. The dialects could affect the communication as the pronounced word is misheard by some personnel due to misunderstanding. In the interview conducted with ten respondents, the majority of the respondents agreed that when complicated words were used, difficulty to understand English dialects and misunderstanding long verbal instruction as the factors of misunderstanding critical information in verbal communication. These findings agree with CAP718 (2002) which shows that the lack of proper communication of the action required was rife and led to a series of mistakes. This finding of this research is consistent with those of Krejčíková (2019). Many regional dialects, English varieties, or international accents may then cause or lead to miscommunication problems. These results were consistent with Goemaere et al. (2018). The existence of long instructions raised feelings of dissatisfaction, decreased the relative value of the instructions, and hindered the efficacy and quality of the work being performed.

Non-Verbal Communication

From Figure 2, there were three top common factors of misunderstanding critical information in non-verbal communication: writing and reading English skills. 54% of the respondents claimed that complex words could be a factor in misunderstanding non-verbal communication. 51% of the respondents also stated that poorly written instructions could lead to misunderstanding the English language in written communication. Only 43% believed that the writing instruction was not specific due to misunderstanding written communication. These results might be because most aircraft maintenance personnel did not have the same competency of English skills. Therefore, when a complex word is used in writing and reading, it might lead to confusion and miscommunications. The instruction needs to be clear to be done faster and more accurately in written instruction. If the written instruction is poor, it can cause a delay in work done or assumptions. A written instruction needs to be tally with the task and must be detailed. The instruction cannot be too general to the task. This is maybe because not all aircraft maintenance personnel have the same knowledge and skills. Some of the personnel might be new or do not have sufficient experience. Most of the respondents in the interview session agreed that the usage of complex words, poorly written instructions, and written instructions is not specific to the task are the factors of misunderstanding critical information in non-verbal communication. These findings were consistent with Atinga et al. (2018) that poorly written instructions were another aspect that affected communication. Because of bad handwriting, people confessed to being confused when they struggled to understand.

Ways to Improve Aircraft Maintenance Personnel's English Language Proficiency

Verbal English Communication

From Figure 3, 100% of the respondents stated that they could improve their English language proficiency in verbal communication by providing training to enhance the level of English language skills. Next, 97% of the respondents stated that they could improve their English language proficiency by using simple English. 95% of the respondents also stated that providing an introductory course in aviation English could improve verbal communication English proficiency. The results might be because everyone needs training and an introductory course in aviation English to enhance their English skills. Each MRO company needs to provide this kind of training quarterly so that the competency of each personnel is enhanced. This will make sure fewer English language errors could happen. Complexity could make things go wrong. Therefore, using simple English could improve aircraft maintenance personnel's English language proficiency. English is not the first language in Malaysia, but most people in Malaysia can understand simple English. These recommendations, which were providing training to enhance the level of English language skills, speaking using simple English, and providing an introductory course of aviation English, were agreed by a majority of the respondents in an interview session with ten respondents. These findings support the idea raised in other research, which is White (2018). In the aviation sector, workers must have English language skills and communicate efficiently and effectively. To do this, English language training must be designed and developed to meet the aviation industry's requirements. These findings of this research were consistent with those of Knezevic (2015) state that Simplified Technical English may be used to make substantial changes in the direction of efficient communication and improvement in maintenance efficiency.

Non-Verbal English Communication

From Figure 4.8, 97% of the respondents stated that they could improve their English skills in non-verbal communication by providing an introductory course in aviation English. Next, 95% of the respondents stated that providing diagrams to enhance understanding of the written text and providing training to enhance the level of English language skills could improve aircraft maintenance personnel's English language proficiency in non-verbal communication. This could be because training is the most efficient method to improve anything, including English language skills. Providing more diagrams could help aircraft maintenance personnel simulate the task in their mind, and the work could be done by minimising the errors. In the interview session with ten respondents, providing an introductory course of aviation English, providing diagrams to enhance understanding, and providing training were the recommendations to improve aircraft maintenance personnel's English language proficiency were agreed by a majority of the respondents. These findings support the idea raised in the research by White (2018) that the company should provide training to Aircraft Maintenance Personnel. The training will help the Aircraft Maintenance Personnel (AMP) become familiar with the technical conditions. Engineers engaged in aircraft maintenance should be encouraged to write in Standard Technical English (STE). Mohammadzadeh et al. (2015) said that the company should provide personnel with English training courses. These results support the ideas presented in the report. Ximeng (2017) also stated that English training is essential and beneficial, and when it comes to translating it into actual work, they are optimistic about the efficacy of English training. These findings are also consistent with Gutiérrez et al. (2015) that the idea of stimuli pictures brings to the teaching process improves cognitive processes that help the creation of idea sequencing.

Conclusion

This research has investigated the factors that led to misunderstanding critical information and the solutions to prevent English language errors. Survey questionnaires were distributed to 120 respondents who are amongst aircraft maintenance personnel via Google Form link. In relation to the research questions of this study, it is now possible to identify the factors that lead to the misunderstanding of critical information amongst the aircraft maintenance personnel. This research also recommends solutions to prevent English language errors among aircraft maintenance personnel with this research. The results from the analysis indicate that,

1. In verbal communication, critical information is misunderstood when complicated words are used,

difficulty understanding English dialects, and long verbal instruction.

2. In non-verbal communication, critical information was misunderstood when using complex words in writing or reading poorly written instructions, and the instructions were not specific to the task.
3. English language skills can be improved in verbal and non-verbal communication by providing specific training on English language proficiency, communicating in simple English, providing an introductory course of aviation English, and providing more diagrams to enhance understanding. Hence, the language error can be reduced.

In general, the findings of this research indicate that misunderstanding critical information amongst aircraft maintenance personnel is caused by the difficulty of understanding English dialects in verbal communication and poorly written instruction in non-verbal communication. However, the research was limited by the survey scope that only focuses on the personnel at the MRO companies. The same research must be conducted with a bigger scope of aviation personnel related to before, during, or after maintenance tasks such as the authority, manufacturer, management staff, air traffic controllers, and pilots to determine the factors of misunderstanding critical information and recommendations prevent English language error.

Recommendation

Based on the findings and conclusions of the study, the following are several recommendations,

1. Misunderstanding critical information can be reduced by ensuring that English language proficiency among aircraft maintenance personnel is consistently up to par.
2. Providing specific training of ELP and introductory courses of aviation English could potentially enhance the English language proficiency of aircraft maintenance personnel as it hopes to improve the vocabulary on technical terms and comprehension.
3. Aircraft maintenance personnel need to have an English working environment by using simple English to ensure English is used daily during tasks completion.
4. Misunderstanding critical information also can be encountered by eliminating the human factor of shyness by asking the senior technicians or the LAE regarding the uncertainties.

Recommendation for Future Research

The study is mainly focusing on the aircraft maintenance personnel. It is recommended that further research be carried out on a bigger scope related to other aviation personnel such as the authority, manufacturer, management staff, air traffic controllers, and pilots. The factors are primarily based on English language error itself. Therefore, it is highly recommended to investigate the use of English and its effects on human performance and the working space environment. Further analysis of the content of the specific training for ELP and the introductory course of aviation English can improve English language proficiency amongst aircraft maintenance personnel. Hence, the English language error can be avoided.

Acknowledgment

We would like to thank Unikl MIAT for the support and encouragement in completing this research.

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A STUDY ON READING ACTIVITIES AMONG AIRCRAFT MAINTENANCE PERSONNEL (AMP)

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Introduction

Aircraft Maintenance Personnel (AMP) are responsible for keeping aircraft operating safely and efficiently. To maintain airworthiness, the AMP must perform inspection, operation, and maintenance by referring to the aeronautical publications (FAA, 2008). All the aeronautical publications are written in the English language, and due to this, the AMP is expected to be proficient in the English language. This is vital as the International Civil Aviation Organisation (ICAO) (2003: p.1-3) claimed that the AMP "need to know not only the importance of using the maintenance manuals but also to understand the language and structure of the documents". Even though the AMP's responsibilities require them to read various technical documentation, reading skills cannot be said to be the most important skill for the AMP as it is not mentioned elsewhere. Shawcross (2005), however, stresses that reading is the most dominant skill used as the AMP spends about 20% of their working hours consulting written materials to ensure the safety of all the aircraft parts by conducting regular services, repairs, and overhaul.

It should be noted that studies on AMP are mainly focusing on human factors. The study on the AMP received attention only recently, and it is still in its infancy. For example, Burda and Maciejowski (2019) conducted research to identify the communicative needs of Polish Air Force University students and the challenges that the course developers and instructors confronted. Another research that focused on the AMP was a study by Helguera (2019). They studied English language training needs among the AMP in Argentina.

The present study focused on reading activities among the AMP to understand the nature of reading activities among the AMP to determine the types of activities that required the AMP to read.

Literature Review and Methodology

According to Doležalová (2015), reading literacy is an important transversal competence for private, professional, and public life. Kinnison and Siddiqui (2013) divided technical documents about aircraft maintenance into four types, namely:

1. Manufacturer's documentation such as aircraft maintenance manual (AMM), component maintenance manual (CMM), and illustrated parts catalogue (IPC);
2. Regulatory documentation such as advisory circulations (ACs), airworthiness directives (ADs), and notice of proposed rulemaking (NPRM);
3. Airline-generated documentation such as inspection manual (IM), task card (TC), and engineering orders (EOs); and
4. ATA document standard.

As for the maintenance training Organisation (MTO) must be appropriate to the scope and level of training undertaken (CAAM, 2021).

Concerning this issue, it appeared that there is a need to study the nature of the AMP to understand what and when the technical documentation is used.

To satisfy the objectives of this study, qualitative research was held. According to Hammarberg, Kirkman, and de Lacey (2016), qualitative study technique usually depends on the purpose of the study. Apart from that, qualitative study answers "how" instead of "how many" (Absoul, 2021). For this study, a semi-structured interview was selected as the method to collect the data. The participants were selected among the specialists who used to work in the aviation industry and the specialists who are currently working in the aviation industry. Due to the COVID-19 pandemic situation, we could only manage to interview six participants. Not only that but the interviews were also conducted online.

Result

Types of activities

Data analysis demonstrated that the AMP usually communicates via written documentation. The AMP also deals with various types of documents that can be associated with aircraft maintenance activities. Communication occurs when the AMP is performing the aircraft maintenance tasks in a team. Figure 1 below illustrates the process flow on how the AMP realised the communicative tasks through written documentation.

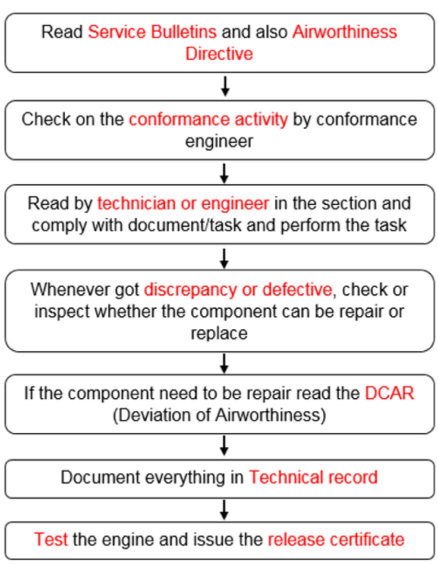

Figure 1 The process flow of the communicative tasks

As can be seen from Figure 1 above, the purpose of the communication is to complete aircraft maintenance tasks. As stated by Participant 5, they need to communicate during work via related documents due to some problems. Following this situation, the AMP needs to refer to the deviation of airworthiness (DCAR) to fix the problems.

Reading documentation

Since there were two categories of participants, the second findings exposed two different types of documentation, namely (1) documentation used in the aviation industry and (2) documentation used at the university. It is interesting to note that there are similarities in documentation used by both the aviation industry and the university. The documents can be categorised as (1) aircraft manufacturer's documentation, (2) regulatory documentation, and (3) airline-generated documentation.

Discussion

The findings from the semi-structured interviews established the following about reading among the AMP,

1. The nature of the work of the AMP requires them to read the documents to assist the AMP in performing the aircraft maintenance activities.
2. Most types of documentation used in the aviation industry and documentation used at the university are quite similar. The practical training conducted at the university reflects the aircraft maintenance activities performed in the aviation industry.
3. Even though the participants come from different backgrounds, they still refer to the same written documentation such as AMM, IPC, and AD.
4. Communicative tasks require the AMP to communicate with their teammates, especially during shift rotation.

Conclusion

This study began with the primary aim to conduct the analysis to understand the nature of reading among the AMP. It can be concluded that the purpose of reading activities among the AMP is to complete the aircraft maintenance tasks. The function of technical documentation, in addition to that, is to assist the AMP in performing and completing all the aircraft maintenance activities.

Acknowledgement

The authors would like to acknowledge the participants for their time and contributions.

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A STUDY ON WRITING ACTIVITIES AMONG AIRCRAFT MAINTENANCE PERSONNEL (AMP)

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Introduction

Aircraft Maintenance Personnel (AMP) are responsible for keeping aircraft operating safely and efficiently to ensure the airworthiness of aircraft and aircraft parts, regular services, repairs, and overhauls are required. When performing inspection, operation, and maintenance, the AM needs to refer to the aeronautical publications (FAA, 2008). According to FAA (Viera, Santos & Kubo, 2014: p. 2), “verbal and written communication skills are the backbone of Maintenance Resource Management”. However, engineering students are said to have difficulties with writing skills (White, n.d.). Shawcross (1992), in addition to that, stressed the importance of writing among the AMP since they need to document their work and justify the actions performed through writing various types of reports.

The present study focused on writing activities among the AMP to understand the nature of writing tasks among the AMP and identify the importance of writing activities among the AMP.

Literature Review and Methodology

According to Khan & Ankushrao (2019), engineering students are often equipped with technical knowledge but lack soft skills such as writing. Likewise, Gray, Emerson & MacKay (2005) claimed that science graduates do not usually have appropriate writing skills. According to Kinnison & Siddiqui (2013) and Shawcross (1992), several examples of technical reports should be written by the AMP, such as logbooks, troubleshooting, airframe record, engine records, and test reports.

To satisfy the objectives of this study, qualitative research was held. According to Hammarberg, Kirkman, & de Lacey (2016), qualitative study technique usually depends on the purpose of the study. Apart from that, qualitative study answers “how” instead of “how many” (Absoul, 2021). For this study, a semi-structured interview was selected as the method to collect the data. The participants were selected among the specialists who used to work in the aviation industry and the specialists who are currently working in the aviation industry. Due to the COVID-19 pandemic situation, we could only manage to interview six participants. The interviews were also conducted online.

Result and Discussion

Types of writing tasks

Data analysis demonstrated that the AMP usually communicates via written documentation. When asked about types of writing tasks, the participants stated that they dealt with various types of documentation relating to their work. The majority of them mentioned that they usually write specific documents for aircraft maintenance activities that have been performed.

The findings obtained from the interviews with six participants revealed that they are involved in preparing a written document in their job. Most of them informed that some of the examples of documentation are routine and non-routine task cards and inspection report cards.
Apart from that, there are other documents that the AMP need to write, such as,

P1: Inspection report card, workshop process label, component holding label, and unserviceable label
P4: Release certificate, inspection report card, and airworthiness directive on the task card.
P5: Holding label form, inspection report card and task card.

The importance of writing tasks among the AMP

The interview found that written documents are important for the AMP to perform since they are categorised as legal documents.

They also mentioned that the Civil Aviation Authority Malaysia (CAAM) would audit the documents every year to ensure that all the aircraft maintenance activities performed have been documented. As explained by Participants 2 and 4,

P2: All the written documents must be recorded and be kept for CAAM audit
P4: As evidence for we to comply and for the auditor to check either we documented or not.

Apart from that, written documents are important because it would be the evidence that the AMP has done their job as Participants 3 and 5 put in,

P3: As proof that you have signed after the job has been done.
P5: As evidence for the job has been done

Lastly, Participant 6 explained that the nature of their work that working in shift required them to document all the activities to ensure the other AMP would continue the ongoing task based on what they had written. Participant 6 added that this document could be said as “a medium part of communication between AMP and as evidence”.

Conclusion

This study began with the primary aim to conduct the analysis to understand writing activities among the AMP. It can be concluded that,

1. The AMP usually writes all the related documents after they have completed their tasks.
2. A written document in aviation proves that they have completed the tasks following the procedures written in the manuals.

Acknowledgement

The authors would like to acknowledge the participants for their time and contributions.

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CHALLENGES OF THE NETWORK ERA IN LANGUAGE EDUCATION: INNOVATIVE METHODS AND APPROACHES IN TEACHING FOREIGN LANGUAGES

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Introduction

Since the end of the last century, the world education system has been undergoing a transformation caused by several factors. First, it is the changing broad socio-cultural context of the educational sphere in general and foreign language education in particular; the challenges of recent years, when education has been forced to move to an online format, which requires finding new effective approaches to learning in this situation (Bartosh, Galskova & Kharlamova, 2017, p. 18-26). And second, the paradigm shift in science in general and linguistics in particular, which was expressed, first of all, in the recognition by most scholars of the anthropocentric paradigm.

Methodology

This study is based on the theoretical framework of foreign language teaching methods (Bim et al, 2009); communicative-oriented language teaching (Bim et al., 2009); the developmental potential of a foreign language (Milroud et al., 2011); the use of ICT in foreign language teaching; psychological and pedagogical and lingo-didactic approach in the field of intercultural communication and education (Baksanksy et al).

Results and Discussion

Analysis of the genesis and development of value systems in the modern context of social life allows us to identify new axiological relationships arising in education at the present stage of its development. These changes result from the evident interdependent and objective processes in the socio-cultural space, which stimulate new social attitudes. Among these processes are globalisation and regionalisation, the formation of innovative society, the rapid accumulation and updating of information, changes in the nature of knowledge and technology of its acquisition, and computerisation and informatisation of all areas of modern human life and education (Figure 1).

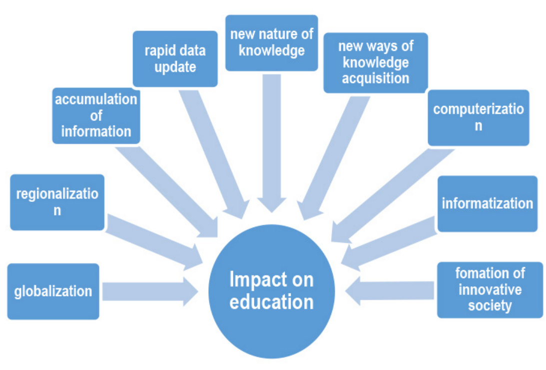

Figure 1 Processes influencing modern education

The impact of these processes on education affects the instrumental changes at the level of individual elements in general and the level of theoretical ideas about the patterns of educational activity, including foreign language teaching. This means that in recent decades, ideas about the objectives, conditions, content, forms, methodology, and means of teaching foreign languages, and, most importantly, the results of language education are changing significantly.

The modern age with its global problems has turned language proficiency into a certain factor of human capital: today's professional, speaking a foreign language, becomes a personality in society, socially and economically accessible, with prominent perspectives for successful professional and personal self-realisation. In other words, the geo-economic world and the transnational reality demand the need to consider modern language education as an important tool of investment attractiveness of a particular person and society as a whole, and, at the same time, as a sociopolitical and sociocultural phenomenon of particular importance for such areas as social cohesion, development of its social structure, development of an individual personality.

The ability to overcome cultural and linguistic obstacles is an important component of a modern person. The knowledge of a foreign partner's language for communication and its ethnocultural features plays a leading role in this process. New information and communication technologies that provide access to a rich information heritage and virtual contacts with different cultures and their representatives are greatly important in this process.

When considering the impact of globalisation processes on language education, it is necessary to keep in mind the change in the role of a foreign language in all the aspects of its consideration. The most interesting, in our opinion, is the fact that these processes have generated new lingo-educational values in the depths of education: the ability of people to cooperate and mutual responsibility, high social activity, and competence in carrying out social interactions in a foreign language as well, in the modern multicultural and multilingual landscape, the ability to dialogue, which is based on the recognition of the equality of languages and cultures. The orientation of language education towards these values has determined the high socio-political cost-effectiveness of intercultural ideas, which were embodied in lingodidactics in the intercultural approach. The basis for building a methodological system on intercultural grounds, including the solution of training tasks of technological properties, form the results of philosophical, linguistic, psychological, pedagogical, and lingua didactic research in the field of intercultural communication and intercultural education (Baksansky, Gnatik & Kucher, 2010; Baryshnikov, 2000; Zinchenko, Zusman & Kirnoze, 2008; Suprunova, 2013; Khaleeva, 1989).

In accordance with these results, the intercultural approach, as any culture-centered methodological approach, is characterised by the focus on learning a language as a cultural phenomenon, introducing the learner into the country's cultural space of the language being studied to motivate them to learn the subject. But the intercultural approach also has its distinguished characteristics. It is its focus on the establishment in the educational process of equality of native and the new languages, own and other cultures, the formation of students' ability to build a mutually beneficial dialogue in a foreign language with all the subjects of modern multicultural and multilingual common living space, that is, the ability and willingness to intercultural communication (Kytina, Pochinok & Bartosh, 2020).

Lingodidactics, based on the main provisions of the theory of intercultural communication (Leontovich, 2007), has made serious progress in understanding the lingua didactic essence of the concept of "intercultural communication" as a set of specific processes of interaction between communication partners belonging to different lingo-ethnocultural communities (i.e., partners belonging to different languages and cultures) (Khaleeva, 1989, p. 57). This communication does not imitate authentic communication between members of the same culture. Still, it takes place in intercultural situations in which communicating people have to "be (feel) in the dimensions of two different sociocultural communities, reflecting on the specifics of two different lingosocieties" (Khaleeva, 1989, p. 58).

Within the framework of the intercultural approach, the goal of learning foreign language changes, which, as we know, determines the specificity of both its content and technology. If, for example, the communicative approach, which won the minds of scientists and practitioners since the second half of the last century, is focused on the formation of foreign language communicative competence, following the model of native-speaker communicative competence, the intercultural approach is aimed at forming intercultural communicative competence, not identical to native-speaker competence. Intercultural competence is the ability to interact productively with speakers of another culture in their language (Gromova, 2011, p. 11) because the speakers belong to different lingocultural communities. This competence, unlike foreign-language communicative competence covering to a greater extent linguistic and speech abilities, reflects mainly the ontological aspect of human personality formation

(Malkova, 2000) and is connected with comprehension of both the linguistic picture of the world of a foreign speaker, i.e., comprehension of a set of knowledge about the world imprinted in the language form, and the conceptual picture of the world, i.e., comprehension through texts in a broad understanding of another social reality.

Thus, as noted by several researchers, there is a pronounced shift in the standard to which language learners should strive (Bernstein & Bosova, 2004). If previously the standard was a native speaker, now it is a "mediator of cultures" (Elizarova, 2005, p. 22), i.e., a person who has not only foreign language communicative competence but also intercultural competence or readiness and ability to perceive "the other", the ability to cooperate, appreciate the human community, understand and accept the differences that exist between peoples or ethnic groups. This goal responds to the challenges of the modern sociocultural space of language education due to the globalisation processes of social development. Secondly, linguists, considering the intercultural aspects of teaching a foreign language, are increasingly active and, in our opinion, justifiably address "authentic communication", in which the learner generates authentic statements, i.e., statements - independent, proactive, reflecting its individuality, accumulated experience, including linguistic and speech, expressing formulated thoughts, genuine emotions, and feelings, - authentic communication situations in which the most natural for students emphasis is shifted from linguistic aspects to meaningful, semantic ones. The intercultural approach convinces us that teaching a foreign language, which was discussed above, is possible only based on material taken from real communication, pragmatic, artistic, professionally-oriented (special) texts, the current youth press, i.e., exclusively based on authentic texts.

Thus, even this quick and surface analysis of the intercultural approach, which was sprinkled with ideas of the globalisation order at the beginning, shows that it offers ample opportunities to introduce new colors of another culture into the picture of the world of the learner, created with the help of the native language, - the culture interiorised through the language being studied, and at the same time develop the ability to explain (at a certain level) other people's way of life/behavior, the ability to use a non-native language as a tool of knowledge of another lingoculture and expand their worldview through an understanding of lingocultural concepts formalised using the studied language, and, as a result, better awareness of their worldview, the importance and need to know their native language and culture, their belonging to a particular ethnic group, region of their residence and the state. It is no accident that there is a connection between the intercultural approach and the cognitive aspects of foreign language learning, which, as emphasised in lingodidactics, is associated with the need to understand the characteristics of culture and language of their people, with the ability to analyse intercultural differences and take them into account in communication, with a willingness to understand another culture and another way of life (Soboleva, 2011, p, 14).

In connection with the latter observation, it is necessary to refer to such factors of social development as regionalisation (Zinchenko, Zusman & Kirnoze, 2008, p. 109]. What it means is that despite the transformation of humanity in all its dimensions into an integral whole, the increasing diversity and the generation of a broad multicultural and multilingual context of the life of a modern person, his desire for interaction and close cultural, business, scientific, etc. contacts, representatives of different lingo-ethnocultures actively defend their identity, national culture, and native language. At the same time, they are aware that national culture and language are essential factors in preserving national and lingo-ethnocultural identity. This value-load of language education introduces new "plots" in understanding the goal of foreign language teaching - developing the students' ability to use a foreign language as a tool for learning the linguistic and ethnocultural specificity of a foreign language and simultaneously comprehending their identity. This ability, which is not an innate quality and should be the object of targeted development and, above all, in the foreign language learning process, is essential for the intercultural approach. Its content is designed to combine common human values and values inherent in the native society, to form in students the need to find something that unites people and not separate them, as well as the ability to understand the linguistic and ethnocultural specificity of a speaker of the learning language while maintaining the "individual national natural style" of communication (Baryshnikov, 2000, p. 11), which should characterise his speech and non-verbal behavior in intercultural communication with his foreign peers.

Thus, two contradictory and interdependent processes - globalisation and regionalisation - have generated a new worldview "structure" of the era. Hence, the modern person's new requirements can be reduced to three characteristics: responsibility, tolerance, and identity.

Language education, of course, is called to take this into account, using reasonable technologies of "connecting" the learner to different conceptual systems, comparing these systems with the picture of the world of the native lingo-ethnic society to understand better the problems of modernity and its role in solving them. From this point of view, the possibilities of e-learning are quite obvious.

Immersing themselves in authentic information in a foreign language, learning it and comparing it with their own experience and knowledge, students come into computer-mediated contact with a foreign culture and its speakers, acquire real speech, cognitive, socio-cultural experience, and along with this, and experience life, the social, experience of emotional and value relationships to themselves, the world of their culture and culture of another nation. Thus, we are talking about those personal parameters that make the modern man capable of social interaction at the intercultural and interethnic levels in the modern socio-cultural context.

In the era of innovation and densifying information, the public sphere, especially its the production and entrepreneurial segments, has become interested in innovation-oriented professionals who have creative thinking and the ability to perceive innovation.

Responding to the new situation of social development, requiring a person capable of acting independently and proactively, ready for self-realisation and self-actualisation, for a change of way of thinking and living, and innovative activities, language education puts forward new imperatives in the field of goal-setting and content. These new imperatives are related to preparing a young generation of people who are ready not only to exist quite successfully in the modern world but also to transform it, capable of technological, Organisational proactively, social innovations, and be creative in doing so. Consequently, the new times impose new requirements not only for the subject (foreign-language communicative competence) but also (primarily) for personal, educational results, focusing education on new personal characteristics of the student, which are associated with his social and personal characteristics and non-standard, innovative thinking. Therefore, it is necessary to talk about the new values of language education, including the learner’s ability, sensitivity, and receptivity to innovation.

The system of education in general and language education, in particular, has responded most naturally to the challenges of the new innovative stage of social development by adopting a competency-based educational ideology, which forms the basis of the competency-based approach. In its framework, language education is designed to prepare graduates with non-standard, innovative thinking, the ability to act proactively and independently in problematic situations, which dictates the need to go beyond language as a system into the field of content and meaning, and the use of interesting and innovative technological solutions, including information and communication technologies. It is from this point of view that the competency-based approach itself can be recognised as innovative.

The student’s knowledge, skills, and abilities are socially oriented and integrated into his real-life context.

Technologised environment has made valuable such personal qualities as the ability to search for information in various sources, including foreign ones, its critical evaluation, critical thinking, the focus on mastering new competencies. Being open and ready to perceive and generate new ideas, analyse, generalise, solve non-standard problems, interpret information and express your point of view, and manage information obtained from different sources, including electronic ones - these are the imperatives of the target settings of modern language education.

Since any experience is formed only due to the practical implementation of a specific activity, it is necessary to create conditions for the practical use of the studied non-native language, including in situations of interpersonal and intercultural interaction with its native speakers. E-learning tools and technologies should play an important role in solving this problem. Their use implies a “dialogic” educational process, characterised by group forms of learning, creativity, and interactivity, the actual interaction of all subjects in the learning of foreign languages. Therefore, in recent years, lingua didactics has paid special attention to creating conditions in which students learning a foreign language are encouraged to do active research and project work with the help of the language, show independence, their own (mental, speech, speech-thought) activity. Formation of competencies of cognition with the help of the language studied, self-knowledge, and improvement of their competencies dictates the need to refer to the resources of creative and interactive technologies of electronic teaching of foreign languages. Finally, let us note the role of computerisation and informatisation in determining the imperatives of modern language education.

Often the concepts of “computerisation” and “informatisation” are used synonymously, which is wrong. The fact is that in relation to language education, computerisation means the introduction of electronic computer technology in the sphere of teaching foreign languages, and informatisation means the activities associated with the construction and development of telecommunications infrastructure of language education, which combines geographically distributed information resources, as well as the use of communication and information technologies. Consequently, education itself has become a mass communication system, providing the teacher and the student access to global foreign language experience and knowledge and the possibility of contact in virtual space with different cultures and its representatives.

Computerisation and informatisation fundamentally change an individual's lifestyle and accelerate the pace of development of professional and educational spheres of life. But we need to argue that the unified world of information and Technologised reality put language education before the new challenges dictated by the era of information transformation or the "network era". The result of computerisation and informatisation of social and educational reality is the emergence of a "planetary communicative space" in which, as Prokhorov (2017) notes, "both the virtuality itself and the process of communication itself act as 'reality', since it is this process that its participants materialise" (p. 13), and which, along with the new model of continuous updating and application of knowledge, significantly changes ideas about the values and meanings of education.

Since virtual space of communication due to its temporal and spatial openness proper has generated a new type of communication - "virtual cultures' polylogue" (Prokhorov, 2017, p. 13), it seems important to conduct a comprehensive study of it to identify the specific features and develop tools and techniques that allow foreign language learners to form the ability to be effective in this polylogue.

Of course, the new priorities of language education arise in social development, which is influenced by civilisational changes. Each civilisational era forms its own set of worldview structures and is characterised by new value and meaning relationships in society (Stepin, 2008), which determine behavioral patterns and regulate the interpersonal behavior of modern people.

Therefore, the socialisation and education of young people, the formation of their system of values and attitudes are impossible without the system of values, which was formed in a certain historical period. As for the modern civilisational stage, its system includes the values of creative human activity and innovation, individual autonomy and responsibility, human rights and freedom, etc. Computer technology forms a new type of consciousness and personality of young people who are characterised by so-called "clip thinking" as a kaleidoscopic flow of perceptions and impressions, a low level of critical consciousness and self-awareness, they lack clear logic and rational grounds.

In this context, the responsibility of teachers for properly Organised e-learning increases immeasurably, which is designed not only not to harm the student, but, on the contrary, to act as a tool to solve complex problems associated with both the achievement of learning outcomes and the development of students, familiarising them primarily with humanistic values of universal order, the basis of which is the value of linguistic and cultural diversity, the value of dialogue between cultures.

Linguistics emphasises the rich potential of language education in terms of humanistic development of the student, expanding his spiritual space, enrichment with knowledge of humanistic, universal values of native and foreign cultures, reflected both in specially selected value-oriented materials (Rodchenkova, 2010), and socio-cultural educational technologies (Smetanina, 2010). After all, the language is an important tool for successful human activity in today's multicultural and multilingual community of people united by globalised and information-rich problems. Thus, the era of the global innovation mode, on the one hand, and the need to build a knowledge economy and the information saturation of existence of a modern person, on the other, caused the widespread appearance of situations requiring non-standard solutions. Under the new conditions, there is a demand for people who are able and willing to make these decisions, to act freely, creatively, and with interest. These personal qualities are also a consequence of the challenges of the present century and, therefore, should be the subject of formation in the language education system, which will undoubtedly have an increasing influence on the value and semantic and Organisational, and technological aspects of language education. This, in turn, gives language education a special mission: to develop and shape the personality. Its content is the student's personal development for his successful participation in real and virtual intercultural interaction with representatives of other lingo-ethnocultures in the process of knowledge and self-knowledge with the help of the studied language of another culture. In this regard, of particular importance are, first, taking into account the cultural, ethnic, and religious specificity of students, secondly, developing their ability to understand the other world, and in the process of mastering it - their lingoculture and its role in the formation and development of the world multilingual and general cultural space, and, thirdly, to learn to use all possible and primarily electronic tools of knowledge and mastering.

The paradigm shift in science in general and linguistics, particularly at the end of the 20th century, was expressed in recognition of the anthropocentric paradigm by most scholars. Being accepted in lingodidactics required the professional community to deeply reconsider the theoretical foundations of language education and methodological knowledge obtained in the new socio-cultural and educational reality.

The paradigm focuses on lingua didactic research and language education as a set of general ideas and even philosophical attitudes. It affects the methodologies and tools used in language teaching. It should be noted that the historiography of foreign language teaching methodology as a science convincingly shows that the adoption of each of the paradigms determines its historical milestones of development, the dynamics, and characteristics of different methodological theories, concepts, approaches to foreign language teaching, and methods. The choice of the scientific vector of methodological research, as convincingly shown by Russian researchers (Gez, Frolova, 2008; Mirolubov, 2002), is largely influenced by the following circumstances,

1. the paradigmatic view of linguists at their object of study - language;
2. the paradigmatic view of linguists and lingua didactics at the relationship between native and foreign languages;
3. the paradigmatic view of psychologists at the teaching process;
4. and the paradigmatic view of educational philosophers and didacticians at education.

And if we talk about the anthropocentric paradigm, it, by its human-centered views of the above objects, has made relevant to language education not only the communicative experience of the learner but also the value-semantic and emotional evaluation. Within this paradigm, a new sociocultural type of education in general and language education, in particular, is constructed as a certain "interdependent integrity of the main elements of the educational process and the ways of their formation, inherent in a particular type of society" (Smirnova, 2001, p. 148-149).

For our area of interest, the specificity of these elements, as N.D. Galskova notes (Galskova, 2015) comes down to the following main points,

1. First, the main value of lingo-education becomes the teacher's personality and the learner, its motives, new-formation, uniqueness, competence.
2. Secondly, we should point out the specifications of the goal of language education, which in the context of the anthropocentric paradigm is the development of the learner's personality - a linguistic personality.
3. Thirdly, the idea of the content of lingo-education changes, which is lingoculture, both the native culture of the learner and the culture of the language being studied.
4. Fourthly, the main type of communication in the educational process becomes motivated communication, interaction, and cooperation of all its subjects, interaction, authentic communication, and the main methods are represented by new interactive technologies or by N.F. Koryakovtseva definition – "personality-centered productive technologies" aimed at Organising active interaction (joint activities) of subjects of the learning process to accomplish the planned subject, meta-disciplinary, personal and professional goals.
5. And finally, fifthly, since the involvement of modern language education in the social relations system is characterised by authenticity, it involves the implementation of productive activity by students, which is carried out using e-learning.

Thus, the advent of the anthropocentric paradigm in lingua didactics has led to scientific interest in the problems associated with the process of mastering a non-native language in educational settings in isolation from the country of the language studied, his ability to language, general and key competencies as constitutive characteristics of his personality, personal qualities, and properties. That is why it can be argued that the basis of the anthropocentric paradigm becomes the concept put forward as an educational goal - it is the "linguistic personality", its communicative and cognitive aspects and spheres. This concept reflects the main characteristics of a person's ability to interact with other subjects in a particular language socially. The formation of this ability is possible only in learning situations that require,

1. From students - their activity to solve communicative and cognitive tasks of a creative and problematic nature, reflexive self-assessment, understanding, and awareness of the fact that they are in the dimensions of two (several) cultures;
2. From linguadidacts - scientific attention to the problems of developing the personality's ability to cognise and comprehend another image of consciousness, another picture of the world, the regularities of a person's mastery of language not only in the real but also in virtual intercultural space.

So, nowadays, in connection with the progressive reorientation of the educational sphere towards the personality and value and meaning orientations, the axiological (value-centered) approach to education has become especially relevant.

The history of methodology science testifies that a change of 'style of scientific (methodological) thinking' or 'paradigm' leads to an evolution of methodological thought that finds its expression first of all in methodological approaches (Figure 2): from linguistic (in the first half of the twentieth century) to communicative (in the second half of the twentieth century) to culturological (at the turn of the century) and communicative (in the second half of the twentieth century) to culturocentric (at the turn of the century), and today and tomorrow it seems (along with culturocentric, of course) to be axiological (value-oriented) approaches. It is in the center of the latter is the ability and readiness (communicative, psychological, etc.) of the student for authentic communication in a foreign language and cognition through this language, familiarising him with universal values, the formation of his value and semantic guidelines, the need for learning/cognition as a means of changing the world and self-realisation in the social and personal sphere and an individually motivated attitude to his education, its level, and quality, including in the field of foreign language and culture (Galskova, 2020).

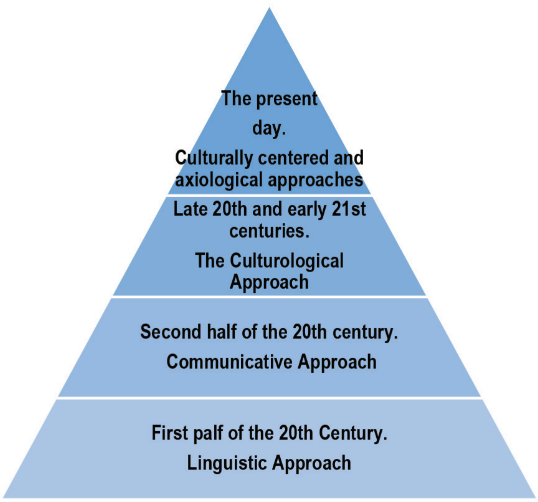

Figure 2 Evolution of Methodological Approaches (20th century to the present)

As for the social essence of this phenomenon, it is manifested in the fact that lingo-educational value relationships are always formed and transformed in the course of the historical development of society, they are associated with changes in different spheres of human life: in a broad social context and in the depths of language education itself. Since each historical era is characterised by a specific set and hierarchy of values, their appropriation by a particular individual in the educational process is an important basis for its formation. However, as noted earlier, socio-economic and political transformations create only the prerequisites for new methodological directions. They do not always lead to the transformation of the value system because the latter is associated with changes in various spheres of social and human life. Nevertheless, an analysis of these transformations allows us to clarify the specific set and hierarchy of values in the sphere of lingo-education at a particular stage of its formation to determine the value essence of education itself in the field of foreign languages. This subject has undergone a tough historical development in methodological science (Tareva, 2011). Today we can claim that the educational value of the discipline "Foreign Language" is a personality, its actualisation based on knowledge and perception of a foreign reality and another culture and a better awareness of their native language and culture (Galskova, 2020).

The primary condition for the successful implementation of this provision is the use of new learning technologies and modern technological solutions designed to prepare students and universal identity, who have universal ways of learning, can adapt flexibly in changing life situations, independent critical thinking, work independently with information. Consequently, new technologies, unlike information-reproductive ones, should have a creative component, a focus on "discovering" new knowledge for students, accumulating new experience in using this knowledge, new ways of learning, and an orientation toward their educational product, which has personal meaning for each of the students. All these requirements are fully met by modern technology of e-teaching and e-learning of foreign languages.

Conclusion

Thus, language education, developing intercultural ideas, recognise among its important values not only the ability to live together but also the ability to realise its universal essence as a cultural and historical subject, the ability to appreciate the human community, to understand and accept the differences that exist between peoples, ethnic groups.

Innovative transformation of language education should result in qualitative changes in the objectives, conditions, content, forms, methodology, and means of learning and teaching activities and educational outcomes, introducing novelty into them and creating conditions for improving the effectiveness and quality of educational processes. Any lingua didactic innovation is designed to bring about progressive changes in the student's lingo-cultural training, forcing a rethinking of the educational process in terms of new demands on the individual and society in relation to the foreign language. Preparation of a modern young person who meets the requirements of today and tomorrow is associated with the need to form not only the need to learn a foreign language and master it as a means of communication, cognition, self-realisation, and social adaptation, but also key competencies that allow them, if necessary, to improve their language and educational level, that is, to improve their competences. Information-reproductive ones should have a creative component, focusing on "discovering" new knowledge for students, accumulating new experience in using this knowledge, new ways of learning, and an orientation toward their educational product, which has personal meaning for each of them the students. All these requirements are fully met by modern technology of electronic teaching of foreign languages.

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TECHNICAL STUDENT'S PERCEPTION TOWARDS ONLINE LEARNING DURING COVID-19 PANDEMIC

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Introduction

The COVID-19 pandemic has put higher educational institutes (HEI) worldwide in limbo, making the academic calendar unpredictable. In addition, all physical face-to-face teaching and meetings are ceased, facilities are closed to physical access, and students are sent home (Azman and Abdullah 2021) or stay in the hostel. Face-to-face learning has always been perceived as advantageous in social presence, social interaction, and satisfaction (Bali and Liu 2018). However, online learning has become a necessity during the pandemic (UNESCO 2020). Furthermore, as academic activities have transitioned to online learning platforms, problems concerning the preparation, design, and effectiveness of e-learning have emerged as a new concern in academia (Muthuprasad et al., 2021). This research aims to gather information from the technical student's perspective for online learning improvement.

Through an online survey of 303 students, this study reached to understand the student's preference for online learning. According to the findings, 100% of respondents embraced online classes and dedicated themselves to online learning during this pandemic. Smartphones have the most significant percentage of chosen devices during class, suggesting suitable font size in the learning slides. Furthermore, it has been discovered that students prefer online examinations compared to traditional examinations. Students believe that online programs are appealing because of their flexibility and convenience. However, broadband connectivity concerns in remote locations make it difficult for students to participate in online learning efforts. However, in the engineering education system, where many courses are practical, a complete transition to online mode may not be viable, necessitating developing a hybrid model. The results from this article will serve as empirical evidence to help develop a curriculum for the new norm.

Method

A questionnaire is developed consisting of Part A and Part B. Part A contains the respondents' personal information. Part B is concerned with the assessment of students' perceptions of the online class.

Part B is divided into five sections, covering student readiness, student awareness, suitability of the online platform, teaching and learning (T&L) process, and program suitability. Part B uses a rating scale for an answer in a Likert-type question. Questionnaires are distributed to correspondence online covering the Kulim district area.

The information gathered from the questionnaires is analysed using the Mean average value. The range of Mean average values is supported from literature and becomes the reference in determining the correlation between parameters.

Result and discussion

This chapter focuses on the data analysis from the completed surveys. The raw information from the survey is transferred into Microsoft Excel and used to examine the data. The data is statistically analysed using percentages, mean scores, and standard deviations.

This study received responses from a total of 303 people. Part A of the study's results is described in a table, including the number of respondents and their percentages, while part B includes the mean score and standard deviation.

Respondents by gender – Part A

Part A includes respondents 'background data regarding the gender, age, type of institution, type of program taken, year of study, type of device used for online classes, and duration of online classes in a weekly schedule.

Table 1 Number and percentage of respondents by gender

Gender	Frequency	Percentage (%)
Male	144	47.5
Female	159	52.5
Total	303	100.0

Table 1 above shows the number and percentage of respondents randomly selected from Tuanku Sultanah Bahiyah Polytechnic UniKL MSI, Vocational colleges, and others. A total of 52.7% of the total respondents are female students, which is higher than the percentage of male student respondents, 47.3%.

Respondents by age – Part A

Table 2 shows the percentage of respondents based on the age of students who answered this questionnaire. Students aged 18-19 years the most answered this questionnaire which is 33.33%. This age range is usually students who follow semesters 1 to 4 or are in years 1 and 2. Then followed by the second most data is in the age range of 20-21 years which is 33.00%.

Table 2 Number and percentage of respondents by age

Age (years)	Frequency	Percentage (%)
16 – 17	13	4.33
18 – 19	100	33.33
20 – 21	99	33.00
22 – 23	36	12.00
24 above	52	17.33
Total	300	100.00

Respondents by institution background – Part A

Table 3 Number and percentage of respondents by institution

Institution	Frequency	Percentage (%)
Polytechnic (PTSB)	194	64
UniKL (MSI)	85	28.1
Kolej Vokasional	17	5.6
Others	7	2.3
Total	303	100.00

Table 3 above shows the percentage of respondents by institutional background category. 64% of the total respondents who answered were students of Tuanku Sultanah Bahiyah Polytechnic. At the same time, 28.1% of the respondents are UniKL MSI students. The rest are students from other institutions such as Vocational Colleges and others.

Respondents by used device – Part A

Figure 1 shows the percentage of respondents based on the type of device used to follow classes online. As many as 52% of the total students use smartphones as an online classroom medium. The use of laptops or personal computers is 47%. The data also shows that students rarely use a tablet or Ipad as a medium which is only 1%.

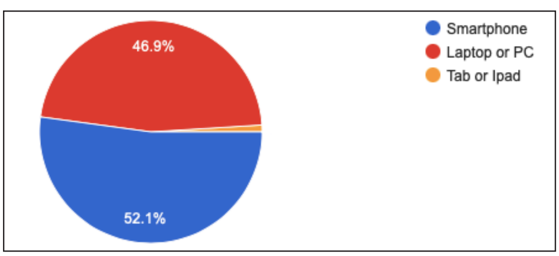

Figure 1 Percentage of respondents by the type of device used.

Respondents according to the number of class hours in a week – Part A

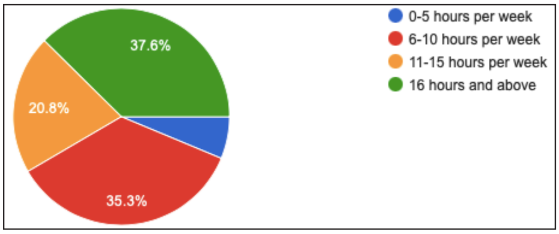

Figure 2 Percentage of respondents by hours per week class

Figure 2 shows that 37.6 percent of students take online programmes for 16 hours or more per week. This suggests that students must spend a significant amount of time online. 35.3 percent of students attend classes for 6-10 hours per week, while 20.8 percent attend lessons for 11-15 hours per week. The data also shows that only a tiny fraction of students are involved in classes lasting 0-5 hours a week, at least 5.7 percent.

Analysis of Part B (students' perceptions of online classes)

For the analysis of Part B, a questionnaire was constructed using a Likert Scale 1 to 4 to measure students' perceptions of the online classes followed during the study, especially during the Covid19 pandemic season. This is because, during this pandemic period, institutions of higher learning had to conduct classes entirely online, hybridized according to the current situation of the pandemic.

Feedback for this section was interpreted based on the mean score of the four-point Likert Scale as in table 4.4 below referring to the Riduwan (2010).

Table 4 Mean score interpretation by scale level

Skor Mean	Mean Level
1.00 – 1.50	Partially related
1.51 – 2.50	Low related
2.51 – 3.50	Medium related
3.51 – 4.00	Highly related

Student's readiness aspect

Table 5 shows the results of data interpretation on students' readiness to attend classes online. The mean score showed a mean value of 2.79 (standard deviation: 0.7803), which is moderate. This level indicates that students are not yet fully prepared to take classes online. Regarding internet facilities used by students, the mean value is also 2.64 (standard deviation: 0.690), the lowest of the overall items of student readiness. This data shows that more than half of the respondents have problems getting a fast and good internet line.

Table 5 Students' readiness level by online class

No	Item	Mean	Readiness level	Standard deviation
S1	My internet line is stable and fast.	2.64	Medium	0.690
S2	I have no problem attending online classes at 8 am.	2.86	Medium	0.715
S3	I have no problem attending online night classes.	2.71	Medium	0.806
S4	The device I use is suitable for online classes.	2.96	Medium	0.600
Average Score		2.79	Medium	0.703

Student's awareness aspect

Table 6 Student's awareness related to online class

No.	Item	Mean	Concern level	Standard deviation
S1	I prefer online classes rather than face-to-face.	2.54	Medium	0.908
S2	I am always motivated to attend online classes.	2.79	Medium	0.777
S3	I am fully focused during online classes.	2.55	Medium	0.789
S4	I always submit my assignments on time.	3.05	Medium	0.692
Average Score		2.73	Medium	0.792

As for student awareness, as shown in Table 6, the overall analysis average score is 2.73 (Standard deviation: 0.792), which is medium. The lowest Mean scores were on items S1 and S3. Students preferred online classes over face-to-face, and students focused entirely during online classes, showing Mean values of 2.54 and 2.55 Medium approaching low levels.

Suitability of online class platform

Table 7 Suitability of platform for an online class.

No.	Item	Mean	Platform suitability level	Standard deviation
S1	The online platform provided is user-friendly.	3.01	Medium	0.593
S2	The online platform provided is easily accessible.	3.00	Medium	0.604
S3	The online platform provided is compatible with my devices.	3.00	Medium	0.598
S4	The online platform provided is convenient for discussion sessions.	2.80	Medium	0.736
Average score		2.95	Medium	0.633

According to Table 7, the findings of the Mean score analysis of the suitability aspect of the online classroom platform are greater than the level of readiness and awareness of the students as previously indicated. This element has an overall mean score of 2.95. (Standard deviation: 0.633). At 3.00, the mean values for items S1, S2, and S3 were greater. This shows that the online platform supplied is user-friendly, accessible, and compatible with the devices used by the students. Only the score of 3.00 remains in the Medium to High range, indicating that this class platform still requires improvement.

Teaching and Learning (T&L) process

Table 8 shows that the online teaching and learning process has a Mean Medium Average score of 2.82. (Standard deviation: 0.640). Students had trouble understanding online education, as evidenced by the lowest Mean value of 2.57 on item S4. For this facet, the overall Mean score values for the other elements were also at the medium level. This study also reveals that the online T&L method has to be enhanced. Lecturers may use multimedia in various ways while online to pique students' attention and comprehension.

Table 8 Student's opinion on the T&L process of online learning.

No.	Item	Mean	Level of T&L process	Standard deviation
S1	The T&L method used during online classes is appropriate.	2.89	Medium	0.597
S2	Two-way communication takes place during an online T&L session.	2.91	Medium	0.643
S3	The duration of T&L online is sufficient.	2.90	Medium	0.600
S4	Online T&L sessions are easy to understand.	2.57	Medium	0.721
Average score		2.82	Medium	0.640

Course Suitability Aspects

Table 9 The suitability level of courses conducted online

No.	Item	Mean	Level of suitability	Standard deviation
S1	I prefer face-to-face classes.	3.09	Medium	0.811
S2	I prefer a combined class between face-to-face and online.	3.01	Medium	0.750
S3	I prefer to have an extra class.	2.44	Low	0.736
S4	Institutions provide fast internet data.	3.34	Medium	0.707
S5 The course syllabus is suitable to be conducted online.		2.89	Medium	0.710
S6	The number of online classes in a week is appropriate.	2.98	Medium	0.614
S7	Online exams are the best.	3.21	Medium	0.774
Average score		2.99	Medium	0.729

Table 9 shows the suitability level of the online course from the student's perspective. This component has a mean average score of 2.99 (standard deviation: 0.729), which is Medium. One item with a low mean value, item S3, of the student's eagerness for extra classes on campus. The low mean value shows that the pupils do not want to take any more classes.

Conclusion

In essence, online learning has become a powerful force in reshaping the educational scene, especially in Malaysia. In response to COVID-19, planning to conduct, coordinate, and assess the technical subject online is necessary. This document serves as preliminary information for planning and implementing a significant learning transformation. The current condition is satisfying as this research shows that students are satisfied and interested in the online learning environment. In summary, COVID-19 has given the student the possibility to implement online learning since educational systems must keep up with the rapid rise of new technologies, making online and remote learning a must at the tertiary level in Malaysia around the world.

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THE ELEMENTS OF MULTIMEDIA IN EDUCATIONAL TECHNOLOGY IN THE CRITICAL APPRECIATION OF TRADITIONAL PROSE

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Introduction

This research aims to explore the relationships between multimedia and folklore. The objective is to characterize the elements of multimedia and its relationship with literature in traditional prose *Asal Padi*. The research also aims to classify the elements of multimedia and its literary characteristics in traditional prose *Asal Padi*. Lastly, it also aims to explore dominant elements of multimedia in the said traditional prose.

Students have little interest in folklore and students always find it difficult to appreciate the intended meanings of the literature. At school levels, the subject Malay Literature is an unpopular one. Many students claimed that the discourses between texts and contexts are the reasons why students do not opt for this subject. This research tries to draw a network of relationship between elements of multimedia and Malay literature. It tries to understand if the use of multimedia can inculcate the students' interest in reading Malay literature with the idea that literature is multidimensional, contextually framed and intercultural sensitive.

In terms of research design, we employ a qualitative strategy. The participants are 100 students from SMK Tasik Selatan, Kuala Lumpur, through purposeful sampling method. The research instrument is the courseware about KOMSAS that contains the prescribed Malay literary texts. The findings indicate that with the use of multimedia, students could appreciate Malay literature and enjoy the literature class.

Literature Review

"Global Middle Ages Project," is research at the University of Texas that bridges digital literacy and literature. The project leader, Professor Geraldine Heng believes that "the project breaks the institutional and national boundaries that have long influenced medieval studies, creating a global rather than fragmented view of the medieval past." (Heng, 2009).

The rapidly growing cyber media nowadays has had an impact on the development of various fields of knowledge. This is no exception in the field of literature. The rapidly evolving culture of information and communication technology in all fields around the world is impacting the development of various disciplines of knowledge. The world of literature which belongs to the world of creative arts is also no exception to the influence of this culture. This shows that the use of multimedia courseware in the field of literature has become one of the best alternatives for adolescents to understand the content and storyline of folk literature.

Oral literature or folk literature is an old Malay literature also known as classical literature. Oral literature is passed down from word of mouth by storytellers who are called *penglipur lara*. Roslina (2013) stated that *penglipur lara* has a unique way of delivery the oral literature, there is systematic and scientific knowledge. Therefore, the delivery of oral literature and the development of the disciplines are in line with the currents of modernity, and could inculcate interest especially among adolescents.

This study uses the Anthology *Ku Ingin Berterima Kasih* (2015) published by *Dewan Bahasa dan Pustaka* and the Ministry of Education Malaysia. This study focuses on the traditional prose text *Asal Padi* which is a traditional prose contained in the anthology *Ku Ingin Berterima Kasih* (2015).

Method

This study analyzed the dominant multimedia elements. Multimedia elements that are focused in the use of a multimedia courseware entitled *Asal Padi*, namely graphics, text, animation and audio. The methodological framework is pinned using questionnaires and observation methods. Through the questionnaire, respondents answered questions related to multimedia elements in the prose *Asal Padi* which have been categorized into graphics, text, animation and audio. Sampling is a form of effort for a researcher to obtain information from a sample that can be representative of the population. According to Mohd Majid Konting (2004), a population is an observation of a group of individuals or objects. Meanwhile, sampling is a research strategy in which researchers can obtain resources about a population from some individuals who are members of the population.

While some of the individuals involved in the sampling represent a population studied is known as the sample. The selected respondents were among adolescents aged between 12- and 15-year-old. This study was conducted among adolescents because of the level of adolescent understanding of the traditional prose delivery of the story *Asal Padi* (2015), which is appropriate for their age and language use. Besides, the theme, plot and setting of *Asal Padi* (2015) are also deemed appropriate for the students.

Discussion

This study shows that the effect of adolescents' appreciation and interest in literature in multimedia is very encouraging. Based on the scores obtained through the questionnaire and observation, adolescents who are very interested in the presentation of traditional literary texts *Asal Padi* are 85 (85%) people, 15 (15%) people are interested, 0 (0%) are less interested, and not interested 0 people (0%).

This shows that teenagers are very interested in the story of *Asal Padi* and it is easy to understand after the literary elements are translated into multimedia graphics. This is in line with Gagne's Information Processing Theory (1975) which is shown through the response phase. Through *Asal Padi* multimedia courseware, the response phase experienced by teenagers has generated interest and motivation to watch it. Through this method, the story of *Asal Padi* has been translated through the use of multimedia elements such as graphics, audio, text and animation. The situation allows teenagers to keep it in long -term memory. According to Nur Aisyah (2011), multimedia elements can maintain focus, improve cognitive ability and social skills to learn in a more comfortable environment in terms of time and ability of adolescents to study literary texts.

Thus, the interactive courseware has increased the interest of teenagers and can motivate teenagers to understand literary works. This is shown in the following tables,

Table 1 Dominant elements of multimedia in *Asal Padi*

Elements of Multimedia	Graphics	Texts	Audio	Animation
Percentage	50%	25%	15%	10%

Table 2 Impact on critical appreciation of *Asal Padi*

Students' Interest	Very interested	Interested	Neutral	Not very interested	Totally not interested
Percentage	85%	15%	0%	0%	0%

This explains that teenagers can easily understand the plot of *Asal Padi* with the help of the element's multimedia. According to Muhammad (2000: 39), the function of literary works is that literature helps to educate adolescents towards noble values. In fact, the uniqueness of this literary work is also emphasized by Rahman (1990) who stated that there are two reasons why literary material is interesting. First, the literary material uses language in the best way and if the material chosen is a work or part of a quality literary work. Thus, the language remains interesting, especially from the aesthetic point of view. Second, literary material has an appeal that can arouse interest in reading it and this appeal stems from the nature of literary works that often have entertainment features.

Conclusion

Thus, this study suggests that *Asal Padi* multimedia courseware has given a positive and entertaining effect and to increase the interest among teenagers. The use of such methods has successfully demonstrated its effectiveness in increasing the interest and motivation of adolescents in learning literary texts. Indirectly, the use of multimedia can be a tool in helping students to approach literary texts.

In conclusion, the *Asal Padi* courseware has good impact on teenagers. This study has proven that multimedia courseware could assist students to understand literary works. Researchers also found that graphic elements have attracted the interest of teenagers to understand the storyline of the Origin of Paddy. Graphic elements became the attraction to teenagers due to the bright color factors on literary elements such as the characters and the setting.

Acknowledgement

We are sincerely grateful to the BOLD grant (Ref: J510050002/2021032) funded by Universiti Tenaga Nasional, Malaysia to carry out this study.

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TEACHING THE CONCEPT OF NATIONHOOD TO ENGINEERING STUDENTS: AN EXPLORATION OF ETHNOCRITICAL THEORY AND PRACTICAL CRITICISM

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Introduction

This study explores an innovative and creative pedagogical method in the teaching of nationhood pertaining to identity and diaspora to engineering students using Malaysian prose. In fact, Millan (1996) explored the use of poetry in engineering students. But apart from moments of conjecture, this study did not focus on nationhood-related prose and the use of local materials. This is the gap that this current work-in -progress paper is trying to fill in.

The use of Ridzuan Othman's Calculator in a CEFR-aligned curriculum differs from many studies that have been reported thus far. This study aims to use local materials, which are context-specific and culture-specific and this can help the students to imagine vividly. This study uses participants from Malaysian Literature in English classes from an engineering faculty. There were 65 engineering students who participated in this study. The study uses the theoretical frameworks developed by Vethamani (2004) which specifically discussed the learning and teaching of literature in Malaysia. This study also employed site visits to some places described by writer. This can help the students to understand clearly rather than doing an arm-chair observation. The motivation for this study is to engage in a more nature-based learning setting. The study is designed to let the students explore by themselves, the issues that are described in the poems and the identity issues at large, particularly framed within a Malaysian context.

The findings indicate that students are more motivated and inspired when they can see the succinct connections between prose and nationhood. This has inspired the students to use interdisciplinary ideas and converge the knowledge gained in other subjects to discuss the issues of nationhood in Malaysia. The idea of convergence is particularly important for students to see things from a different perspective. The pedagogical implication is that engineering students can learn to see the issue of nation-building in Malaysian from the humanistic lenses.

Literature Review

Calculator is an instrument to count and perform mathematical activities and the output is always in the numerical forms. We can, therefore, associate calculator to rational, scientific, logical and mathematical values. Within the philosophy of mathematics, this paper anchors on the branch of Mathematical Platonism where it can be defined as the view that (a) there exist abstract objects – objects that are wholly nonspatio temporal, nonphysical, and nonmental – and (b) there are true mathematical sentences that provide true descriptions of such objects. The discussion of Platonism that follows will address both (a) and (b). (Balaguer, 2017). This can be further discussion in (Lakoff & Johnson, Philosophy in the Flesh:

the Embodied Mind & its Challenge to Western Thought, 1999), (Lakoff & Nuñez, 2001).

Due to its anomaly as a title, this story uses the word "Calculator" as a title. It portrays a different perception and cognition. Unlike the traditional titles in mainstream prose where titles are usually are sentimental, figurative and descriptive such as Things Fall Apart by Chinua Achebe, Far from The Madding Crowd by Thomas Hardy and In A Far Country by K.S. Maniam. Hence, the title is a palimpsest in the literary tradition. Calculator is a short story by Ridzuan Othman (2002), is about a Malaysian couple who are going planning for their memorable honeymoon. They are two interesting persons. Jane, whose ethnicity is unclear, and she could be a Eurasian, a Chinese or an Indian. Suleiman, on the other hand, is a Malay. The story describes the dialogues, conversation and thought of the two personas. In their conversation, they use a lot of nature-related metaphors to invoke and fixate on the questioning of identity and nationhood. This interplay is prominent in stories related to postcolonialism and diaspora. (Chrisman & Williams, 1994).

What are the epistemological, ontological and theoretical underpinning of the idea of nationhood? The concept of nationhood within a larger realm of the postcolonial worlds has been discussed rigorously by Aijaaz (1992). In the Malaysian context, nationhood can be defined as a cultural concept (H'ng, 2004). This coincides with Raihanah's idea that nationhood is intricately related to individuality and ethnicity (Raihanah, 2008). Ahmad Zufrie and Ida have also discussed nationhood in relation to ethnocentrism (Ahmad Zufrie & Ida Baizura, 2018). Hence, this paper adopted this theoretical lens for the discussion in which we can view nationhood as the macro level of neighborhood, sisterhood etc. The paper seeks to question the concept of nationhood in its abstract notion, and the generative role in a young nation like Malaysia. It echoes the idea that we need time to maintain cohesion and a sentimental of wholeness among individuals participating in social systems on such a huge scale (Zawiah, 1994).

Methodology

In this research, qualitative literary criticism and qualitative content analysis are the methodological framework. Qualitative literary criticism is, according to Kaelin (1964) "instruction in literary criticism must contain two elements: the laying down of a workable method of analysis (aesthetics), and "travaux pratiques" in the use of the method laid down (criticism)". Data analysis was conducted using NVivo.

Discussion

In September, she will marry Suleiman. The marriage certificate and the accompanying event are unlikely to add any significant new info to the body of knowledge already existing between Suleiman and herself. They know each other well. Which is not to say they know each other perfectly. After all, they are not appliances that come with instruction manuals and warranty cards. They are not objects, so much as spaces to be explored, inhabited. They are foreign lands. (Lines 10-16).

Malaysia has a rich history of the British colonisation. The influence of the British colonisation is immensely perceptible in the landscape and heritage of Malaysia. The discussion on the interplay of colonisation and nationhood is discussed in (Gabriel, 2020). In this short story, the author, a Malay, depicts that "they know each other well, which is not to say they know each other perfectly".

In Malaysia, we are a pluralistic society with three major ethic groups and many other smaller ethnic groups. Chronologically, the Malay is the son of the soil, the term coined by (Asmah, 1982). The Chinese came from China and the Indian came from India in the previous centuries where Malacca city was one of the pivotal regional centers for trade and business. The sultanate of Malacca on the Malay Peninsula at the height of its power in the fifteenth century controlled the corridor that carried the traffic of the world's busiest East-West trade (Zawiah, 1994). Its glory has resulted in the influx of especially the Chinese and the Indians. The two personas, a Malay and a non-Malay, yet to understand each other diametrically, planned to get married with the hope of an idealistic marriage.

Nonetheless, this has contributed to negotiable conversations due to the worldview that each of them possesses. In fact, they have been together and should have well established an understanding between them. However, in their unconscious minds, they still question the congeniality of that understanding.

This is the real purpose of calculator, the reason that it is here today on the table, amongst the greasy food and soft drinks: conversion. (p 59, para 7)

The arrival of Jane is a non-Malay at the restaurant initiated the conversation. She had happened to love Suleiman, a Malay, and a Muslim. Consequently, in order for Jane to engulf in "his" family and society, she has to convert, from non-Muslim to Muslim. She has to give away her belief and religion. In this context, similarly, Jane realizes that the real purpose of the calculator (simile to Suleiman) is the conversion. Mixed marriage has huge impact on them and their family. As Zawiah (1994) says, to build a nation, we need a kind of ideology capable of creating cohesion and loyalty among citizens in an abstract anonymous manner. This coincides with Naipaul's idea about the integration of cultures.

They are at the McDonald's in the shopping in Sri Petaling. They are planning their honeymoon. England as the destination is Jane's idea, a childhood dream. (p. 59, para 4)

Another aspect of nationhood is the use of language as a tool (Phillipson, 1992). English came to Malaysia during the British colonization. It has penetrated every dimension of one's daily life. This echoes the view of a renowned Professor of English at the University of Malaya, Professor Dr Sharmani Patricia Thomas Gabriel who opined that "English should be viewed as a Malaysian language, in a cultural sense as well (The Star, 2016). The unleashing wave of the great British Empire has yet to diminish totally.

Historically, multicultural Malaysia is a result of British Colonial policy of importing labor (Leow, 2016) and (Ahmad Zufrie & Ida Baizura, 2018). Today, we have successfully built a harmony and multicultural society consisting of Malay, Chinese, Indians and other races. Code switching and code-mixing scenario is even more prominent in Malaysia. Yet, the English culture, has somehow or rather, mingled into each culture. McDonald, a fast food shop, is originated from the United States.

Paradoxically, why does the author choose McDonald over the mamak in this narrative? This, again, has shown that the influence of the western culture is still very susceptible. Besides that, honeymoon is also not a Malaysian culture. It is practiced by the westerners. Here, in the story, the couple was trying hard to imitate the Western styles. This mimicry, as suggested by Bhabha (Bhabha, 1994) acts as camouflage into the mingling of different cultures.

She looks at him, he smiles, but they are so close that she can analyze the gist of it. That's all right. It's clear enough. In fact, it is amazingly clear. She will not need the calculator. (p. 66, para 3).

As the author pointed out, the personas were facing financial challenges, which may halt them for going to England. The idea of going broad is fascinating. However, Suleiman also suggested to have the honeymoon in the Cameron Highlands. He suggested that they could also feel the "Englishness" by staying some of the colonial boutique hotels such as the Smokehouse, the Lakehouse or the Cameron Resort. However, at the story progresses, they had yet to decide on the destination.

Conclusion

This short story uses realism and satire to invoke the idea of nationhood, especially in mixed marriage. The unconscious mind is often submerged in relating our psyche to the natural world. Nationhood, with its tentalising complexity is often used as a theoretical tool in searching for the conscious mind. Nonetheless, other theorical framework could regain the paradoxical axis of such ideal as discussed in (Chong et al., 2010). The line of reasoning is unclear to which it could invalidate the theoretical complexity as an emancipatory notion. However, what is clear, is that discussion of nationhood must be necessarily partially disabled by the oversimplicity over pragmatism.

Acknowledgement

We are sincerely grateful to the BOLD grant (Ref: J510050002/2021032) funded by Universiti Tenaga Nasional, Malaysia to carry out this study.

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MULTIMEDIA UNIVERSITY

TRACK IV

EMERGING TECHNOLOGIES IN THE CLASSROOM

CREATIVE APPROACH TOWARDS ONLINE TEACHING FOR FIRST-YEAR ENGINEERING STUDENTS

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Introduction

The transition from high school to University programme is a different environment with its demands, expectations and challenges. The conventional blackboard lectures that involve facial expressions are still very efficient teaching methods [1]. The relation between teacher and student improve the performance and quality of teaching and the quality for those who follow lectures online [2-5]. Most of the time, blended refers to an instructional way that consists of the availability of different materials studied by learners individually or in groups before the actual lecture starts. A different blended approach is presented with an innovative technological environment to allow flipped classrooms by distributing videos, quizzes and documents online before the lecture begins. However, with the advent of pandemics and restrictions on movement, blended learning became central in many universities worldwide.

In this view the blended type learning, with the help of innovative information communication technology tools, this study has been designed, implemented and analysed. Its effectiveness and impact on the program attainment are investigated by comparing with the results obtained by implementing blending learning in May 2020 and without implementing blended learning in September 2019.

Methods implemented in blended learning

Active learning captivates students in the process of learning through activities or discussion in Physical Chemistry. This course structure has three Course outcomes and two Program outcomes as listed in Table 1. Concerning the blended learning approach, a case study was carried out at the university with a student's strength of 90. In order to equip the active learning approach implemented in this coursework are icebreaking, flipped classroom techniques with blended learning activities and Kahoot to make the class more interactive for first-year students. Their grades were analysed from A to F based on their performance in class through formative assessment (quiz, assignment, and test) and final exam through summative assessment.

Table1 Course Outcomes and mapping to Program Outcomes

CO	Physical Chemistry	PO
CO1	The principles and theoretical aspects of ideal gas, laws of thermodynamics, phase behaviour, kinetics, and electrochemical systems to understand ideal gas's.	PO1
CO2	Analyse the complex problems of laws of thermodynamic phase behaviour, kinetics.	PO2

CO3	Design and analyse the lab component for thermodynamic phase behaviour, reaction kinetics, catalysis	PO1/ PO2
PO1	Apply knowledge of mathematics, science fundamentals to complex engineering problems.	
PO2	Identify, formulate, conduct research and analyse reaching substantiated conclusions using first principles of mathematics, science and engineering	

Initially coursework started with encompassing numerous icebreakers in the first few weeks of their university experience. The first interaction with the students is held with the help of "icebreaking" activities to create a vibrant learning environment and is designed to get students to introduce themselves by creating a friendly environment as they transition to a new learning environment. Throughout the learning, students imbibe discipline, thinking and working in a team. This course was taught by implementing a blended learning approach that creates an opportunity to interact, share content and deliver with the help of information communication tools before the lecture began by providing videos, material and short quizzes. The learning activities for this course were framed covering theoretical knowledge, skills and problem-solving. This is demonstrated through the loom, free digital software that enables the teacher to share a lesson to watch at a student's convenient time interval and deliberate later when the lecture session is scheduled. Apart from this, there are a few other module approaches are implemented like Kahoot to conduct class quiz, brainstorming and online quiz sessions for formative assessment.

Results and Discussion

The results were compared with those obtained in the previous semester without implementing blended learning in September 2019. During this semester students progressed between 40-100 percentage marks distribution formative and summative assessment as shown in Figure 1. Whereas by implementing blending learning, it is clear that students have performed better and distributed between A to C gradesas shown in Figure 2. This shows that active learning has influenced the students to perform better by actively participating in groups and working individually in both assessments. There has been a 10-18% increase in program attainment, as well by implementing this active learning.

Conclusion

The practice of blended learning can possibly become a significant solution to engineering education since it permits resourceful time in the classroom, more attention towards problems challenged by students, opportunity to assess and track the level of students' basic knowledge.

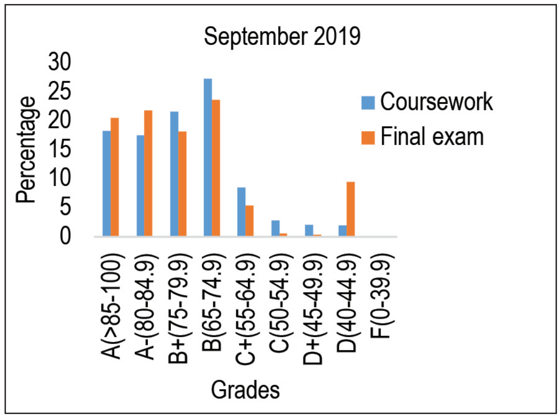

Figure 1 Percentage attainment without blended learning

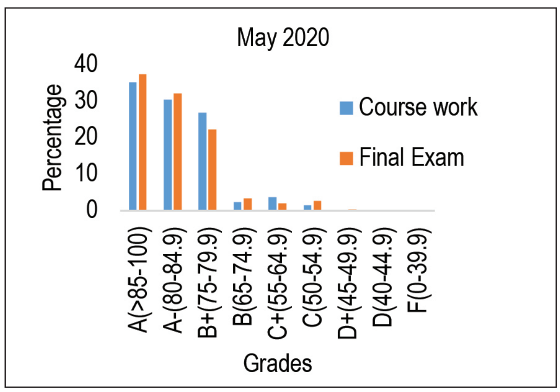

Figure 2 Percentage attainment with blended learning

The result analysis of program attainment showed an increase of 10-18% in students' overall performance in comparison to September 2019 performance, as shown in Figure 3. Additionally, students developed participation skills and enjoyed online learning sessions. Besides, they understood how to work among their peers. The result suggested an overall improvement in the students' online learning experience and proved that transition to online learning was a success despite the emerging circumstances. The suggested future research direction will be of interest to educators, academics, and the researchers' community

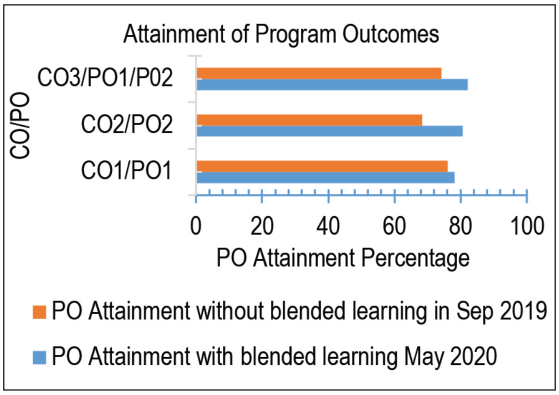

Figure 3 Program Outcomes attainment

Acknowledgement

The author likes to thank Universiti Teknologi PETRONAS, Department of Chemical Engineering, for this thoughtful implementation of blended learning in first-year engineering course work.

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MYCIKGU: PRESCHOOL WEB-BASED SYSTEM

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Introduction

Based on the "Instrumen Penilaian Prasekolah Kebangsaan" (IPPK), teachers should refer to the Content Standards and Learning Standards to implement teaching and learning activities in the classroom. This requirement is to ensure that students achieve the learning objectives. The assessment carried out in the school should be recorded for the reference of teachers and participants. IPPK helps teachers to prepare preschooler development reports. Currently, preschool teachers have provided a template to assist them in recording and reporting their students' progress.

Pianta et al.(2016) stated that the quality of early education is the shield in four aspects. The first aspects of a curriculum include the length of the school day or the training of teachers. The second covers general classroom setting features, ranging from playground equipment to sports. Third are the dimensions of the teacher-student interactions directly experienced by children. Finally, aggregate indices, such as quality rating systems and enhancement systems, combine measurements across program element types, implying that the teacher's role as co-constructor is to work collaboratively with children to enhance their interests.

The learning outcome level is persistent after the teacher thoroughly prepares the teaching and learning and records the assessment using the "Sistem Perekodan Instrumen Pentaksiran Prasekolah Kebangsaan (SPIPPK) system". The teachers need to mark each learning standard and skill achieved by the students manually into the system.

Problem Statement

Preschool teachers need to assess the student's performance based on the evidence that the student has done and accomplished. Many Learning Standard (LS) require teachers to teach and identify the student's skills and achievements. Thus, preschool teachers need to enter data precisely.

The Ministry of Education (MOE) of Malaysia requires all preschool teachers to use a standard assessment to evaluate the preschooler. Most teachers face a problem using the formal evaluation because they need to quickly enter the data into the system . Due to that, some of the data that they entered might be invalid and not verified.

This study aims to develop a system that could assist the preschooler teacher in entering student marks more comprehensively. This system, namely MyCikgu, is a web-based system for preschool teachers to record results and information for preschool students according to the subjects and instruments learned in real-time. The system will make it easier for preschool teachers to record and identify their student achievements without manually filling in the data. Basic information such as student name, school, class, teacher name and students according to the courses taught in the reporting template by subject is automatically updated in the system. Teachers will record the level of learning mastered by students according to content standards and learning standards that are already provided more efficiently and not manually.

Methodology

There are two phases in this stud as the following,

Phase 1 Data Gathering
The method used to collect the information is using the observation technique strategy to collect the critical information about the MyCikgu System Application. Especially when the contrast between the current knowledge-based method is established and compared, the observation technique is vital to use. In addition, another approach is used by questionnaire surveys to establish the method. This approach is used to collect specifications from the client for the system and to understand the environment of the reporting process. The techniques used for data analysis is Qualitative Method data research which is through a questionnaire surveys

Phase 2 System Development
The methodology that will be chosen is ADDIE methodology to develop MyCikgu System Application. This is a part of the Instructional Systems Development (ISD). Much of the existing instructional concept models are spin-offs or variants of the ADDIE model; the Dick & Carey and Kemp ISD versions are examples.

The usage of fast prototyping is one widely recognized addition to this pattern. This is the concept of getting continuous or formative input when producing instructional materials. The model seeks to save time and resources by troubleshooting but is always easy to repair. (Culatta, 2020). ADDIE model is the generic process traditionally used by instructional designers and training developers. The five phases are Analysis, Design, Development, Implementation, and Evaluation that will give guidelines for creating MyCikgu system application step by step.

Testing Method and Result

Black Box or Behavioral testing is a method to test the functions of system applications without formal internal code structure, implementation details, or internal routes. The tester tested the system with any information and observed the result such as usability issues, system's reaction time and reliability trepidations.

Testing Procedure and Data Analysis

Since the outbreak of the pandemic, public testing, such as meeting individuals outside, has been restricted. The developer decides the procedures to test the system. The developer examined the requirements and specifications of the system. Choosing valid input, which is optimistic case scenarios and some invalid input, which is an adverse test scenario, will verify that the application or the system under test can detect them. The developer compares the actual outputs and the expected outputs.

Table 1 Summary Analysis Black Box (Test Case ID 01 – 06)

Test Case ID	MTC 01	MTC 02	MTC 03	MTC 04	MTC 05	MTC 06
Test Case Name	User (Teacher and Admin) Login	User (Parents) Login	Login Validation	Update Student Results	Update Students Details	Update and Add New Student
Test Case Description	User should be able to fill username and password to login	User shall be able to fill MyKid to login	Validation if user does not fill the login form	Teacher should be able to update data (results) of student	Teacher should be able to update data(details) of student	Teacher should be able to add new student
Expected Result	Login into the system without error and display user dashboard	Login into the system without error and display user dashboard	Error login and display popup for user to login	Data automatically stored in database	Data automatically update in database	Data automatically update in database
Description	Successful to login and redirect to user dashboard	Successful to login and redirect to user dashboard	Login unsuccessful	Data successfully stored in database	Data successfully stored in database	Data successfully stored in database
Remark	No error display	No error display	Error to login	No error display	No error display	No error display

Table 2 Summary Analysis Black Box (Test Case ID 07 – 11)

Test Case ID	MTC 07	MTC 08	MTC 09	MTC 10	MTC 11
Test Case Name	Update and Add New Teacher	View Student Results	View Student Details	Download Functionality	Email Functionality
Test Case Description	Admin should be able to add new teacher	Teacher and Parents should be able to view student results	Teacher and Parents should be able to view student details	Teacher and Parents should be able to download student results	Admin should be able to send email
Expected Result	Data automatically update in database	View student results according to subject/component	View student details after click view	Student results are being saved and downloaded	Email can be sent to teacher as reminder
Description	Data successfully stored in database	Successfully view results according to subject/component	Successfully view student details	Unsuccessfully download results	Successfully connect to Mail to send email
Remark	No error display	No error display	No error display	Fail	No error display

The goal of black-box testing is to test the validation of the system's functional requirement. This type of testing provides an overview of the software's performance and output. Table 1 and 2 show the testing result and most of the systems met the project's goal.

Future Recommendation

A few proposed features in the MyCikgu system cannot function due to insufficient time and payment problems in proceeding with the construction of the system. One of the features that need to be improved is the Download or Print button. There is insufficient time to implement the Download features into the system. It is also required to register and pay to use the software. Other than that, the parts for sending automated messages through WhatsApp to teachers and parents are unavailable. As the software system also needs to pay, the price is not affordable to continue adding the features. If it is possible to get some funds to continue the development of this system, it would be great.

There are other recommendations with high hope to improve the MyCikgu System Application. By adding a live graph of student performance levels in Teachers Dashboard and Admin Dashboard and percentage for status updates done by teachers on the Admin page. With this recommendation, the system could be complete to be published and used by All Government Preschool Teachers. As for the suggestion, I hope to collaborate with Kementerian Pelajaran Malaysia (KPM) to launch the system for all Government Preschool Teachers and with Aplikasi Pangkalan Data Murid (APDM) for inserting student attendance into MyCikgu System Application. It is essential to record student performance data accurately and without making any mistakes. The MyCikgu System Application can help simplify and speed up the data filling process

Acknowledgement

We want to convey our special thanks to the Malaysian Institute of Information Technology, Universiti Kuala Lumpur, for presenting this paper at International Conference on Advancing and Redesigning Education (ICARE) 2021. This paper is one of the outcomes of our Final Year Project in UNIKL.

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FORMAL AND INFORMAL GROUP DISCUSSION THROUGH MICROSOFT TEAM CHANNELS AND BREAKOUT ROOMS

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Introduction

Teaching is one of the most challenging yet rewarding processes. Ensuring effective and efficient teaching and learning needs significant effort and verse knowledge on teaching pedagogy. Each student is unique; they learn in different ways: seeing and hearing; reflecting and acting; reasoning logically and intuitively; memorizing and visualizing and drawing analogies and building mathematical models; steadily and in fits and starts (Felder, 1988). Accordingly, various teaching styles have been developed to cater to different learning styles. The instructor generally adopts five main teaching styles depending on their preference, course and students, i.e., authority, demonstrator, facilitator, delegator, and hybrid styles (Nashed, Lahoud, & Abel, 2021; Opdenakker & Van Damme, 2006). These teaching styles can be manifested into various teaching methods such as lecture, reading, audio-visual, demonstration, group discussion, practice and peer teaching. It is commonly accepted that students retain better what they learn when they actively participate during teaching and the best is when they do peer teaching (Letrud, 2012). Among the teaching methods, one that offers a balance between teacher direction and student participation is group discussion.

Group discussion is a student-centered strategy in which students are divided into groups and encouraged to discuss a certain topic. The teacher facilitates and instructs them so that the discussion is fruitful. This approach is called an "Argument," which is a method of reasoning through the presence of evidence to justify and later reach a consensus on a claim (Erduran, Simon, & Osborne, 2004; Osborne, 2010; Toulmin, 2003). When the teacher encourages the collaborative practice that leads to an argument, students will be able to participate and develop their critical thinking, problem-solving, and scientific communication, through which they gain a better understanding and the ability to use logical and scientific reasoning (Berland & Reiser, 2009; Gokhale & Machina, 2018)2018. The focus of this teaching strategy is to achieve high-level cognitive levels and achieving objectives. It aims at the transformation of classroom culture into a more democratic and democratic-thinking environment. Concisely, the students should be able to learn deeper, as they conclude and agree collaboratively with the differences they must deal with within the members (Paine & Knight, 2020).

Group discussions can be organized in two ways, formal and informal (Joyce & Showers, 2002). For formal discussions, the topics to be discussed are highly structured, with an appropriate schedule established and certain rules followed. The teacher acts as the leader of the group. On the contrary, in informal discussions, the topics to be discussed are unstructured and have no fixed hours or rules to follow. The students have full authority over the group direction, while the teacher only facilitates when required. The students learn best when they are actively involved, mentally engaged, enthusiastically participate in the process of inquiry, discovery, investigation, and interpretation (Tesfaye & Berhanu, 2015).

The COVID-19 pandemic has shifted the education system and affected the interaction between teachers and students. Universities are forced to conduct online teaching and learning activities with students, which is currently the only feasible alternative (Coman, Țîru, Meseșan-Schmitz, Stanciu, & Bularca, 2020). In this regard, the commonly adopted group discussion has to be fined tuned for an online setting. This poses a great challenge due to the different nature between face-to-face group discussion and online group discussion. One way to overcome this challenge is to use channel and breakout room which is recently introduced in Microsoft Team, one of the widely used learning management systems. As a part of the Microsoft 365 family of products, Microsoft Teams has now progressively developed education-oriented features on the platform. The channel and breakout room functions in Microsoft Teams are developed to accommodate the needs of collaborative discussion among students. By using these features, the teachers can create a special workplace for students, differentiate teaching, pay special attention to certain projects, and even let the group work together to complete a class project. The avenue provided by Microsoft Teams offers as a leading Learning Management System (LMS) is a key factor in assisting students to achieve their learning goals optimally (Fortune, 2011; Rojabi, 2020).

Despite its promising potential, no study has been conducted to assess the suitability of the Microsoft Team channel and breakout room in facilitating student group discussion in the online learning environment. Therefore, this study is conducted to evaluate the effectiveness of channel and breakout room features in Microsoft Teams to stimulate formal and informal group discussion. This study's findings and outcomes are expected to assist lecturers and universities in better preparing and to conduct their online learning. Ultimately, it can help students to effectively sail through the new learning experience through an online platform.

Method

This study is conducted for scientific inquiry, a common university course which focuses on the fundamental processes of scientific thinking through hypothesis and development of theories of major local and global issues. Traditionally, this course is delivered through traditional lectures and group discussions. With the current pandemic, the lecturers face difficulties to engage student through group discussion effectively. For formal group discussion activities, a channel feature with a private setting has been adopted to provide space for students to discuss their group project assignments. With the recent introduction of the breakout room, the lecturer has the option to conduct informal group discussions by grouping the students in the breakout room and calling them back to the main room after discussion. For formal group discussion, the grouping is permanent throughout the semester, while for informal group discussion, the grouping is ad hoc grouping, allowing different group on each lecture.

At the beginning of the semester, the authors give students information about the courses, delivery methods, assessments and the learning outcome that we want to achieve. In addition, they will be briefed on the formal and informal group discussion and how both methods will be implemented for the scientific course in an online setting. They have also been made aware of the survey conducted at the end of the semester to harness their perception. This is to give the students head-up information on the study that is being conducted in the classroom. Next, a questionnaire is prepared in Microsoft Form to gauge student perspectives on the effectiveness of both group discussion methods. Students can only answer once and this was not made compulsory. The survey is voluntary, and we do not collect their name or student ID to maintain respondent confidentiality. We only capture their gender, age and semester to obtain their demography data. In addition to respondent demography, 5 level Likert-scale questions were prepared for informal and formal group discussion as listed in Table 1. As can be seen, the question patterns for both informal and formal group discussion are similar.

Table 1 Likert scale questions to gauge student perspective on the formal and informal group discussion using MS Team

Question	Informal	Formal
1	I learn better through informal group discussion than traditional lecture	I learn better through formal group discussion than traditional lecture
2	All group members are actively involved in group discussion	All group members are actively involved in group discussion

3	I can clarify difficult topics with my group member during group discussion	I can clarify difficult topics with my group member during group discussion
4	I learn new knowledge and skills which are not taught in the lecture during group discussion	I learn new knowledge and skills which are not taught in the lecture during group discussion
5	I am excited to work with different groups each lecture	I am excited to work with the same group throughout the semester
6	MS Team breakout rooms is an excellent avenue for group discussion	MS Team channel is an excellent avenue for group discussion
7	I would like to have this informal group discussion for my other courses	I would like to have this formal group discussion for my other courses

This study has been conducted for two cycles (January 2021 and May 2021 semester) in order to achieve better students' perceptions. Moreover, it will ensure that the conclusion drawn from this study is not student catch dependent and can be extrapolated for other batches with caution.

Due to the qualitative nature of the data, a simple analysis will be conducted to process the data prior to presentation and discussion. Nevertheless, a more thorough analysis with more advanced statistics is possible with the data collected from this study. In addition, we have also collected comments and feedbacks from the students to formulate improvement in the future.

Results and Discussion

This study has been conducted for 2 cycles (January 2021 semester and May 2021 semester). The survey response rate for this study is relatively high, with more than half of the class responding to the survey which was given through our learning management system, Ulearn. On the first cycle, 38 students (61.3%) respond to the survey out of 62 students taking the course, while on the second cycle 44 students (55.7%) respond to the survey out of 79 students taking the course. These students are taking major in Mechanical Engineering, Chemical Engineering, Electrical and Electronic Engineering, Civil and Environmental Engineering, Petroleum Engineering and Petroleum Geosciences.

More male students responded to this survey as compared to female students. In total, 25 male and 13 female students participated in the first cycle of this survey with an age range between 18-24 years old, while 31 male and 13 female students participated in the second cycle with an age range between 19-25 years old. Most of them have not been taking this course before and are on the semester they suppose to take the course. A small percentage is repeating students from earlier cohort; however they have not experienced the use of MS team channel and breakout room previously.

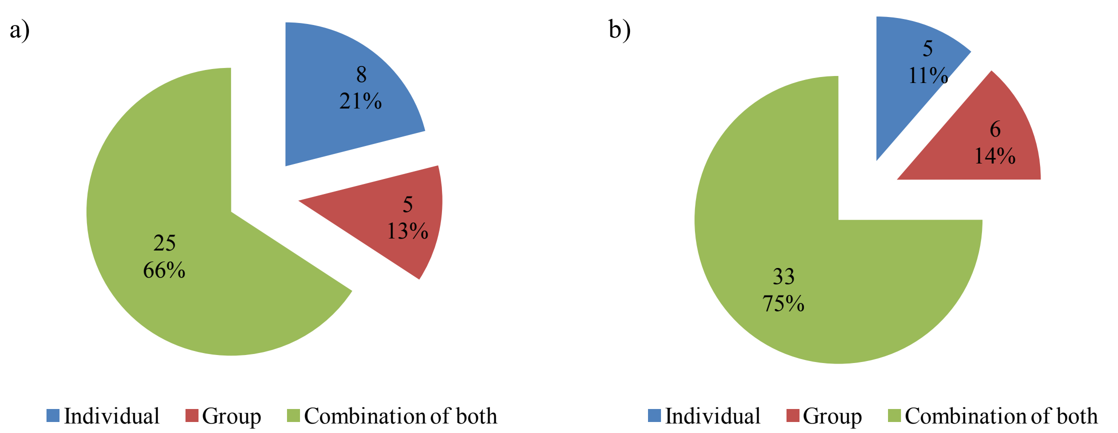

Figure 1 Student learning preference is captured in a) cycle 1 and b) cycle 2.

Learning preference

As aforementioned, each student is unique with a specific way of learning. Some prefer to work together and some favor working individually. When exposed to group work, some of these individual learners still can work effectively while some need assistance to be effective group members. Thus, we would like first to gauge their learning preference; whether they prefer individual learning, group learning or a combination of both. It turns out; most of them prefer the combination of learning methods with 66% vote for this option in cycle 1 and 75% in cycle 2. Comparing individual and group learning, more students are learning towards individual learning in cycle 1, but the opposite was captured in cycle 2, as shown in Figure 1. This is most likely attributed to the fact that in cycle 1, they come from various programs, while in cycle 2 they come from 3 programs only. Another possible attribution is their relation with their batch mates. A more cohesive batch may prefer to have more group learning than those that are not cohesive. For them, group learning will help them to master the topic better.

In contrast, group learning is challenging for those who do not have good relations with their batch. In a case where some of the group members are not on pace, the learning progress of the whole group will be jeopardized. Moreover, with individual learning, students have freedom in their learning schedule, fewer distraction and liberty over the learning environment. Nevertheless, this is based on the authors' opinion. A more structural study is required to confirm this.

When we ask them further whether they prefer to have the same group throughout the semester or change the group for every class (or several classes in some cases), the majority (70% and 71% in cycles 1 and 2, respectively) prefer to have the same group. This entices us to further know the reason for their preference as presented and discussed in the following section.

Student perception on informal and formal group discussion

Having a preliminary finding that most students prefer to have a combination of both individual and learning and that they prefer to have the same group for the whole semester, we then proceeded to harness their perspective on the informal and formal group discussion and the effect of these group discussion on their learning performance. As discussed in the methodology section, students have been informed that both informal and formal group discussion methods will be adopted in the classroom at the beginning of the semester. The authors have also briefed what are the definitions of both methods and how these methods will be carried out throughout the semester. Students have also been informed that their perception of the adopted method will be garnered for evaluation and improvement purposes. The results for cycles 1 and 2 are summarized in Figures 2, respectively.

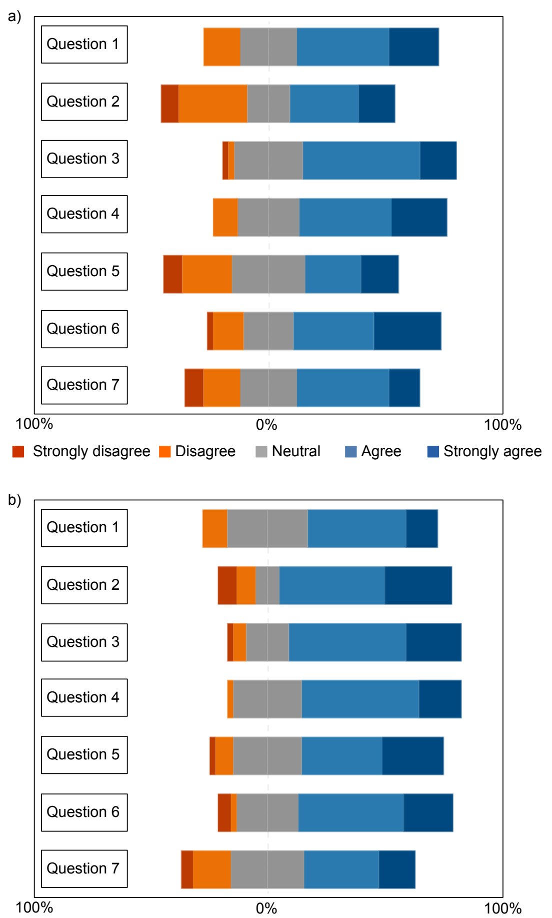

Figure 2 Student perspective on a) informal group discussion through MS Team Breakout Room and b) formal group discussion through MS Team Channel (Cycle 1)

Overall, we can see that students agree that breakout room and channel provide an excellent avenue for them to do their group discussion and most of them agree that this initiative shall be expanded for other courses.

In addition to the guided question, a general feedback question is given in the survey to garner student opinion on the initiative to have an online group discussion in this course. Some positive and negative feedbacks for informal group discussion are summarized in Table 2.

Table 2 Likert scale questions to gauge student perspective on the formal and informal group discussion using MS Team

Cycle 1
"It's always excited who I will team up with. Either good or bad teammates is ok for me since it is only for one lecture."
"All members seem not to be participating. Only one or two take it seriously."
"Depending on how well we work together, sometimes it goes really well other times not so much."
"Sometimes the MS Teams Breakout Rooms are tiring when there aren't participative members."
"It helps me a lot to understand more about the topics that i learned on that day."
"Some are silent throughout the whole session."
"Informal group discussion is exciting and makes me engage in the class more."
"It makes students very focus and active in the class hence resulting to a better understanding of the course."
"Nice and gain a lot of contact with other people prevent from sleep."
"It is new and exciting to be done but with the cooperation of all team members and no free-rider :(. "
"It depends on the group member, if we have all of the members to be proactive students who love to give suggestion and havecritical thinking on an issue, the informal group discussion may be interesting. However, based on my experience, only a few who were proactive and sometimes none."
"When we are grouped with students who are actively sharing their opinions on the proposed subject, it is beneficial. However, it would be a burden if the group includes students who are considered free-riders who stayed quiet throughout the discussion as they wanted those who spoke up to finish it on their own"
"It was really good, it helps you to improve your leadership as someone should initiate the discussion, as well as helps in enhancing the communication skills and professionalism."
"I think the breakout room is effective if the group members participate in the discussion and it would be better to work with familiar faces."
"It helps students to communicate among them to come out with the best results from the discussion."

Cycle 2
"I found it is hard to start a conversation when I opened my mic and spoke to those students, they kept silence."
"I can group with different people, out of my comfort zone, learn something different, cooperate with new friends."
"Some members are not cooperating which spoils the mood and energy of the group work :/"
"New friends means new friends, and old teammates lead to more teamwork."
"Not everyone involved actively, therefore, making it a bit difficult."
"It is hard to discuss in an informal group because some students do not care about it as it is not graded."
"Not everyone wants to use a mic, prefer typing in chat, so it makes it not that much different from Whatsapp messaging."
"Can see varieties of answers among classmates for each subtopic of the subject."
"My team is great and i learned a lot from them"
"Gives me anxiety most people don't even use their mic."
"Discussion in smaller group member is really good and actively participated."
"Certain student does not give any cooperation."
"I get to discuss with students from different courses."
"Some of the breakout rooms its okay, they will discuss together. But some they just do their own business."
"Due to remote learning, being assigned randomly, especially when the course is mixed with students from other programs would be more difficult as they didn't know each other well. Having them change every lecture where the number of students is large really leaves no time for students even to get to know each other well. Most of the time, my discussions are way too quiet. Some didn't even participate."
"So far MS team breakout room is a very good platform to discuss our project presentation and it can be private which only certain people can join."
"Overall, it is good, although there are some students who did not like to participate and become a deadman in the discussion yet getting free marks."

As can be inferred from the summarized feedbacks, the effectiveness of informal group discussion really depends on the group member. If they have good group members who actively participated during the discussion, they acknowledge its benefit . In contrast, if most group members are passive and keep quiet during the discussion, they do not see the benefit of this initiative, even though some of them express their frustration on it. Nevertheless, there is someone who always takes it positively does not matter whether they have effective group members or not, since this informal group discussion is only for one lecture. Overall, students agree that informal group discussion does help them in learning despite their grudges on the passive group member.

Meanwhile, the positive and negative feedbacks for formal group discussion are summarized in Table 3.

Table 3 Likert scale questions to gauge student perspective on the formal and informal group discussion using MS Team

Cycle 1
"It is stable everyone is cooperating well. But lack of excitement. However, for the final project would still prefer choosing own teammates."
"It needed to be just one group for the whole semester."
"It is easily accessible for when we need to do a recorded presentation but besides that, there is not much use for my group."

"It makes us gain a better understanding of the course by contributing and learning from one another."
"Love how all my teammates are very cooperative and we manage to complete the project faster than expected."
"It is great as we have the same group which we know their abilities and personality. this ease the discussion process."
"Graded group discussion would be stressful and possibly disrupt the discussion."
"For a formal group discussion (Project group based on my understanding), students were more proactive and participated in group discussion. However, still a few of them were not cooperative and inactive during discussion and did the work ineffectively."
"As students choose their own team members, it is solely the students' responsibility to ensure that the members complete their assigned tasks. Thankfully, I've teamed up with colleagues who are committed to making the final project a success."
"The students can discuss the issue and voice out their opinion freely during the discussion."
"It is basically more about you can comfortably talk to each other and you know your teammates better. This will help in distributing the tasks according to their skills and talents so that the outcome will be the best."
"Time management is very important for formal group discussion where all the member should be punctual at the time have been set. Otherwise, other group members will wait for their member to complete the task at the last minute."

Cycle 2
"Prefer this since members are more serious and willing to perform for a better score."
"Formal can get things done as fast as possible and professionally."
"Everyone plays their role perfectly during the session."
"Lucky to have group mates that that can carry their weight and then some more. "
"Can communicate better for discussion and sharing opinions."
"Quite difficult to set up the meeting as group members have different free time."
"I understand more when they discuss the question."
"It is very good and systematic overall. Having formal groups is better because everyone would be participating and know each other well."
"Formal group discussion allows us to develop a disciplined personality, especially when doing the presentation."
"My team has many problems in terms of some members still have a problem regarding doing their part in the research project and also giving very minimal contribution during the meeting session."

In contrast to the informal group discussion, where some students were irritatingly quiet during the discussion most of the students actively participated in formal group discussion. Everyone plays their role effectively. Nevertheless, one student voiced out that graded discussion may create stress and possibly disturb the discussion itself. In addition, some raise concerns about the difficulties of arranging meetings and some group members are passive.

Conclusion

Shifting from traditional face-to-face to online learning has broughtchallenges and opportunities to explore new methods to better engage student participation and enhance the student learning experience. The learning management system, Microsoft Team, used in our university has provided the avenue for informal and formal group discussion. The preliminary finding suggested that most students agree that both features have helped them better learn the subject and to expand the implementation to other courses. Nevertheless, significant numbers of students express their disagreement on the benefits of online group discussion through this online platform, especially on the informal group discussion, which is ungraded. More studies are underway to investigate this interesting topic better.

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THE STUDENTS' READINESS OF E-LEARNING IN HYBRID APPROACH FOR TEACHING AND LEARNING IN GMI

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Introduction

E-learning has become an invaluable component of all educational institutions like schools, colleges, and universities around the world due to the pandemic crisis of COVID-19. This deadly situation has flipped out the offline teaching process, particularly for Technical and Vocational Education and Training (TVET) institutions where a hands-on approach has been emphasized in its teaching and learning approach before. When the Malaysian Government had announced on the Movement Control Order (MCO) where total lockdown was being imposed, this situation has prohibited German-Malaysian Institute (GMI) from conducting its teaching and learning as usual. Being one of the TVET institutions in Malaysia where major content is based on practical training, GMI has taken an initiative to adapt to the pandemic situation by shifting its approach from face-to-face to e-learning style. However, the new approach has drawn a challenge in upholding practical competency among students as it is their niche that needs to be emphasized among TVET students. As a result, GMI has adopted a hybrid approach where a combination of e-learning with several other approaches in its teaching and training is able to upkeep the practical competency needed. This paper presents the experience and the challenges face from the students' perspective as a way of assessing their level of readiness in adopting e-learning for a hybrid approach. A survey was conducted for January-July 2020 intake students, where 858 participants were involved in the study. Results from this survey highlighted several factors such as self-efficacy, interface, community, usefulness, students' satisfaction and intention to use e-learning are among the factors that contribute to the students' readiness to adopt e-learning.

E-Learning Approach and its Adaptation

E-learning is not a new approach used for teaching and learning in education nowadays. The increased use of e-learning among educational institutions has led to a change in the higher education scenario from traditional face-to-face to a different style and approach used. Ngampornchai and Adam (2016) define e-learning as a learning activity that is supported with electronic technology such as online classes or portals to access the courses outside the classroom. Several approaches that involving e-learning have been introduced, particularly within the tertiary level namely blended learning, hybrid learning, flipped classroom, etc., where an 'online' element is considered as an important source of knowledge used in those approaches. One of the main reasons why it encourages the use of e-learning in education is that it gives students greater access to education in comparison to traditional methods of teaching where students can undertake their study from anywhere and at any time as well as being given the option to study part-time or full-time (Worthen and Sanders, 1987). In other words, e-learning has transformed the educational sector by enabling students to share information and data relatively easily. To support this, Yeap, Suhaimi, and Nasir (2021) highlighted that the advent of ICT and the internet has greatly influenced how knowledge is transmitted and hence nurtured the use of e-learning as part of the learning process. This can be seen where the persistent increase in technological innovation and internet accessibility has increased the motivation for online learning since the beginning of the millennium (Tallent-Runnels et al., 2006). In changing the delivery method from a face-to-face to an online approach, it is easy to adopt for courses that do not require practical sessions or hands-on skills. Menon (2020), in his study, admits that courses like administrative management, management systems, programming and IT courses can be conducted online undeniably. However, for some courses, particularly in TVET institutions, the instructor cannot just depend on an e-learning approach as some modules still require practical training sessions. In adopting e-learning among TVET students, Yasak and Alias (2015) highlighted that use of ICT is more effective in developing cognitive learning compared to hands-on occupational skills. Yeap, Suhaimi & Nasir (2021) also assert that the cyber security course will be relatively easy to conduct via online learning compared to automobile mechanics courses that require hands-on practice. Hence, the dependency of TVET institutions in practical approach regardless of theoretical approach will make a readiness to use online learning crucial in ensuring successful e-learning adoption. As for GMI students, practical skills are acquired through learning-by-doing, which occurs during the hands-on experience at the workshop or laboratories. For this kind of approach, Hoftijzer et al. (2020) agreed that some practical exercises which require the use of specific equipment or materials indirectly make e-learning approaches a weak substitute to conventional methods where there is still a need for the students to fulfill the course on-site. Thus, adopting several other approaches is vital for the students, instructors and institutions to ensure the learning outcome is achieved while adapting challenges during the pandemic.

Challenges of E-Learning Approach

As e-learning is not new in certain institutions, it is still considered a new approach for some institutions and has a lot of challenges to deal with. Hence, the delivery methods via e-learning are continually being explored for viability and effectiveness in their teaching session. For instance, Kopp et al. (2019) revealed that while assessing the assumptions surrounding the digital transformation of higher education institutions, he gave five common assumptions that are considered more of hindrances to digital transformation for higher education institutions as against contributions to its realization. The assumptions are related to (i) change, (ii) pace, (iii) technology, (iv) competencies and (v) financing.

Concerning that, Joshi et al. (2020) highlighted that the instructional achievement of online learning is debatable because it causes the absence of face-to-face relationships among learners and instructors. However, Hodges et al. (2020) responded that a well-planned online learning process may provide a meaningful experience to students as compared to normal courses presented online. Meanwhile, in responding to challenges faced in adopting e-learning, Nguyen et al. (2020) revealed that the main obstacles of e-learning are based on several stakeholders' perspectives, namely infrastructure, technology, management support, execution and pedagogical aspects. This is aligned with Marwa et. al (2021) where he highlighted that the highest challenge and factors affecting the acceptance of e-learning as a tool for teaching within higher education may lead to the strategic development and implementation of e-learning. Therefore, the challenges faced in implementing e-learning may vary depending on the needs of each institution. However, it is important to note of how the learning should be implemented to suit the needs of the instructors as well as the students as a whole to fulfill the course contents and students' ability itself.

Hybrid Learning Approach

Previously, the idea of teaching consists of the transmission of knowledge from an expert (teacher) to a learner, where it is a misconception that is manifested in an over-reliance on the face-to-face lecture format. The introduction of the hybrid learning model refers to the blending and mixing of the learning environments: face-to-face classroom instruction and online environment (Doering, 2006). A hybrid learning environment gives students the privilege to understand and explore real-world issues through authentic learning experiences facilitated in an online learning environment (Ellis, 2001). Hybrid learning aims to provide the most efficient and effective instruction experience by combining online and face-to-face learning delivery. Dziuban et al. (2005), in his article on blended learning, outlined that the choice of a blend is usually determined by several factors in which the nature of the course content and learning goals, student characteristics and learning preferences, teacher's experience and teaching style, or online resources are explained as factors. Thus, several approaches embedded in hybrid learning are vital to enrich the students' learning experience by combining the best features of on-site and online classes. For instance, in hybrid programs, students have a greater opportunity to adopt and promote the learning community because they have simultaneous access to the face-to-face and virtual campus. However, in a hybrid environment, institutions need to be more conscious about how to guide students to enhance their learning and not complicate them with poor design flow. Additionally, hybrid learning can allow the students who missed out on the face-to-face classes to re-enter the virtual class in an online platform. The delivery mode could be varied such as,

1. audio (a review of the in-class lecture)
2. visual (a script of the audio file)
3. hands-on (an activity that helps the learner process the information).

With the potential of hybrid learning environments to offer the best of the two worlds (traditional classroom environment and virtual learning environments), the main reasons why hybrid learning should be employed in teaching is as follows,

1. it contributes to pedagogy because it supports more interactive strategies, not only face-to-face teaching (Graham et al., 2003);
2. it thus encourages collaborative learning; students or educators can work together on some projects from anywhere and at any time (Bruffee, 1993);
3. it deepens intercultural awareness since it puts together researchers, educators, and students from anywhere in the world.
4. It contributes to pedagogy because it supports more interactive strategies, not only face-to-face teaching (Graham et al., 2003), and
5. it might match a student's learning style, although there is no clear consensus on this issue (Coffield, 2004; Hubackova & Semradova, 2013;).

Methodology

For this study, an electronic questionnaire was designed for data collection via Google forms. The invitation link for students to participate in the survey was sent via mail. In looking for the students' readiness in adopting e-learning at GMI, the questionnaire post consists of students' self-regulation, accessibility for computing devices, and the level of familiarity with education-related technologies in implementing online learning. Students were given a week to respond, and a few reminders were sent to them during the data collection period. A total of 858 students participated in this survey from January to June 2020 intake comprising semester 1 to semester 6. They are from different backgrounds comprised of three different departments, Mechanical Engineering, Electrical Engineering and Pre-University and General Study Department. The data were then gathered and further analyzed for the results. A simple analysis was done to observe the students' readiness in online learning during the pandemic.

Results and Discussion

The questionnaire was divided into five sections, including the demographic of the students. Mainly, section 2 collects the respond on the readiness of online learning from students' perspectives. Table 1 below shows the response on the readiness of online learning is dependent on the accessibility of the internet and the communication tools being used. Based on the results, 70.7% are comfortable communicating electronically and 61.4% said that they have an internet speed of more than 20MB to ensure there is no internet disruption while having online learning. E-learning studies have shown that the main elements of success in e-learning are as followed: access to computers and the internet, search skills, classification and data analysis, effective use of the tools, familiarity with communication methods, planning skills and learning methods (Rhode, 2004; Pallof & Pratt, 2003; Watkins; Seraji, 2010). The results also show that the majority of GMI students, a millennials generation, are used to the internet and technology.

Table 1 The accessibility and communication tools

No	Survey Question	Respond
1	I am comfortable communicating electronically	YES: 70.7% NO: 29.3 %
2	The internet speed that I currently possess is	<20 MB: 38.6% >20MB: 61.4%
3	Choose the adequate tools that you have for online learning	Mobile phone: 56.2% Notebook/Laptop: 37.2% Others: 6.6%

Referring to Table 2, wherefrom scale of 1 to 5 strongly disagree to strongly agree, the majority of students chose for each statement for scale 3, which was unsure of the acceptance of e-learning. However, based on the result shown in the pie chart in Figure 3, 72.3% of 856 GMI students are ready for online learning.

Table 2 The readiness of online learning

No	Survey Question	Respond
1	I possess sufficient computer keyboarding skills for doing online work	Scale 3: 46.2%
2	I think I am a self-discipline student where I can have full attention during an online session	Scale 3: 41.7%
3	I think I can learn better from the Online Learning platform	Scale 3: 42.4%
4	I believe that Online Learning is more motivating than the classroom learning	Scale 3: 54.5%

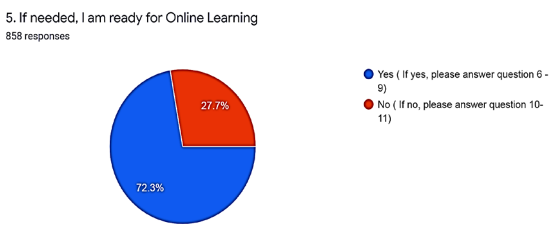

Figure 3 Respondent to Question 'If needed, I am ready for online learning'

For those who responded 'no' to question number 5, were required to respond to question number 10 and 11. The analysis is summarized in Figure 4 below from 238 responses. There are 167 students out of 238 who fully agreed that face-to-face learning is more effective than online learning. They are probably concerned about the practical-based class that is not suitable for an online learning platform. Furthermore, in GMI, the students normally applied collaborative learning in the Problem-Based Learning approach in their classroom. In the early pandemic, group discussion formation is one of the challenges in the online learning platform. Nowadays, additional plug-in such as breakout room is functioning to form a group discussion.

The results indicate that GMI is one of the TVET institutions where 70% of the contents on the module is practically based. Full implementation of online learning may jeopardize the students' psychomotor skills. However, online learning that has been executed may need improvement from time to time to overcome

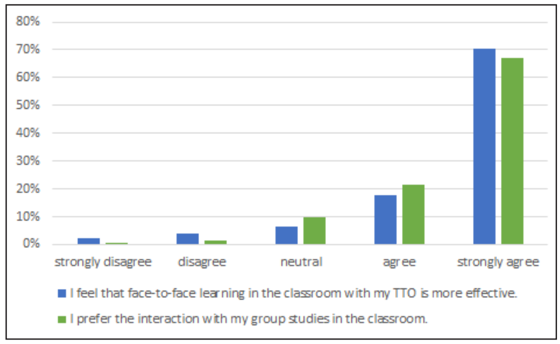

Figure 4 Summary of the data who responded 'no' for question number 5

the time constraint of the students in the future. Tight schedules previously that require practical and theory face-to-face could lessen the burden of the students if the theory classes are flipped to online learning. Therefore, the result of the effectiveness of online learning is needed to improve the current practice. According to Marwa et al. (2021), the highest challenge and factors affecting the acceptance of e-learning as a tool for teaching within higher education may lead to strategic development and implementation of e-learning. Thus, hybrid learning is the possible approach that needs to be developed and implemented to see the impact of e-learning as a whole for theoretical and practical-based modules. Online education is deeply rooted inadequate planning and designs of instructions with several available theories and models, but the migration process of the universities to online education becomes questionable because these processes witnessed the absence of proper planning, design and development of online instructional programs due to the pandemic (Olasile B.A, Emrah. S, 2020). Hence, the strategic development on the hybrid approach must acknowledge the readiness and acceptance of online learning and foresee the balance between online learning and face-to-face learning. With regards to the hybrid approach used, the 'Hybrid Online Model' emphasizes the impact and interaction on critical elements within the learning community. Therefore it should start with a proper pre-planning stage (course roadmap) with careful attention to face-to-face classroom content as well as online content. Providing necessary training on technology-based for educators, which emphasizes the teaching aids used for online learning, will facilitate better interaction between educators and students. The dependency of online learning on technological equipment and the provision of the equipment was a big challenge for institutions, instructors and learners. D. Yates (2020) while answering a question posted on ResearchGate, by John R. Yamamoto-Wilson, a retired professor from Sophia University, on the effects of Covid-19 and online learning on instructors and teaching stated that students with outdated technological devices might find it hard to meet up with some technical requirements of online learning (Olasile B.A, Emrah. S, 2020). In addition to that, the institution's role is vital and critical as a supporting element to achieve the goal for this new learning environment. Although hybrid learning can be diverse in how it is being implemented, instructors agree that this approach has the opportunity to provide personalized instruction with some element of student control over path, pace, time, and place. Instructors and students need to be given the latitude to teach and learn in these hybrid spaces while being protected and supported by institutions. Ultimately, instructors and students bear an equal responsibility as they collaboratively learn and experiment in these evolving spaces.

Conclusion

During the pandemic situation, the changes in the teaching methods pose new challenges for teachers and students. In this paper, we have discussed the readiness and challenges of e-learning. We can conclude that depends on the accessibility of the internet and students readiness in e-learning depends on the accessibility of the internet and the adaptability of online tools and the suitable content being delivered. Therefore, despite the challenges, e-learning would contribute new learning skills to the students and instructors. This would give a new paradigm in teaching and learning as needed. This paper also recommends future studies to consider the different concerns of all stakeholders when evaluating hybrid classes, particularly in managing several barriers faced by students, educators as well as institutions in adopting this model especially in restricted situations like a pandemic.

Acknowledgment

We acknowledge the educators and students of the German-Malaysian Institute, Malaysia, for their participation in the survey and other contributions towards the success of the study.

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FRAMEWORK FOR MEASURING QUALITY OF COURSE ASSESSMENT

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Introduction

Course Learning Outcomes (CLO) and assessment are two of the most important components in the OBE framework. For long time assessments were known as a means for assigning grades to students. The importance of assessment goes beyond that in OBE programs and they play multiple roles. For example, assessments are used to calculate student attainment of CLOs (Mohamed, Taib, & Reza, n.d.). CLO attainment is an important indicator of achieved learning for the students and for the class as a whole.

Proper calculation of CLO attainment is important because CLO performance is used to evaluate course performance and determine improvement actions for the course. CLO attainment also impacts the calculation of attainment of Program Learning Outcomes (PLO).

Discussions on OBE quality normally focuses on processes related to OBE and proper alignment of different components done through several mapping activities. For instance, assessment, CLOs and teaching and learning activities (TLA) must all be consistent and supporting each other (Elsheikh, Sarudin, & Gunawan, 2017)the procedure helps meet some of the accreditation requirements imposed by the Malaysian Engineering Accreditation Council such as explicit assessment of programme outcomes. Key to success is the careful mapping between course components. Besides, the procedure simplifies course design consequently leading to continual improvement. The procedure can be applied to wide range engineering courses. It also gives more control on planning a balanced assessment.","event":"2017 7th World Engineering Education Forum (WEEF. Number of issue, however, are not considered. These includes issue such as,

1. What the total number of assessment the course should have?
2. What is the optimum distribution of weightage for the assessments?
3. What is the appropriate number of CLOs?
4. What is the appropriate way of mapping assessments to CLO?

Some of these issues are considered by the regulator without giving justification.

In this study we propose four quality indicators to measure the quality of the assessment system for the course. Careful investigation of these indicators give clearer understanding of assessment and how it related to CLO and other course components. It also help find answers to the above questions in a more rigorous way.

All four tool make use of weight assigned to assessment. Results obtained from using the tools are more useful when assigned weightage is a true reflection of assessment in terms of used resources (time and energy), relevancy and so on. Assigning weightage to assessment is subjective and can cannot be perfected. That is one limitation of the proposed tools.

This work is mainly based on the fields of information theory and probability theory. The assessments are treated like noisy information channels. Each assessment carries a message about the achieved learning of the student. Due to the added noise, an assessment measure of achieved learning always has some degree of uncertainty. Some of the methods to combat this noise is by diversity means (using multiple assessments) and also by improving the quality of the assessment.

The rest of this paper is organized as follows. The next section explains the mathematical model on which all the four indicators are based. Each of the four indicators occupies one section. Last section is for discussion and to make some conclusions.

Model

We assume a course with N assessments named A_1, A_2, $\cdots A_N$ and M CLOs named CLO$_1$, CLO$_2$, $\cdots$ CLO$_M$, where $N, M \geq 1$.

Each assessment is allocated some weightage w_i, $i = 1, 2, \dots N$, such that,

$$\sum_{i=1}^{N} w_i = 1$$

Each assessment is mapped to one or more CLO. $w_i^{(j)}$ is the fraction of assessment A_i allocated to CLO$_j$. Note that $w_i^{(j)}$ is equal to 0 if A_i is not mapped to CLO$_j$.

The total allocated assessment weightage to one CLO is measured by the CLO assessment power. Assessment power, $w^{(j)}$, $j = 1, 2, \cdots M$, is the cumulative assessment of CLO$_j$ by all assessments. $w^{(j)}$ depends on assessment weightage w_i and fraction of marks allocated to the CLO $w_i^{(j)}$. It can be calculated by,

$$w^{(j)} = \sum_{i=1}^{N} w_i w_i^{(j)}$$

Intensity of Assessment

The first tool is to help us answer the question of how much assessment is enough. This measure is called intensity of assessment, $\mathcal{J}$. $\mathcal{J}$ is expressed by the following.

$$\mathcal{J} = 1 - \sum_{i=1}^{N} w_i \log_2 w_i$$

The minimum value for $\mathcal{J}$ is 1 and the maximum value is ∞. $\mathcal{J}$ is obtained when there is only assessment in the course. The aim should be to maximize $\mathcal{J}$.

Equation (3) can be used to answer the following two questions.

1. What is the best distribution of the weight?
2. How many assessments should we have?

This mathematical model views the assessment as a source of information. As with Shannon's entropy, $\mathcal{J}$ is proportional to the number of assessment N. So, to answer the second question, ideally we should have as many assessment as possible. In practice, however, we are limited by available time and resources.

On the other hand, for fixed N, $\mathcal{J}$ is maximized with equal distribution of weightage. Due to the limitation of space, proofs of the above claims are omitted.

Assessment Accuracy in Measuring CLO Attainment

Accuracy, φ_i, of an assessment A_i measures its ability to assess targeted CLOs. It is expressed by the below formula.

$$\varphi_i = \frac{\log_2 M - \sum_{j=1}^{M} w_i^{(j)} \log_2 w_i^{(j)}}{\log_2 M}$$

The range for φ_i is 0 to 1. $\varphi_i = 0$ when assessment power of is equally distributed to assess all CLOs.

As indicated by (4), the accuracy of the assessment is increased when its assessing power is focused on assessing a smaller number of CLOs. Maximum accuracy ($\varphi_i = 1$) is achieved when 100% of the assessment power is concentrated on one CLO only. This is conclusion agrees with the requirement imposed by some of the accreditation bodies like the Malaysia Engineering Accreditation Council (EAC) (Elsheikh et al., 2017)the procedure helps meet some of the accreditation requirements imposed by the Malaysian Engineering Accreditation Council such as explicit assessment of programme outcomes. Key to success is the careful mapping between course components. Besides, the procedure simplifies course design consequently leading to continual improvement. The procedure can be applied to wide range engineering courses. It also gives more control on planning a balanced assessment.”,”event”:”2017 7th World Engineering Education Forum (WEEF. Non-explicit mapping of assessment to CLOs, where one assessment maps to multiple CLOs, is prohibited by the EAC.

The overall accuracy, φ, is the average accuracy of all assessments.

$$\varphi = \sum_{i=N}^{N} w_i \varphi_i$$

Precision in Assessing CLO Attainment

In many situations, the calculation of CLO attainment ignores the actual distribution of assessment weightage. This undermines the importance of the weightage of assessments. Normally the overall course distribution of assessment weight is more reflective of the actual weight of these assessments. It is not fair, for example, if a quiz with 5% weight to have the same impact on CLO attainment as a final exam question worth 25%. One reason why actual weightage is ignored could be to avoid complex models for calculating CLO attainment.

Assessment precision is a characteristic of the assessed CLO. $\rho^{(j)}$ measures how in agreement is the distribution used in calculating attainment of CLO$_j$ with the actual distribution of the measuring assessments. $\rho^{(j)}$ is expressed in the below equation.

$$\rho^{(j)} = 1 - \frac{\lambda^{(j)}}{\lambda_{\max}^{(j)}}$$

where $\lambda^{(j)}$ is the amount of deviation from distribution used in calculating CLO attainment from the actual distribution. $\lambda^{(j)}$ is given by,

$$\lambda^{(j)} = \frac{\sum_{i=1}^{N} \left(\acute{w}_i^{(j)} - w_i w_i^{(j)} \right)^2}{N}$$

$w_i^{(j)}$ is the weightage of assessment A_i used to calculate the attainment of CLO$_j$. Note that the term w_i $w_i^{(j)}$ represents the actual weightage of the assessment in calculating the CLO attainment.

To improve precision, we have to ensure that the assessment distribution used in calculating CLO attainment is as close as possible to the actual distribution. It can be shown that zero precision occurs when all assessing power is allocated to the assessment with the least weight. Mathematical proof is omitted due to limited space.

The overall precision in calculating all course CLO attainments is calculated by,

$$\rho = \sum_{j=1}^{M} \rho^{(j)}$$

Fair Distribution of Assessment Power

Fair distribution of assesses power, $\mathcal{F}$, meausres how evenly the total assessment power is distributed among CLOs. We use the below formula to calculate $\mathcal{F}$.

$$\mathcal{F} = \frac{\sum_{j=1}^{M} w^{(j)} \log_2 w^{(j)}}{\log_2 M}$$

$\mathcal{F}$ is calculated only if there are two or more CLOs, i.e., $M \geq 2$. $\mathcal{F} = 1$ is the maximum value obtainable which indicates 100% fairness. $\mathcal{F} = 0$ indicates 100% biased distribution of assessment. It occurs when all assessment power is allocated to one assessment only.

Discussion and Conclusions

The proposed measures of quality for the assessment set is a good way to avoid some of the issues encountered when designing courses. All discussed quality indicators, except assessment intensity, have the range 0 to 1, where 0 is the worst case and 1 is the optimal value to seek. As for the assessment intensity, it can take any value equal to or greater than 1.

The quality of assessment is not limited to those discussed here. The actual design of the questions/activities and how well relate to the covered material is important too.

This work is far from complete. There are several possible extensions. First, some of the conclusions made are to be proved analytically. On the other hand, the suitability of the framework tools should be further investigated. Finally, some of the proposed tools can be assessed empirically.

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DEVELOPMENT OF GAMIFICATION-BASED DIGITAL STORYTELLING MODEL IN CYBERSECURITY

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Introduction

Nowadays, using gamification applications is conspicuous in cybersecurity, motivating users and changing their behavior to keep themselves safe. However, other challenges to retention knowledge criteria, such as decreasing the rote-learning time and reducing the error proportion in understanding, can be achieved by using appropriate components incorporated into gamification design. The more this combination is designed and developed effectively, the more the results are satisfying. This paper proposes developing gamification with digital storytelling that helps in counting less rote-learning times and lesser error to indicate understanding. Also, it leads to better retention of cybersecurity content based on gamification elements, digital storytelling model, memory model, and cognitive theory of multimedia learning. A developer can develop this combination using our model to enhance memory retention and gamification use in cybersecurity.

Related Works and Methodology

An eminent design science research methodology that Vaishnavi Kuechler has proposed would be adapted for development gamification with digital storytelling. It is the acceptable approach that researchers are mainly selecting, whereby the main concentricity is on the final artifacts such as models (Ruhi & Akhigbe, 2016). The research methodology that will be conducted in this work includes three phases; awareness of the problem, suggestion, and development (Hooper, Barbour, Walsh, Bradbury, & Jacobs, 2018). The development of gamification-based digital storytelling goes through some phases and activities until the final artifact is obtained, as shown in Figure 1. This paper, briefly explain these phases, focusing on phase three (development) as follows;

Awareness of problem

In this phase, the research problem should be defined through literature study and content analysis, and it could be solved. Wherein the statement of the problem is instituted based on these activities. Before that, the research gap was identified in the current knowledge retention mechanism in the classroom. Subsequently, the main problem is stated in the low rate of knowledge retention in the cybersecurity classroom of higher education institutions (Ibrahim & Al-Shara, 2007) (Cooper & Richards, 2017) (Schrenzel, 2015). Thus, we selected technical and vocational education and training (TVET) students. Such as the students in the Malaysian Institute of Information Technology in Universiti Kuala Lumpur. Moreover, we pinpointed the main components in developing a gamification-based digital storytelling application based on competitive studies, such as gamification dynamics (Kapp, 2012), mechanics (Siemon & Eckardt, 2017) and constructs (Campbell, 2016), digital storytelling model based on common elements (Freytag & MacEwan, 2015; McKee, 2010; Ohler, 2013), multistore memory model (Groome & Brace, 2014) and cognitive theory of multimedia learning (Mayer, 2014). These studies, therefore, contribute to building up the research objectives that stated in firstly, developing a new gamification-based digital storytelling model. Secondly, to evaluate the effectiveness of the new gamification-based digital storytelling model in terms of time and understanding by comparing the conventional way with the new model in the classroom.

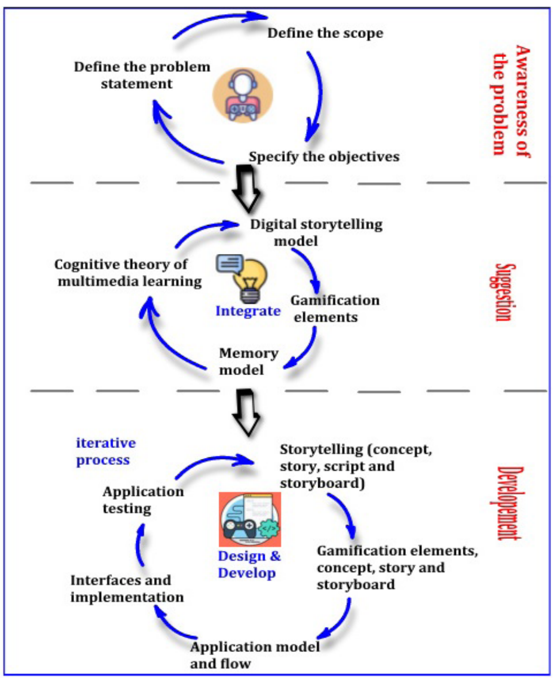

Figure 1 Gamification based digital storytelling methodology

Suggestion

In relation to the recommendation phase, the outputs from the first phase (Awareness of the issue) would be utilized to develop and create the recommended model. Furthermore, the cognitive theory of multimedia learning clarifies how to implement the cognitive processes of instructional multimedia sources effectively and efficiently during the learning activity. Therefore, implementing such cognitive processes is vital in the knowledge retention process. In addition, studies on the multistore memory model were conducted to obtain the appropriate solutions for the knowledge retention processes and flow in the proposed model. At the same time, we extracted the main digital storytelling elements based on the common factors of digital storytelling models.

Moreover, gamification mechanics, dynamics and constructs. These components are essential for designing and developing educational gamification applications. All these components would be incorporated into the proposed model in the third phase, as shown in Figure 1. therefore, we would convert the combination into the proposed gamification-based digital storytelling model.

Development

The development of the proposed model would be based on the activities performed in the suggestion phase. All the main components of developing gamification-based digital storytelling have been identified in the preliminary phases. All the proposed stages, steps, flows, and gamification-based digital storytelling model processes were integrated to shape the proposed model. Converting the model into an actual application is an intricate process, whereby the transition from theory into practicality is not as simple as anticipated. Therefore, the developing process of the model is conducted in frequent stages to manage the inherent complexity that would emerge during the way. It follows the principle of iterative development (Ushaw, Eyre, & Morgan, 2017). In every iteration, the inefficiency is identified and enhanced upon. Thus, it is iterated until the application pursues the complexity of the proposed model exceedingly. In this phase, we go through the following activities.

a. Design the digital storytelling

In this activity, the digital storytelling is designed based on some steps, starting from the story concept that should be simple and entertaining to the audience, with emotional and memorable events—secondly, the story events are related to phishing content. In contrast, the events revolve around a young man facing phishing threats. Here the design of story events should follow the digital storytelling model(McKee, 2010; Ohler, 2013). Thirdly, the story script describes how the storytelling is told, and a specific format is used to write the story script, which are scene headings, actions, character names, and dialogue. Lastly, the storyboard, the story script would be visualized in this process using storyboard template type, whereas the actors, props, backgrounds, and camera angles were fit together in any particular scene or sequence of shots. Then we used Iclone pro software to design and animate the digital storytelling based on the storyboard.

b. Design the gamification elements

In this activity, firstly, the gamification elements have been selected, which can help to motivate , engagement of students and enhance their knowledge retention. Moreover, we can integrate these elements with other components and theories that discussed above to achieve the study objectives. Therefore, the elements were the gamification mechanics such as points, badges, rules, timer, levels, and leaderboard. At the same time, the gamification dynamics were status, competition, and rewards system. In addition, gamification constructs were feedback, progression, and unlock the content. Secondly, the gamification concept, it is simple and entertains the audience with playful and memorable games. Thirdly, the gamification story is related to phishing content, and it revolves around multiplayer games divided into three different levels related to phishing threats. The players can learn based on gamification elements and digital storytelling. Here, gamification elements should follow the proposed model and flow that we will explore in the next section. Lastly, the storyboard, the gamification story, would be visualized in this process using storyboard template type. In contrast, the actions, props, backgrounds, and camera angles were fit together in any particular scene or sequence of shots. Then we used Unity 3D software to design and animate the gamification system based on the storyboard.

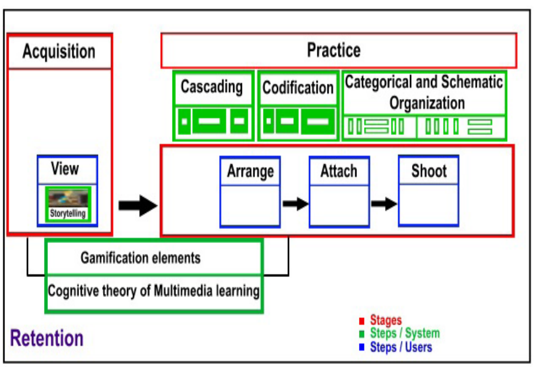

Figure 2 Gamification based digital storytelling model

c. Application model and flow

As shown in Figure 2, the gamification model focuses mainly on the theories or techniques of knowledge retention that are possible to be incorporated into gamification design. Therefore, this combination can engage, motivate users, enhance their knowledge retention, and provide a long-term effect. Technically, some of these techniques would be available as practices and performed by users to improve their knowledge retention, such as acquisition, attachment, arrangement, and association. In contrast, the application would be designed to facilitate the knowledge retention process to users, such as codification, cascading, digital storytelling, memory model, cognitive theory of multimedia learning, and gamification elements.

Results and Discussion

The primary stages and steps that mentioned above would be systematically incorporated with other components, as shown in Figure 2. These components will be briefly described as follows,

Cascading: It describes how practices are unveiled to the player incrementally and continuously (Monfort & Krempels, 2015). Using the cascading technique can enhance knowledge retention because practices are not given all at once but in manageable chunks to ensure the player's focus is on the desired objective. Thereby, confusion and misdirection of players by providing excess information are prevented, and each iteration of new data can be applied directly. Following the general principle of cascading, we divided the phishing practices into three games (levels); drag and drop, flip and flop, and hitting game. Therefore, each game would be available only if the players achieved the required conditions. This is also closely associated with unlocking content. The game mechanic of levels as cascading practices leads to unlocking content, and successfully moving throughout those experiences is one way to move up levels in the game.

Codification: It concerns how the practice's structure is formatted and organized to ensure better retention. In comparison, systematized knowledge is easier to be retained than non-systematized one (Loftus & Loftus, 2019). In our design, the game practices are codified in terms of the complexity of phishing content from easiest to hardest. Starting with 'drag and drop' game that is relevant to building a secure webpage, then moving up to 'flip and flop' game that pertains to recognizing the clues of mailbox phishing, while 'hitting' game is the last whereby the players have to shoot the balloons that suspected to be phishing indicators. This organization brings semantic order to the content that players want to learn. Thus, it is likely that the codification function of the practices decreases storage demands by ordering the stimuli in a manner that more closely matches the preexisting organizational structure of long-term memory. Additionally, exercises that connect the to-be-remembered content to the organizational structure of long-term memory may also facilitate retention (Baddeley, Eysenck, & Anderson, 2014).

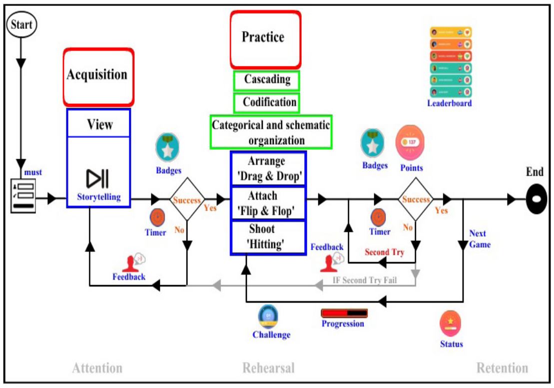

Figure 3 Gamification model flow

Categorical and schematic organization: A category is a set of objects that belong together (Farmer & Matlin, 2020). Categorical organization enfolds organizing practices in a taxonomical hierarchy whereby abstract category labels organize subordinate paradigms (Worthen & Hunt, 2015). Following this theory, in our game practices, and to enable the player to remember the lures of cybersecurity phishing. For example, the player must remember the following lures; unknown senders, HTTP, address bar, suspicious subject lines, generic greetings, padlock sign, requesting for personal or financial information, and status bar. These lures could be organized into two separate categories, each of which subsumes four lures. For example, HTTP, address bar, padlock sign, and status bar would be subsumed under the category label ‘drag and drop’ game, which pertains to building a secure webpage. While unknown senders, suspicious subject line, generic greetings, and requesting personal or financial information would be subsumed under the category label ‘flip and flop’ game, which pertain to recognizing mailbox phishing. With this kind of organization, one would need only to remember the category labels or game names, which should cue the particular lures to be remembered. As such, the organization of the to be remembered lures should decrease the cognitive load. Moreover, with this kind of application, the intervention of categorically related associates would not be necessarily problematic.

A schematic organization enfolds organizing to-be-remembered practices such that spatial relations among lures are preserved (Worthen & Hunt, 2015). Using our categories for game practices discussed above, the needed lures could be organized according to where they are located on the screen or the web page. For example, in the ‘drag and drop’ game, which is relevant to building a secure website, the player might note that the padlock sign, HTTP, and the address bar are placed on the upper part of the web browser, and the status bar appears at the bottom part of the web browser. Thus, the upper and bottom parts of the web browser would serve to organize and cue to-be-remembered lures.

Concerning model flow, as shown in Figure 3, The players must create their accounts (username & password) and be logged in using their accounts. Then, each player must watch digital storytelling of phishing threats in the acquisition phase until the end as a rule of gamification elements. The badges would be given if the player successfully finished this stage. Using the digital storytelling technique, the multistore memory model (Groome & Brace, 2014) makes the players pay more attention to the content. Then, players can start the game in the practice stage, beginning with the ‘drag and drop’ game, then flip and flop game, and finish shooting the balloons game. Finally, the player can collect points and badges based on some conditions and rules as gamification elements.

In contrast, the player cannot pass each game (level) unless he achieves 2/3 of the total points within a specific time (1 minute). If the player succeeds and achieves the conditions in each game (level), he can unlock the next game (level) and play with the same rules. As a challenge, the player would be given a second try in each game (level) if he could not succeed from the first try with the same rules, except the time would be minimized (45 seconds). If the player failed on the second try, he would return to the first stage to watch the digital storytelling again and start the game from the beginning. Consistent with the multistore memory model discussed above, the multi practices or levels technique helps the players enhance their knowledge retention effectively. In addition, the players can receive feedback while playing, and they can also check their status and progression. The leaderboard as well would be available for each player to see the ranking of other players. The winner is who achieving the higher points and badges within less time.

Interfaces and implementation: The successful installation of a gamification-based digital storytelling application will result in the system interface with login depicted in Figure 4a. In comparison, new players are required registration for login into gamification. After logging into gamification, players can access digital storytelling of phishing threats (Figure 4b). Here the players must watch all the digital storytelling content to enable playing the gamification.

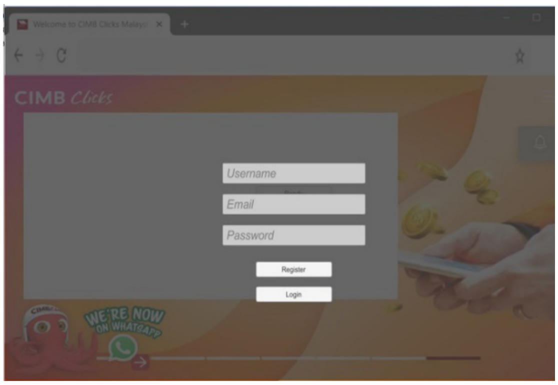

Figure 4a Login interfac

Figure 4b Watching digital storytelling interface

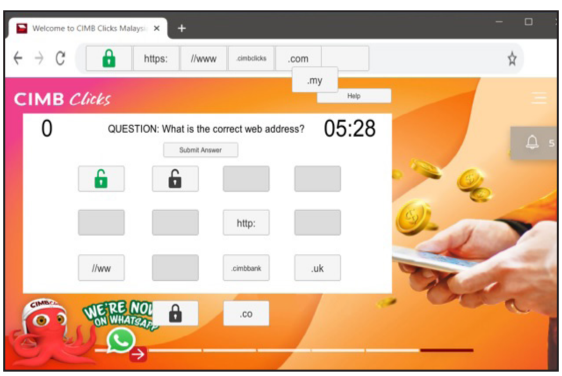

Figure 5a Drag and drop game interface

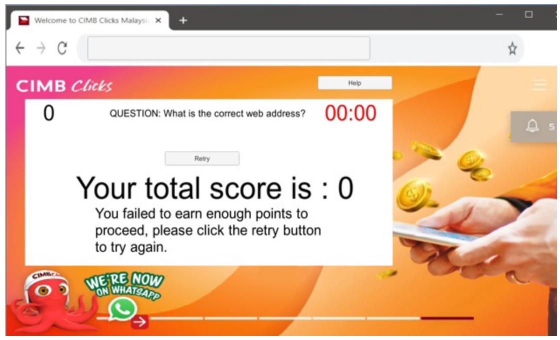

Figure 5b Feedback in drag and drop game interface

Players would be directed to the first level of the game immediately after watching the digital storytelling of phishing threats. The drag and drop game is the first level of the game, as shown in Figure 5a, where the players have to drag the elements of building a secure webpage and drop them in suitable places. In addition, the players have a second try to exceed this game if they could not succeed from the first try, along with other rules and conditions discussed in the previous section. The feedback element also would be available to alert and guide the players in this situation, as shown in Figure 5b

The second game (level) is a flip and flop game, and the players cannot play this game unless they exceed the first game (drag and drop). In this game, the players have to match the clues of phishing of mailbox on the left side to the corresponding information on the right side, as shown in Figure 6a, followed by the same rules and conditions of the first level. Finally, while Figure 6b illustrates the last game (level), which is to shoot the balloons after the players exceed the flip and flop game, they can play this game, where the players have to shoot the balloons suspected be phishing indicators.

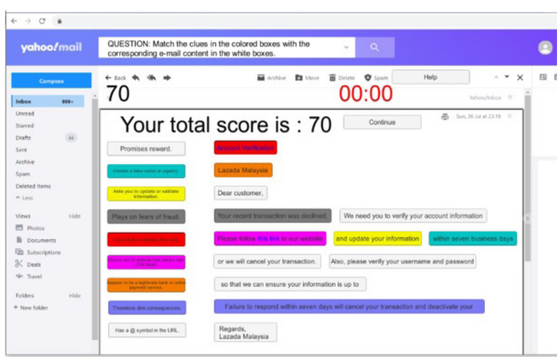

Figure 6a Flip and flop game interface

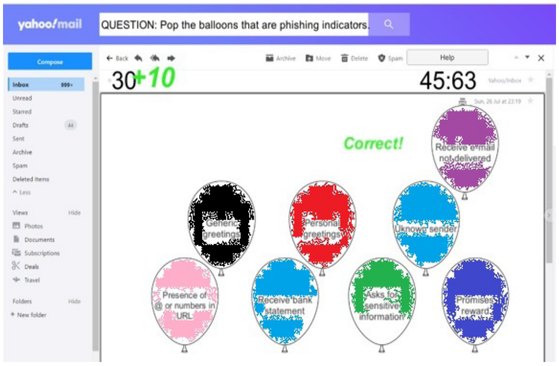

Figure 6b Shoot the balloons game interface

We implemented the gamification-based digital storytelling application with two main sets of components; front-end and back-end.

The back-end component, the gamification-based digital storytelling application, is hosted in a dedicated server, whereas the server runs the Microsoft Azure platform (remote server). The back-end component is hosted on a windows system. It consists of HTTP handlers, which deal with all requests from the front-end components; gamification based digital storytelling application MySQL DB, which contain user profiles, tasks, and play data; gamification based digital storytelling application Admin Portal, through which the administrator of the gamification based digital storytelling application can update some of the content.

Front-end component. The gamification-based digital storytelling application was developed for windows devices. The gamification-based digital storytelling application was built using the game engine Unity3D with C#, which supports cross-platform development; therefore, developers or researchers can target different platforms in future studies. We used Playfab SDK to build the login system and leaderboard and Iclone Pro to create the digital storytelling.

Application testing

We tested the gamification-based digital storytelling application. Thus, to find the bugs, the tester applied Ad hoc test (Chhabra & Research, 2012). The testing life cycle was iterative until the last version of the application. In this kind of testing, the tester was free to try different scenarios and probabilities to discover the faults during the execution, fix them, and ensure that all components and elements were implemented correctly as planned.

Discussion and expected results

This paper proposed developing a gamification-based digital storytelling application that can help enhance knowledge retention in cybersecurity by minimizing the rote learning time and decreasing error proportion in understanding.

The techniques and theories used in this paper can increase the efficiency of gamification in cybersecurity classrooms and enhance students' knowledge retention. Using digital storytelling in this application assisted in attracting the attention of the players to the cybersecurity content and understanding it memorably. Another step can instill the knowledge remarkably in mind, such as practices represented in three different games and two rounds in each game.

These practices work as rehearsal techniques of the knowledge in the memory. Although in this paper, we did not evaluate the application yet in terms of the rote learning time and the errors of understanding. However, the gamification-based digital storytelling application can assist in presenting and calculating rote learning time and error proportion in understanding (the fewer errors, the more understanding) for each player. Consequently, ordering them based on less time and more minor errors using the leaderboard element as shown in Figure 7.

Figure 7 Presenting of less time and more minor errors in the leaderboard

Conclusion

In this work, we investigated the gamification capabilities that have been imperceptible in the previous studies. The paper flicked the possibility of enhancing knowledge retention by gamification elements and not only for motivating, engaging, or students' enjoyment, especially in cybersecurity classrooms. Furthermore, the evaluation of the application in terms of users' rote learning time and error proportion in understanding is not yet known. Further study should examine them for a better user experience in using gamification in learning.

Acknowledgment

The research is funded under UniKL STRG: UniKL/CoRI/str19046. The author would like to acknowledge those who help and support this project directly or indirectly. Special gratitude to Center of Research and Innovation, UniKL.

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EVALUATION OF INDUSTRIAL TRAINING PROGRAM DURING COVID-19: EXPERIENCE OF UNIVERSITI TENAGA NASIONAL

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Introduction

Industrial training is a subject that is part of the program structure for undergraduate students. Industrial training refers to working experience completed by an undergraduate student at an external organization during the progress of a degree study that is relevant to professional development before graduating. This subject is a compulsory requirement in the curriculum of all Bachelor degrees at the Universiti Tenaga Nasional that are taken by all six (6) degree programs in the College of Computing and Informatics (CCI). Students need to pass the course to be eligible for the degree and it is planned to be taken in the second year of study or during the final semester of the study. The course emphasizes on IT practicality and skills (communication, personal, human, presentation and technical writing) in the working environment related to the Information Technology (IT) industry.

The industrial training is offered in the special semester before going into the final year. However, some students opt to do their industrial training after they have completed all subjects. The students are attached for a minimum of 12 weeks of training at various IT organizations in Malaysia.

The industrial training components that are assessed by CCI include the daily log book activity report, the technical report, oral presentation, and the performance skills. The visiting lecturer from CCI are assigned to students and are required to evaluate the reports, log book, and student performance. The host supervisor at the organization is responsible for evaluating the students' technical skills as well as the soft skills, which will be assessed using a template provided by CCI.

The host supervisor serves as an industry supervisor who will guide the student at the workplace. Students will receive tasks or job assignments from the host supervisor, including performing work or project that relates to their program, interacting and communicating effectively with other personnel, and demonstrating excellent ethics and integrity in performing their works.

A grade of Pass or Fail is awarded after the presentation and submission of the industrial training documents. Therefore, this paper aims to explain the evaluation change to suit the virtual working situation due to COVID-19.

This paper is organized as follows: in the second section, the existing evaluation will be explained. The third section will discuss the adapted evaluation that suits the virtual assessment. Concluding, we discuss the challenges faced in evaluating industrial training during the Covid-19 pandemic.

Current Evaluation for Industrial Training at the College of Computing and Informatics (CCI)

CCI consists of two departments, namely Computing and Informatics that offers six different degree programs. The credit hours awarded after the completion of industrial training is six credits within the durations of 12 weeks and is commonly taken during the short semester in February until May. The final result given is either Pass or Fail. This is different than the traditional evaluation of subjects that award grades from A to E based on the student performance in the course (CCI, 2021).

The implementation of industrial training in UNITEN is divided into three phases, : before industrial training, during industrial training and after industrial training. These three phases of implementation of industrial training are monitored by the Industrial Training Committee (ITC), headed by the Deputy Dean of Student Affairs and External Relations (SAER) of CCI. The entire phases of industrial training and the implementation are supported by *Industrial Training System* (ITS).

Before industrial training refers to the students starting to find suitable placements that suit their program and interests. During this process, students are required to find and select a suitable organization for them to do their industrial training. Students may find the companies from the past company list provided by CCI, or look for their own placement using any suitable job portal. Students should undergo industrial training at external organizations that provides proper job experience and relevant with the scope of industrial training for the 3 months.

During the industrial training, the students are placed at chosen organizations for 12 weeks, where they will be provided with works by their host supervisor. The objective of having these students placed in external organizations is to expose them to the reality of the working environment and various aspects of industrial practices and ethics.

Each student is assigned with visiting lecturer and host supervisor that are responsible for assessing the students' work performance and soft skills. The students are assessed using a set of scoring rubrics and rating scales. The scoring will be applied to the assessed components: the Industrial Training Report, Logbook, Oral Presentation, Performance Evaluation by Host Supervisor and Visiting Lecturer. The CCI students' evaluation is shown in Table 1 for local students and Table 2 for international students.

A visiting lecturer is assigned by the college once the students who registered for the course are compiled. The lecturer is responsible to assess the student's performance during a visit to the company. At the company side, a host supervisor assigned by the company is responsible for guiding and assessing the students' performance throughout the 12 weeks..

Table 1 Current evaluation of industrial training for students in Malaysia

Evaluators	Evaluation Method	Percentage (%)
Host Supervisor	Training	40
Visiting Lecturer	Oral Presentation	30
	Report	25
	Logbook	5
	TOTAL	100

Table 2 Current evaluation of industrial training for students doing industrial training overseas

Evaluators	Evaluation Method	Marks	Percentage (%)
Host Supervisor	Student Performance	50	40
	Oral Presentation	20	
Visiting Lecturer	Student performance	10	30
	Oral presentation	20	
	Report	50	25
	Logbook	20	5
	TOTAL		100

Both visiting lecturer and host supervisor are required to assess the students' performance using a specific form prepared by the Industrial Training Committee (ITC). The committee's responsibility is to provide guidance to both lecturer and students and monitor the execution of the course.

Students are expected to prepare a presentation, logbook and industrial training report. The presentation will be assessed by the visiting lecturer, host supervisor during the visiting lecturer's visit to the company before the training ends. Assessment of the student's presentation will be mainly based on the contents, style of the presentation, student's appearance, and the abilityto answere questions.

After industrial training phase, the industrial training report and logbook have to be submitted to the lecturer after the training ends. Both documents are in the form of a printed report that follows the format is set by the college. The assessment marks by both supervisors are entered online through the ITS by the visiting lecturer, as shown in Figure 1. In order for CCI to evaluate the organizations and tasks that the students performed during the industrial training, the students and the host supervisors are encouraged to fill in surveys provided by the ITC.

Update Marks Here:

Milestone	Criteria GV1	Marks	Marks Awarded
Carry Marks Data Entry	Host Supervisor's Evaluation	40.00	32.00
Carry Marks Data Entry	Visiting Lecturer's Evaluation	30.00	20.00
Carry Marks Data Entry	Industrial Training Report	25.00	20.00
Carry Marks Data Entry	Logbook Evaluation	5.00	4.30

Submit

Latest Updated Marks:

Criteria	Marks	Given
Host Supervisor's Evaluation	40.00	32.00
Visiting Lecturer's Evaluation	30.00	20.00
Industrial Training Report	25.00	20.00
Logbook Evaluation	5.00	4.30
Total	100.00	76.30

Figure 1 The marks page for industrial training at Industrial Training System (ITS)

Change of Evaluation During Covid-19

Covid-19 has affected all kinds of learning institutions in Malaysia, where all levels of education systems were closed as a measure to prevent mass movements and gatherings. Since the start of the pandemic, most countries in the world have closed down their educational facilities. For countries that are recovering from Covid-19, schools or universities are starting to be partially open (UNESCO, 2020).

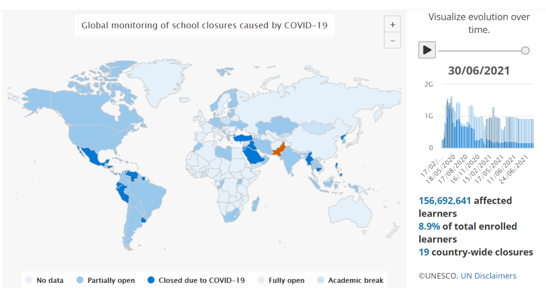

Figure 2 Global impact of COVID-19 on school closures. Figure produced by UNESCO (UNESCO, 2021).

Malaysia has introduced several versions of lockdown, with Movement Control Order (MCO) 3.0 being the latest that was announced on 1st June 2021. However, when Delta variant cases were detected locally, Covid-19 case numbers, hospitalization and death rise to a worrying number. In order to control the pandemic, Malaysia has introduced National Recovery Plan on 15th June 2021, which consists of several phases that limit the number of staff in the offices. Similar control has been used since the start of Covid-19 in Malaysia, where offices are closed down as part of the MCO restrictions. These restrictions have directly impacted the industrial training in Malaysian universities since students are not able to do their internships. Most companies are implementing the Work-From-Home (WFH) policy, and they are not able to take interns as no direct supervision could be provided to the students.

This also affected the current evaluation that requires visiting lecturer to visit the company for the presentation and observe students' working environment. During the Covid-19, most companies are implementing work from home (WFH) policy and physical visit is not possible. This has motivated the committee to change the existing evaluation to suit the situation (ChanLin & Hung, 2015; Zhou et al., 2020).

Based on the current evaluation, the visit to the company by the Visiting Lecturer is an essential component as oral presentation is also conducted during this visit. The lecturer will have the opportunity to discuss the students' performance with the Host Supervisor, which the input from this visit can be used for the performance evaluation.

With the increasing case of Covid-19 that seen the Movement Control Order (MCO) being issued by the Malaysian government, the visit component of the industrial training is changed to suit the situation. Visit by the lecturer to the company for the oral presentation and face-to-face discussion with the supervisor is changed to virtual evaluation, where the student may present their training progress using an online tool. The students may propose any suitable tool that may suit both lecturer and host supervisor platform and environment. Some of the online or virtual tools proposed including Zoom, Webex, or Microsoft Teams. For companies that could not use virtual tools for the oral presentation, lecturers are allowed to call the supervisor to discuss the students' performance or have a discussion through email.

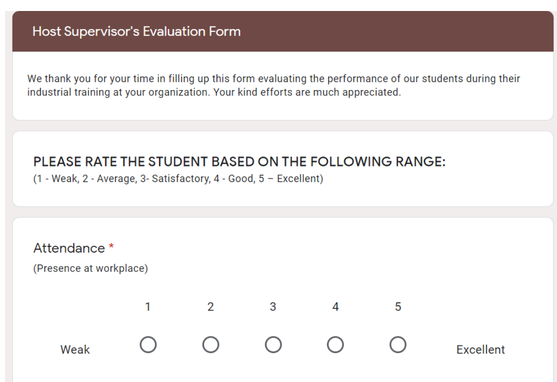

Figure 3 A snapshot of the Google Form provided for the Host supervisor to evaluate the students

Students are given a deadline to submit a report and logbook after training ends. The submission method of these components are changed, wherein the current evaluation, the student submits a printed report and written logbook. As all evaluations are being done virtually, the submission method of both logbook and training report are submitted in softcopy version and emailed to both supervisors, and marks will be given accordingly. The host supervisor will enter the marks using the Google Forms prepared by ITC, where the link will be passed to them through the students or visiting lecturer. Figure 3 shows a part of the host evaluation forms using Google Forms.

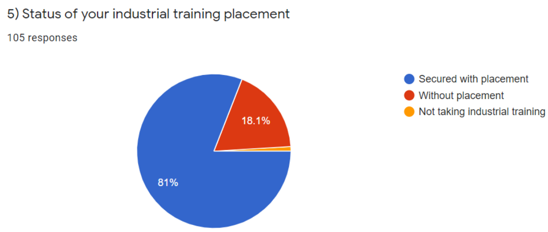

Figure 4 Status of industrial training placement before the industrial training commenced.

Discussion

The first batch affected by Covid-19 was in February 2020, when the Malaysian Government announced the Movement Control Order (MCO) on 18th March 2020, about four (4) weeks after the students started their training. These had posed several challenges to students, organizations that take the students for training and the universities, as explained below:

1. Students

Students have been given a briefing before they start the training and have understood all the processes. They also can easily consult their department coordinators if they have any problems regarding the industrial training processes and procedures by seeing their coordinators in the college. With the Covid-19 situation, students can only consult their coordinators through email. This is a challenge for students without Internet connectivity, especially in getting notices from the college regarding the training.

Furthermore, the increasing of confirmed cases of Covid-19 and the imposing of MCO has resulted in students facing challenges in getting job placement. Job opportunities are limited as companies in Malaysia are in lockdown and need to comply with the Standard Operating Procedure (SOP) enforced by the Ministry of International Trade and Industry MITI. Based on the data collected from the survey a week before industrial training starts, 18.1% of the students still find a placement and only 81% are secured with placement, as shown in Figure 4. However, some students had an issue where their internship was put on hold. They could not start their internship as the respective company did not allow work from home as they wanted direct supervision of the students.

2. Organizations

Some organizations, especially from small to medium industries, are new to Working From Home (WFH) policy. These companies are unclear on how to monitor student's work virtually and assess their work performance as they could not monitor the students directly. They are not equipped with the tools and technology to support an online working environment. Some students were given leave during the MCO as the company could not give a proper task that could be assessed virtually.

Companies were also overwhelmed with new instructions and evaluations given by the college in assessing the students' training. The industrial training coordinators need to pass notices or information through the students to ensure that the host supervisor receives it.

Visiting lecturers who evaluated the students reported that tasks provided to the students were not suitable or they were given tasks with small scopes. As this batch of students were new to the working from home mode, the visiting lecturers provided suggestions to the companies on suitable tasks forfuture students.

3. Universities

The minimum duration for the industrial training has been set by the Malaysia Qualifications Agency (MQA) for a course or program to be accredited. Undergraduate students in CCI, have to undergo industrial training for a minimum period of 12 weeks (Malaysia Qualifications Agency, n.d.). This has been designed into their program structure and suited to UNITEN academic calendar.
Most of the programs in CCI require students to go for their industrial training in the Special Semester or third semester in their Year 2 of study. Once they have completed the industrial training, they have some time buffer before they start Year 3. The duration of the

industrial training has been calculated into their 3-years of the degree program. Students have to follow the timeline given prepared to ensure they could follow and finish their studies on time.

This has been changed by the pandemic, as with the introduction of MCO, the Malaysian Government gives no fixed dates in allowing certain industry sector to work. Although students receive placement offers from organizations, their report duty dates are changing and this jeopardises their industrial training as they could not fulfill the minimum of 12 weeks duration.

MQA realized the criticality of this issue and has proposed that universities in Malaysia should employ alternative ways to replace the conventional industrial training during MCO. The structure of the industrial training has to be changed as organizations are closed down, and they have to postpone or reject students' applications for their industrial training. Consequently, this may risk the students' chances of completing their studies on time.

The proposed alternative methods need to be designed to suit the program and fulfill the learning outcome agreed and set earlier. Some of the alternative methods may include industry-based project, problem-based project, topical study or research project. Simulation activity and virtual practical, through online or performed remotely, can also be used depending on the program taken by the students. These alternative methods can be used as full replacement or partially complete the industrial training for students who have to stop in the middle or have not fulfilled the agreed learning outcomes (Malaysia Qualifications Agency, 2020).

Conclusion

This paper discusses on assessing the industrial training students using the virtual method at the College of Computing and Informatics. The current industrial training evaluation has to be changed to suit the virtual method being introduced due to the Covid-19 pandemic. Challenges exist for students, organizations that take the students for training and the universities as the changed evaluation is new and has not been used before.

Acknowledgment

We would like to express sincere appreciation to the Industrial Training Committee of College of Computing & Informatics (CCI) for providing information on the industrial training in the year of 2020 and 2021. A special thanks to Universiti Tenaga Nasional for providing the fund for the publication of this paper.

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DEVELOPMENT OF A LEARNING TOOL FOR ASSISTING CHILD'S MOTOR AND COGNITIVE THINKING ('LOCO-MO-THINK')

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Introduction

A single person has the ability to learn multiple skills. Some, if not most of these skills are beneficial and important in daily life. Examples of these skills are motor skills and cognitive thinking. Aside from motor skills, one's ability for cognitive thinking is also important. It is the process of gathering and interpreting knowledge. This is important as many industries interpret the cognition of a person as a level of their critical thinking when faced with a problem. Various sectors in industries require an individual to quickly and decisively come up with a solution when provided with a problem. In the modern industrial age, high precision tools are a must for high-quality production. A high level of competency is a requirement among workers to operate the tools. When an individual has honed their skills in both fine motor skills and cognitive thinking skills, they are equipped with a combination of highly sought-after skills, putting them in an advantage against their peers in a working environment, especially in high precision and skill workplace. To get to this level of competency, individuals need to be taught at a young age the basics of the skills required.

This research project aims to create a tool that helps to teach and improve motor skills, especially fine motor skills and cognitive thinking skills in children. The tool 'LOCO-MO-THINK' is created with the idea of implementation as a board game to capture children's attention and enjoyable to explore. Below is the paper's outline; firstly, some relevant literatures and definitions on motor skills and cognitive thinking are elaborated. Next, we highlight how board games are useful in promoting learning. The paper further elaborates on the hardware development, design of cognitive test and fine motor skills test, analysis of test results and concludes with a recommendation for further work.

Literature Review

Motor skills emphasize the ability to make something happen rather than selecting something on cue (Bilodeau, 1961). It can also be said to distinguish the areas according to the hand's relative, tongue and eye. In contrast to verbal learning, which requires the task to be emphasized in words, perceptual learning is the sense of the most obvious elements of the task at hand. Some research works have been conducted to establish a connection between academic performance and motor skills. On visual-spatial integration and visual-motor coordination, it was suggested that these two achievements have potential avenue for targeted math and writing interventions for children (Carlson, Ellen & Timothy, 2013). In a study by Marie-Laure Kaiser et al., visual-motor integration is considered a prerequisite skill before learning handwriting, referring to prior studies conducted with the Scale of Children's Readiness in PrinTing and VMI. A significant correlation was found and measured, especially for older children. Significant relations were found between the VMI result test and the quality of handwriting tend to decrease with age (Kaiser, Albaret & Douding, 2009).

Cognition is the process where knowledge is acquired and manipulated. It is a mental ability and a reflection of one's mind; therefore, it is not observable and cannot be directly computed and measured. However, by observing their actions and behavior, the development of a child's cognition can be inferred (Bjorklund & Causey, 2018). On finding the correlation between physical activity to cognitive, a study by Sibley and Etnier of Arizona State University found a significant positive relationship between physical activity and cognitive function in children. Sample of effective sizes were calculated and compared to the relative and overall effective size. When analyzed, the overall sample was significant from zero. The outcome is also the same regardless of the status of the subject's age and initial assessment (Sibley, & Etnier, 2020).

Games mechanics stimulate the players to enjoy and take part actively. This is called to facilitate and encourage users to explore and learn the possibilities through a feedback mechanic. The outcome of the gamification is the games are appropriate to tackle problems and is an effective tool to encourage learning (Taspinar, Schmidt & Schuhbauer, 2016). Board games are important tools which provide a practical and hands-on approach for knowledge and skill development. A well-designed game can be fun and capture the attention of an audience and create an engaging atmosphere. A competitive environment will also enhance focus and reinforce the knowledge gained by the audience if done correctly and in a healthy way. The board itself represents a tangible medium to point out key information. In addition, the teamwork promoted by certain games reinforce relationships and creates more organized information and conceptual framework to be made concrete. Other benefits include promotion of critical thinking and effective communication among peers (Treger, 2011).

Methodology

The hardware development consists of the following, summarized in term of a block diagram,

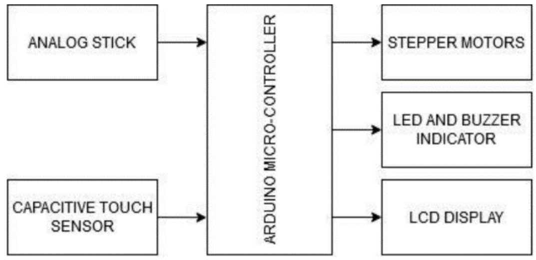

Figure 3 LOCO-MO-THINK system block diagram

The system comprises three main parts; mainly the sensor and input parts, the computing part and output part. The sensor and input part consists of the analog stick and the capacitive touch sensor. The purpose of the analog stick is to detect any directional changes when force is applied. In the other hand, the capacitive touch sensor acts as a switch and allows electrical flow when there is force, in the form of touch, is applied. The computing part, which consists of the Arduino microcontroller. The output part consists of the stepper motor, an indicator such as LEDs and buzzer and an LCD display. The stepper motor will translate the signal from the microcontroller into mechanical movement. The LED and buzzer indicators provide auditory and visual indications, while the LCD display will provide a platform for a string of words translated by the microcontroller to be displayed onto.

Hardware to be used mainly consists of a main controller and interchangeable modules. Figure 2 shows the main controller diagram.

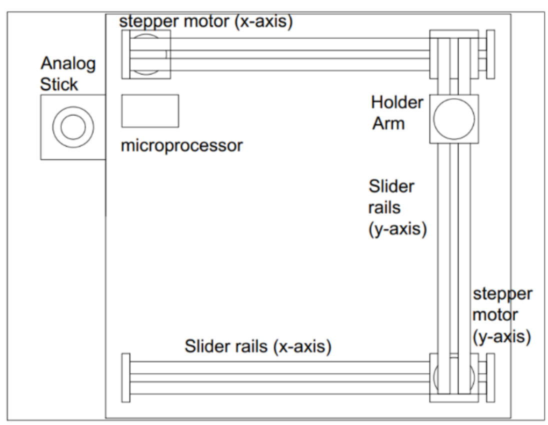

Figure 2 LOCO-MO-THINK controller diagram (top view)

It lets the user control the rotation of the two stepper motors, which are connected to the belts. The belts will move a magnetic arm which is controlled by a joystick. The joystick, hence the magnetic arm, is the main tool interacting with the interchangeable modules.

The interchangeable modules consist of three modules or 'cards', aimed at specific skill development. There is one module for fine motor skills and two separate cognitive thinking skills.

Wire track module

Aimed at developing fine motor skills of the user along with hand-eye coordination. The user is required to navigate the track with the joystick and prevent any contact with the wire track itself. The selected game is a wire and track game. To complete the game, the user must navigate the track to make contact with the end pad avoiding the wire track.

Puzzle module

Aimed to hone problem-solving skills. The user is required to arrange the blocks to the designated locations with the usage of the joystick. The game for this module is a reminiscence to an old arcade game developed by SEGA entertainments, 1982 Pengo. To complete the puzzle, all LED, numbers may vary, must light up to indicate success.

Random generator (RNG) module

Aimed to develop cognitive thinking skills by giving the task for user to find the product of two randomly generated numbers. The selected game is snake and ladders, and users have to complete the game by successfully obtaining the sum of the randomly generated numbers.

Prior cognitive test

Before the users start to use the modules, users are required to take a cognitive test beforehand. The test itself acts as a baseline where the user's performance can be quantified after the usage of the tool. The users are required to take the test again to see the change of user performance in terms of cognition. The test itself is taken online and is divided into four different levels.

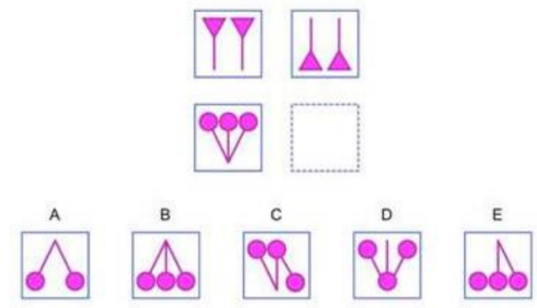

Figure 3 Level 1 cognition test sample

The first level involves the understanding of the user to identify pattern orientation in a simple way by correlating a sample pattern to a new pattern. An example is when set A images are placed in upside-down and down-side up pattern. The user is required to match set B images to the set an image in terms of pattern. The second level is similar to the first level, but it involves pattern identification instead of orientation identification. A sample set is placed and the user is required to identify the next possible pattern to match the initial set.

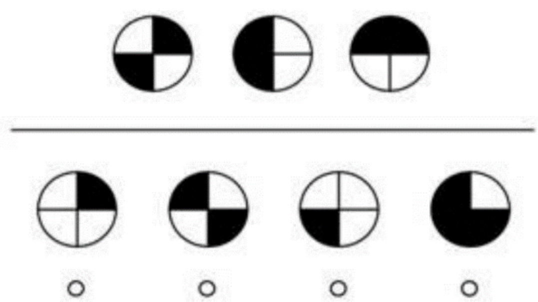

Figure 4 Level 2 cognition test sample

The third level test is the identification of a pattern in several sample images. Several sample images are set into a typical grid pattern where the objective is for the user to fill in the gaps of the empty cell if the most suitable pattern to complete the grid.

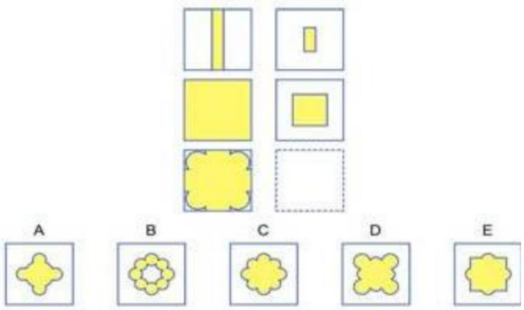

Figure 5 Level 3 cognition test sample

The fourth level of the cognition test essentially combines the levels 1, 2, and 3.

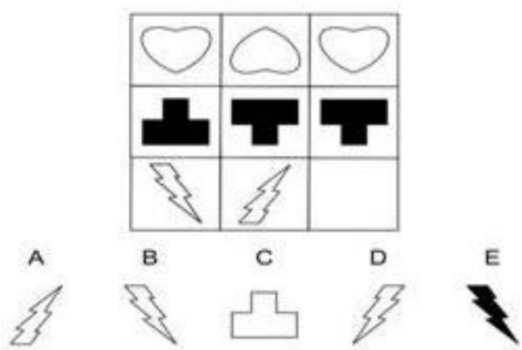

Figure 6 Level 4 cognition test sample

It involves pattern identification on a more complex level. It combines the pattern recognition of the level 2 test with the orientation identification of the level 1 test. The sample set of images are placed in a specific pattern and orientation in a typical grid similar to the level 3 test. The user is required to fill in the grid based on the information of the sample images.

With the intention to test fine motor skills, the user is required to do the line trace test before using the project to get a baseline of the performance.

The test checks for the number of major deviations, number of minor deviations and number of overall deviations from the dotted lines, as shown in Figure 8 and Figure 9, respectively.

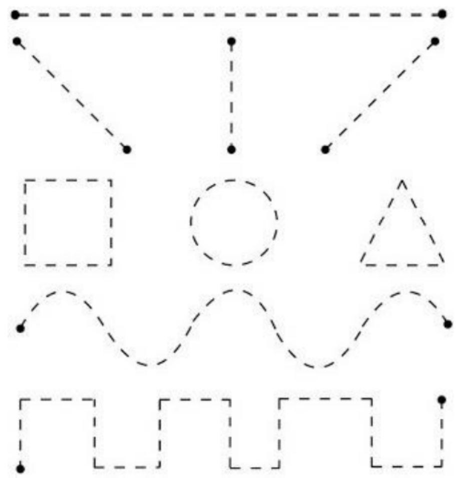

Figure 7 Patterns used in fine motor skill test (trace line test)

Results and Discussion

Results of cognition tests are discussed first, followed by fine motor skills test.

Table 4 Cognition test results

User	Preliminary results (%)	Secondary results (%)	Score increase	Score increase (%)
1	40%	70%	30	75%
2	40%	65%	20	40%
3	50%	70%	20	40%
4	40%	75%	35	87.5%
5	40%	75%	35	87.5%

The preliminary results of the cognition test done by the users were obtained beforehand. The users scored an average score of 42%, with subject 3 scoring the highest at 50%. This is to be expected since the users have never seen the test beforehand or have a firm understanding of the concept of cognition. In the secondary test of the same test, the performance of the users has increased. Users 4 and 5 have seen a drastic increase in their score of 87.5%, followed by users 1 in having the second highest score increase of 75%, with users 2 and 3 having the lowest score increase of 40%. The score increase can be attributed to the memory cognition learning, where people can learn from past experience. The users are able to take their previous knowledge of the test to answer better in the secondary test of the cognition test. The product acts as a stimulus for the users to exercise their thought from using the test module.

In the preliminary fine motor skills test, it is found that the number of deviations ranges from 22 deviations, being the lowest number of deviations and 48 being the greatest number of overall deviations in the trace line test.

Table 2 Overall deviation trace line test results

User	Preliminary results	Secondary results	Diff	Diff (%)
1	22	13	9	40.91%
2	31	22	9	29.03%
3	33	23	10	30.30%
4	22	12	10	45.45%
5	48	15	33	68.75%

Post using the project, the users' performance has increased, which can be seen in the decrease of the number of deviations on the trace line test. An average score of 42.89% increase can be seen in the users, with user 5 having the greatest decrease of deviations, followed by user 4 with a score of 45.45%, user 1 with a score of 4.091%, user 3 with a score of 30.30% and user 2 being the lowest if only a slight increase of score of 29.03%.

Table 3 Major deviation test results (trace line test)

User	Preliminary results	Secondary results	Diff	Diff (%)
1	16	12	4	25%
2	30	12	18	60%
3	19	8	11	57.89%
4	6	0	6	100%
5	10	2	8	80%

In the preliminary test, an average of 16.2 major deviations from the test subject can be seen on the trace line test, with 30 number of major deviations being the highest and 6 number of deviations being the lowest. After the users used the project, the number of deviations has decreased, causing an increase of performance at an average of 64.58%. User 4 has seen a dramatic decrease of major deviations in the secondary test with no major deviations at all.

Table 4 Minor deviation test results (trace line test)

User	Preliminary results	Secondary results	Diff	Diff (%)
1	6	1	5	83.33%
2	1	10	-9	-900%
3	14	15	-1	-7.14%
4	9	12	-3	-33.33%
5	38	13	25	65.79%

In the preliminary, an average of 13.6 minor deviations has been found on the trace line test from all 5 users, with 38 minor deviations being the highest from user 5 and 1 minor deviations from user 2. After the user used the project, there are mixed results in the number of minor deviations. For starters, the average number of deviations from the trace line has decreased to 10.3 deviations with 25 minor deviations being the highest scored by user 5 and 1 minor deviations scored by user 1. However, some users can be seen having an increase in number of minor deviations on the trace line test. Examples of this happening are user 2, where the number of deviations increased from 1 to 10, which is a 900% increase in number of deviations. This can be attributed to the improvement of the number of major deviations. User 2 has a decrease of 18 major deviations from the trace line test. This improvement does not always mean that the major deviations disappear into perfect overlapping lines. These major deviations can simply evolve into minor deviations, which shows the incremental improvement of the user performance.

Conclusion

This prototype has been tested on adult users who are technical students. Further investigations corresponding to lower age will need to be explored. Nevertheless, the objectives and purpose of this project have been achieved. Interchangeable modules were developed that are specified in assisting the development of fine motor skills in the guise of an active interactive board game, which stimuli the senses of sound, sight and touch. This project uses specific modules that help the development of the cognitive thinking abilities of the user, with one model specified in pattern recognition (the puzzle module) and one module specified in the arithmetic and mathematical skill (the RNG module). From the results obtained, the project itself has also proven effective in improving these skills over time, even though more practice in using the tool is required for the impact to be significant. Although, there are results which can be seen as impairing their skills but these are normally chalked up to the human error, different growth rates and varieties of learning curves of each individual. In short, using LOCO-MO-THINK as a prototype for trained and specialized users can be useful for those users at the early stage of life, making the process of gaining motor and cognitive skills easier. The tool will be further developed to ensure future trainees can develop skills and supply the demand for more skilled workers. This will be economically beneficial to the country as a whole.

Acknowledgment

The authors wish to acknowledge the support from the Electronics Section of UniKL BMI for lab usage, manpower and storage of hardware.

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ELECTRONIC TEXTBOOK AS AN EFFECTIVE TOOL FOR FOREIGN LANGUAGE TEACHING IN AN E-LEARNING ENVIRONMENT

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Introduction

Creating an educational intercultural educational space close to an authentic language environment is one of the most discussed issues of modern methodology. E-learning technologies today are aimed at shaping learners' foreign-language communicative competence. Changing the student's passive role into an active one contributes to the implementation of modern pedagogical approaches to learning: axiological, activity-based, competence-based, intercultural. Thus, the change of the computer's role in the learning process leads to the change of the passive learner's paradigm to the active learner's paradigm.

The focus of modern language education is the personality of the student, which is its highest value, and the educational process and its result are associated not only with the acquisition of knowledge, skills and abilities by the student but also with a change in the personal perception of the student. This is the essence of modern language education, and e-learning, including e-textbooks as its main means, is called to play an essential role in the realization of this vision.

During the study, based on the literature analysis, we defined electronic media as a learning tool, identified and analyzed the functions of electronic media in comparison with traditional printed materials and outlined the conditions under which the linguistic and didactic potential of electronic media can be realized. In addition, the necessary structural elements of electronic media were highlighted. The study identified and analyzed the principles of the educational process organization and behavioral trajectory of its participants when working with electronic media as the main learning tool.

Method/Literature Review

During the study, the following methods were used:

1. theoretical analysis of the literature on the problems of research;
2. comparative and comparative analysis of foreign experience of implementing the information and communication technologies in the educational process;

In our study, we referred to research on foreign language teaching methodology (I.L. Bim, N.D. Galskova, N.I. Gez, R.P. Milroud, A.A. Mirolubov, E.N. Solovova, and V.V. Safonova and others) as well as research on the theory of pedagogical systems and the computerization of learning (V.I. Zagvyazinsky, V.V. Kraevsky, V.P. Bespalko, A.V. Khutorskoy and others) and research on the use of ICT in relation to different conditions and goals of foreign language teaching (M.U. Bukharkina, L.P. Vladimirova, M.N. Evstigneev, E.S. Polat, P.V. Sysoev, R. Blake, W.D. Edgington, S. Edmonson, J. W. Hynes, A. Koptelov, G. Stockwell, E.G. Azimov and others).

Some works in the field of communicatively oriented foreign language teaching are of certain interest to our study (A.A. Leontiev, I.A. Zimnaya, S.F. Shatilov, E.I. Passov, T.S. Serova, I. L. Bim, A.A. Verbitsky, V.P. Kuzovlev, R.P. Milroud, D. Hymes, H. Johnson, W. Littlewood, K. Morrow, J. Richards, S. Savignon, Serdyudova; Andreeva; Shvarkovoy and Galinsky), as well as works by Tulegenova, Ryzhova, Sysoeva A.I. Ashmakov, I.A. Bashmakov, V.P. Bespalko, M.V. Bulgakov, V.M. Gasov and others, which reflect the issues concerning the didactic organization of electronic textbooks.

Results and Discussion

In the middle of the last century, a new person-centered approach came into the education system, based on humanistic psychology and pedagogy. The main task of education is to create conditions for the development of a harmonious, morally perfect, socially active personality. Fulfilling this task means that education should be based on the student's past experience, his personal features in subject-to-subject interaction and interpreted through his personality, motives, interests, prospects, etc.

New pedagogical ideas required new methodological approaches, including the use of microprocessor technology, which opened universal access to increasing information flows. Information and knowledge became the leading transforming force of society, and information resources became strategic resources of society, dynamically developing in the second half of the last century in language education.

In education nowadays, there are many theoretical approaches, methodological recommendations and practical advice on the use of information technology and various electronic devices in foreign language teaching. Today the question is no longer whether to use information technology in teaching and learning a foreign language. The problem is the selection of effective e-learning technologies and the possibilities of their adequate integration into a particular curriculum, content and the direct process of foreign language learning, also considering the individual characteristics of teachers and students.

Digital tools and technology have a great impact on the life of modern people. They are constantly surrounded by technical devices, spend a significant part of their study and personal time working with electronic information, communicating in a virtual environment. Social networks and instant messages have become an integral part of our lives, and it significantly affects the thinking process, search activity and processing of information for representatives of generation Y and Z.

Research shows that they cannot absorb information for a long time and in a sequential mode, read large texts, are restless and impatient, borrow materials rather than create their own, and have difficulty systematizing and analyzing the information they receive (Nosova, 2013). At the same time, they are distinguished by the ability to quickly and easily find access to information using digital tools. Accordingly, the rational use of means of new information and communication technologies in the learning process meets the needs of modern youth (Zayets, 201). In other words, e-learning can be considered an integral part of the learning process of any educational subject, including a foreign language.

When students have an active role, the teacher is more of a consultant and expert. He gives a challenging problem to solve to the students as a part of the learning material, using ICT and multimedia. This material includes a detailed outline of the topic, a list of references, references to Internet sources, i.e., everything that is necessary for independent work on the topic. Students use the outline to work through the material independently and consult the teacher regularly. The teacher assesses their ability to understand the problem, gather and select material, work with information, and adequately format the results of their work.

Consequently, the electronic textbook changes the status of the student, involving him in an active cognitive and information and communication process, including and above all with the help of computer tools, allowing to create conditions for the practical application of the knowledge, skills and abilities acquired by him, developing not only foreign language communicative competence but also personal qualities of the learner.

In foreign language teaching methodology, the teaching means are understood as "a set of teaching tools and technical devices, through which the teacher's activity to teach the language and the activity of students to master the language is managed" (Schukin, 2008, p. 321). Learning tools serve as means of implementing the goals and content of foreign language teaching in the real educational process, they are the conductors of methods and techniques of teaching, which in the context of the modern methodological concept should create a favorable atmosphere in the classroom, affect the personality of the student as a whole, create situations in which the teacher is in the spotlight, teach the student to work on language independently, use different forms of work (Galskova, Vasilevich & Akimova, 2017, p. 68). The main function of learning tools is to make it easier for students to learn a foreign (non-native) language and to make this process effective.

Modern teaching tools are usually combined into a set of manuals designed to work on a particular foreign language with a particular group of students and united by a single methodological concept of teaching foreign languages. The central component of the set is the textbook, which is interpreted in didactics as "a mass training book that sets out the subject content of education and defines the types of activities intended by the program for compulsory mastering by students, depending on their age or other characteristics" (Yakushev, 2014). According to this didactic position, the textbook is a linguistic expression of the educational content and guides the teacher and students in their activities, but this does not exclude a certain interpretation of the educational content by the subjects of the educational process.

Analysis of the definitions of "electronic textbook" presented in the pedagogical literature (Serdyukov, 1996; Andreev; Shvarkova, Galsky; Tulegenova et al.), allows you to believe that the electronic textbook has all the features of a traditional textbook and has its own specific characteristics due to the fact that it is created and used by means of the computer.

Both electronic and traditional textbooks have the same functional features. An electronic textbook, as well as a printed one, performs seven main functions, which are based on didactics,

1. Informative – to determine the subject content and activities;
2. Transformative – to implying transformation and revise the knowledge basics focusing on improving student activity; of the textbook becomes an active methodological system;
3. Systematizing – to ensure a strict sequence of presentations;
4. The function of consolidation and self-control - to provide intensive training to form the necessary skills and abilities;
5. Integrating - to assist in the selection of knowledge and its assimilation;
6. Coordinating – to provide effective and rational use of all means of education, including the interaction of components of the educational-methodical complex;
7. Developmental-educational – to create the conditions for developmental learning (Zuev, 1983).

However, in the context of the modern sociocultural model of language education, it seems legitimate, following M.V. Yakushev, to expand the register of didactic functions of an electronic textbook by including in it,

1. integrating function, which implements interdisciplinary links and ensures students' perception of a holistic picture of the world based on these links;
2. pragmatic function, ensuring the assimilation by students of the knowledge demanded by the person and society, the formation of subject competencies and skills of social interaction based on values and ethnocultural features;
3. The technological function, which involves familiarizing students with the methods and ways of activity, the development of the ability to choose rationally, and the ability to make decisions;
4. The function of self-development, which consists in stimulating students' activity in cognitive activity, forming the need for self-education, developing the ability to learn (Yakushev, 2014). A generalized list of functions of an electronic textbook is presented in Figure 1.

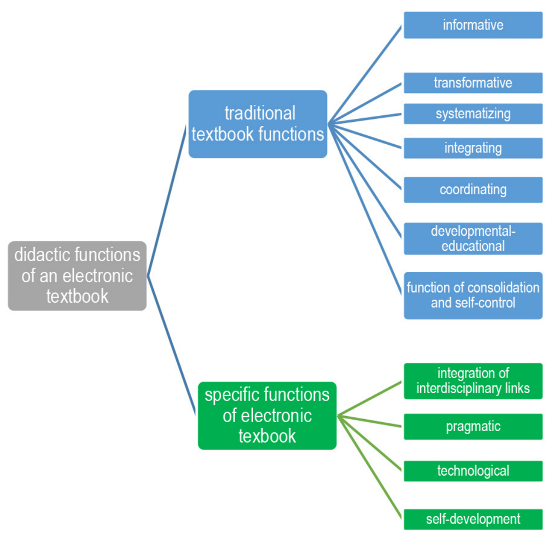

Figure 1 Didactic functions of an electronic textbook

Like a traditional textbook, the full performance of didactic functions of an electronic textbook is possible only under the following conditions,

1. Firstly, if it structurally and substantively meets the requirements of educational standards, and also takes into account the specifics of the educational and educational and developmental potential of a foreign language as a subject in solving the general problems faced by the education system of a certain level and the system of language education;

2. Secondly, its focus on the goals of teaching foreign languages and the educational outcomes recorded in the program;
3. Thirdly, the learning content embedded in an electronic textbook, consistent with modern didactic and methodological concepts takes into account the age characteristics of students, their needs and interests, motivating them to learn the language and its practical use as a means of communication.

Therefore, an electronic textbook must take into account the laws of learning a foreign language by students in the classroom, the basic provisions of psychological and pedagogical and linguistic theories and modern approaches (axiological, personally oriented, communicative-cognitive, active, intercultural) to the construction of the educational process in a foreign language, as well as the basic concepts of the foreign language textbook.

But since we are talking about an electronic textbook, we must keep in mind its specific functions - the functions of an electronic publication and software product. In addition, e-textbooks have features characterized by the presence of multimedia components and interactive elements (Figure 2).

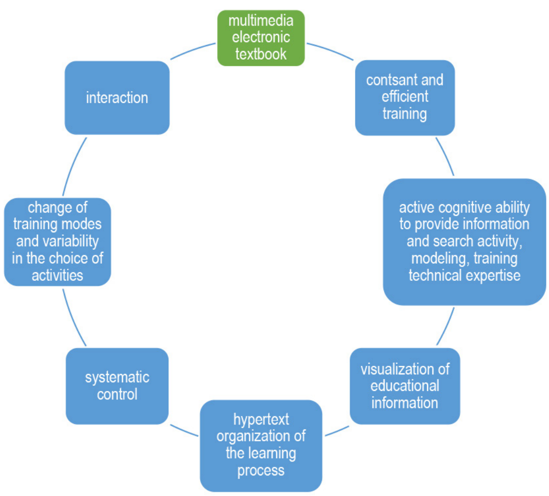

Figure 2 Features of EVs due to multimedia

Here we have identified the features of the electronic textbook, which allow you to expand and complement the content and process-technological content of a traditional textbook, as well as provide a new quality of teaching a foreign language through its additional features.

As we see from Figure 2, the main advantage of working with a digital textbook is that the student is given the opportunity to interact with the acquired information and not passively perceive it due to the presence of multimedia components and interactive tasks. Certainly, an electronic textbook, due to multimedia capabilities (information can be presented both in textual form and in graphic, video, audio and other formats), can provide visualization to an undoubtedly greater extent than a printed one. Its dialogical (interactive) nature provides an opportunity for students to better absorb educational material and allows effective control of knowledge and skills and, above all, self-control, during which interactive exercises allow not only refer to answers but also receive comments if errors were made in an exercise. When working with an electronic textbook, any user can choose a vector of work that is appropriate for him because an electronic textbook can include separate blocks addressed to a particular group of students.

Multimedia creates the conditions for interaction with the learning material (hyperlinks, pop-up prompts, interactive tasks), while ensuring the full implementation of the principles of clarity and interactivity of foreign language learning. Thanks to multimedia, students have the opportunity to choose the appropriate task for each of them and exercise self-control. In addition, the structure of the textbook provides for easy changes in the textbook content.

An electronic textbook realizes its linguo didactic potential by means of the following linguo educational principles,

1. Actualization of cognitive, creative and research activity of the learner;
2. Activation of "authentic communication" with the help of multimedia;
3. Solving information problems with the help of language (information search and processing);
4. Activation of students' productive activities with access to real socio-cultural context through interactive features of Internet resources, etc.

The use of an electronic textbook makes it possible to transform the learning process from "monological" to "dialogical". If in the first approach the predominant form of learning is frontal, the main mechanism of learning - "stimulus - reaction", and the dominant role is played by the teacher, and students act as performers, the second is characterized by group forms of learning, creativity and interactivity, interaction of all participants in the learning process. Therefore, the electronic textbook should stimulate students to active research and project activities in a foreign language, and this activity should be meaningful, exciting and useful. It is important that the electronic textbook creates an environment in which the learner can show independence, his/her own speech and thinking activity, evaluate his/her results and capabilities.

Not every digitized textbook which is an exact copy of its paper analogue can be called an electronic textbook because the information and texts in a digitized textbook have a linear structure, unlike an electronic textbook which has a hypertext structure. e. "such a special form of text material organization, in which text fragments are not presented in a linear sequence, but as a single system of interconnected fragments and with a clear indication of transitions from one fragment to another" (Kuleshova, 2013, p. 8).

As Kuleshova notes, hypertext is characterized by,

1. Non-linearity (text fragments are not arranged in chronological order on one page but are separated from each other and connected by special hyperlinks);
2. Interactivity (the user creates the model of familiarization with the material, chooses the sequence and methods);
3. Remoteness and accessibility (the author of the text and the user distanced from each other and can use the information at different times of day);
4. Virtuality (the text exists only in electronic form);
5. Multimedia (information can be presented both in text form and in graphic, video, audio and other formats).

Thus, hypertext is understood as "branching text", its system allows the user to move freely both inside the text and outside, using hyperlinks (Severova, 2012, p. 169).

"Pop-up windows" with different comments helping to comprehend the text play an important role in the structure of electronic media. The hypertext is the basis for the creation of e-learning tools and their distinctive feature. The presence of hyperlinks expands the internal space of the text and greatly simplifies the navigation on the peccy (Severova, 2012, p. 169).

Analysis of the literature on the topic of research helped us to identify the following active components in the structure of electronic textbook (Figure 3),

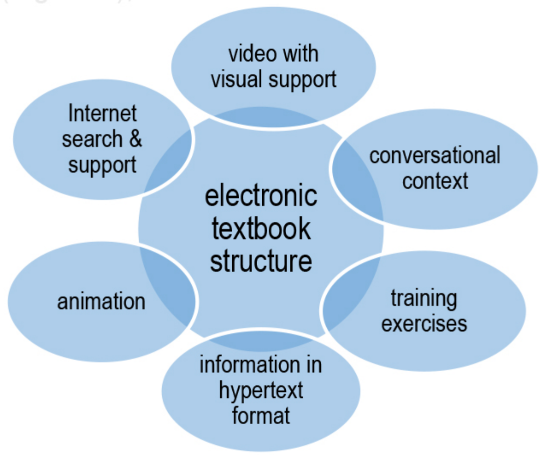

Figure 3 Electronic textbook structure

1. Video fragments with visual support: photos, pictures, automatic dictionaries, grammar comments, training modules, textbook (also with audiovisual elements) modules of speech recording and playback, databases of typical errors;
2. Different kinds of training exercises (substitution, multiple-choice, search for matches, text reconstruction, translation, construction by models) based on the predictability of students' answers (the programs analyze answers mainly by comparing them to standards in a database);
3. Information in hypertext format, which allows you to quickly move from one section to another, from one type of information to another, to search for information;
4. Animation for semantization, speech motivation, and presentation of learning material;
5. Internet search and support in the form of additional educational materials, methodical recommendations;
6. Providing conversational context with information support based on text, audiovisual data banks and information retrieval systems of the Internet.

Due to its ability to accumulate various e-learning technologies, an electronic textbook can act as an intermediary between the educational process and the open foreign-language information world, i.e., to be a "bridge" to the authentic language environment.

The use of electronic textbook changes the functional load of a foreign language teacher. He becomes a technologist of the educational process, a conductor of subject-disciplinary knowledge, a carrier of information, a keeper of norms and traditions, an assistant in the formation and development of the student's personality. The teacher's responsibilities in the chosen learning trajectory include the involvement of each student in an active learning process and in active communicative and cognitive activity. In addition, the teacher needs to create conditions for each student to consciously apply acquired knowledge, skills, and abilities in practice and to understand under what conditions and for what purposes the acquired knowledge can be applied, including the use of modern ICT. Teachers need to create an environment which encourages collaboration and cooperation in problem solving, providing free access to the information needed to apply it in their own statements.

The role of the foreign language teacher described above is based on his personal qualities, his possession of the basics of general and specialized knowledge and skills to apply this knowledge in practice, as well as knowledge of e-learning technologies in foreign languages, including electronic textbooks, its linguodidactic potential and ability to implement this potential in real learning environments.

A foreign language teacher should be competent in designing and implementing the educational process with the use of electronic media in accordance with the fundamental provisions according to which the system of foreign language teaching and its individual components function and develop. As it was mentioned above, since an electronic textbook is an educational tool, its use is based on general didactic principles (principles of formation of subject and meta-disciplinary competences, creativity, activity, visualization, awareness, accessibility, individualization, educative and developing training, activation of self-esteem and self-reflection) accepted in linguo didactics. The main principles of the teaching methodology (communicative orientation of the teaching, reliance on the native language and native culture, interconnected and parallel teaching of different types of speech activity with a differentiated approach to each of them, focus on the formation of intercultural competence, authenticity, dialogicality, organization of teaching in the context of "dialogue of cultures", etc.) and methodological principles (communication orientation, reliance on the native language and native culture, interrelated and parallel teaching of different types of speech activity with a differentiated approach to each of them, focus on the formation of intercultural competence, authenticity, dialogicality, organization of teaching in the context of "dialogue of cultures", etc.).

Thus, teaching foreign languages based on an electronic textbook and the above vision is designed to create psychological and pedagogical conditions, in which there are different forms of social interaction of participants in this process and which provide the student freedom in the manifestation of his thinking operations and actions, in the use of language tools for the implementation of personal needs. It is obvious that the role of an electronic textbook in the creation of such conditions is very significant.

However, since the e-learning tool, in comparison with the traditional, has its own specificity due to its technological capabilities, we should also talk about the specific principles of the educational process with an electronic textbook (Bartosh, Galskova & Kharlamova, 2017).

The first principle - the principle of full use of multimedia advantages of electronic textbook. It is an opportunity to use different resources of the computer tool,

1. information - texts, illustrations, video, audio, animation, slide shows, hyperlinks, and presentations;
2. training - tasks aimed at:
   a. development of language and speech skills (fill-in-the-blanks exercises, crossword puzzles, selection of synonyms and antonyms, etc.);
   b. development of verbal skills (choosing the right answer to questions to the text you have read/ listened to, filling in gaps in the text, etc.);
3. multimedia - an electronic textbook should include animation and sound, its own multimedia resources, which, turning this electronic book into a "living" document, are designed to provide students with access to alternative databases, the ability to comment and supplement documentation correlated with the program content;
4. controlling and measuring - various test tasks in open and closed forms (e.g., choosing the right answer, finding correspondences, establishing a sequence, categorizing objects, etc.).

The second principle is as follows: an electronic textbook contains various types and kinds of interactive objects which allow developing various abilities and skills of students, influencing all perception channels and making the educational process interactive.

The notion of "interactivity" reveals the nature and degree of interaction between objects or subjects, and "interactive learning" is, above all, dialogic learning, in which interaction and communication between subjects of the learning process and subjects with a computer as a learning tool takes place (Gavronskaya, 2008, p. 102-103). The basis of this interaction are interactive tasks and exercises in a digital textbook, which differ from the usual ones in the fact that they are aimed not only and not so much at consolidating the material already learned, as at learning new material. Therefore, each interactive task in an electronic textbook is a creative learning task, which requires students not to simply reproduce the information, but contains some element of the unknown and has, as a rule, several approaches.

The third principle means that an electronic textbook should as much as possible facilitate not only students' understanding of the material but also their better memorization (with the help of computer explanations). This process should involve those capacities of the human brain which are not active when working with a printed textbook (for example, auditory and emotional memory). Of course, an electronic textbook is not a self-teacher. It is as much a teaching tool as a printed one, and it acts as an accompaniment to the teacher at all stages of the lesson. But, as noted above, multimedia capabilities allow full implementation of this principle.

The fourth principle is the versatility of using the electronic textbook in the real learning process. Different variants of the construction of such lessons are possible. For example, after using traditional methods of teaching or printed materials on automation of the use of learned linguistic means the teacher make a transition to the study of new material by asking students to divide into pairs and independently (with the help of the computer) to start the study of new linguistic material and its primary automation (about 20 minutes) or at the stage of consolidation of linguistic and wording material, when students, sitting at the computer, do some training exercises for 5-7 minutes under the guidance of the teacher. Another option is when within a combined lesson with the help of an electronic textbook they automate and improve speech skills and abilities (15-20 minutes). And finally, at the end of the lesson students can refer to the corresponding fragment of the electronic textbook, comparing it with their variant of independent performance, in the conditions of work in groups (3-4 persons), tasks for study of new language and speech material and a certain set of tasks (10 minutes).

Of course, for an e-textbook to be successful, the teacher must be fluent in both the technical means of instruction and this digital learning tool and integrate it appropriately into the learning process. But the student must also be able to use the digital technology and communication tools embedded in the electronic textbook. Obviously, it is impossible to use this teaching tool without a basic level of computer literacy.

Discussion

It is known that some methodologists hold the viewpoint that only an electronic textbook can be innovative because it can offer a broad representative toolkit which allows students to perform learning tasks in all their diversity (Popova, 2011, p. 215).

But opponents of this point of view rightly argue that a printed textbook can also have innovative content, if by pedagogical innovation we mean not only technical means, but also new concepts, methods which are experimentally tested and implemented in the educational process in order to improve its effectiveness (Kitaygorodskaya, 2009).

There is also a third point of view, according to which the best way to achieve the goals of language education is a textbook of the new generation, integrating the capabilities of paper and electronic versions. These variants should complement each other, which will significantly increase the efficiency of the educational process.

In this context the electronic form of the textbook acquires particular importance. As it is known, the habitual printed textbook of a foreign language of the new generation can also provide interest to a subject, stimulate cognitive and communicative activity of students. It is capable of developing not only all the components of foreign-language communicative competence, but also other competences and personal qualities that are important for achieving the goals of education. However, ignoring the new technological and, above all, representational opportunities that the multimedia electronic form of the textbook provides to improve the learning process is not appropriate.

Thus, an electronic textbook must meet certain requirements, among which N.Y. Severova includes,

1. visibility, which means not only the presence of illustrations, but also extensive use of video, animation, and maybe, if necessary, 3D;
2. interactivity, according to which in the process of navigation the student gets help, for example, in the form of comments, pop-up prompts, access to reference information relevant to the material being studied
3. adaptability, which means the ability of electronic textbook, due to the arrangement of the material by levels of learning and placement of the maximum number of exercises necessary for mastering the material, to adapt to the individual characteristics of the user, allowing him to regulate the speed of

learning the material, to analyze the results of the learner and offers the best way to achieve the goal;

4. capacity associated with the ability of electronic textbook to accommodate material of great volume in a compact form;
5. accessibility due to the structure of electronic textbook, which is not linear, but voluminous, allowing students to build their own educational strategy, but with a mandatory sense of responsibility for their results;
6. cross-platform, i.e. the ability of an electronic textbook to be loaded on any operating system (Severova, 2012, p. 182-185).

Analysis of the literature on the subject and teaching practice convinces us that an electronic textbook can be successfully used in the learning process, provided that it, is clearly structured;

1. contains methodological recommendations for students and teachers;
2. is easy to navigate so that the user can navigate through the material and develop his/her own learning strategy;
3. corresponds to the results of the completed exercise offers the student a further algorithm of actions, contains material for different levels of learning.

The authors of the textbook “Electronic technologies in the system of foreign language teaching: theory and practice” believe that the didactic content of an electronic textbook should reflect the latest results of the theory and methodology of teaching foreign languages. At the same time, as the authors of the aforementioned manual point out, the didactic potential of e-textbooks is designed to,

1. provide a system-activity approach in teaching a foreign language, allowing students to achieve personal, subject and meta-disciplinary results of education;
2. to accumulate the latest computer technologies;
3. create an educational intercultural educational space that is close to an authentic language environment through the use of various electronic educational (interactive) resources;
4. ensure the quality of the educational process. (Bartosh, Galskova & Kharlamova, 2017, p. 158).

Conclusion

Thus, based on the above, we can recognize that the discussed type of textbook is,

1. the main source of learning information and a source of additional learning information, which allows the teacher to create an individual educational trajectory for each student, to work with lagging or advanced students;
2. a means of motivation by using additional materials, which in general contributes to the formation of subject and meta-disciplinary skills and abilities, universal learning activities;
3. a tool for organizing cognitive and practical activities of students due to the ability to navigate content and search through external resources;
4. a tool for working with information (networking, formation of subject and meta-disciplinary skills and learning outcomes);
5. a means of interaction between participants of the educational process;
6. a tool for operative control over the level of students’ speech skills and abilities due to the availability of a database of test tasks with automatic checking and open-ended questions;
7. a tool for creating an intercultural educational space that is close to an authentic language environment through the presence of interactive multimedia objects, providing access to authentic resources in a foreign language, and the possibility of communication with speakers of the target language.

In addition, it should be noted a certain convenience of using an electronic textbook. However, for this purpose, it should have a clear interface, and electronic educational resources included in it, should be consistent in style and correspond to the age features of perception of information.

An electronic textbook or its form as a modern tool of foreign language teaching provides optimization of the educational process due, first, to the possibility to combine traditional methods and innovations in it, second, to the extended content of the textbook (videos, presentations, slide shows, links, hyperlinks, etc.) and, third, to the possibility for students to self-check and self-control and, respectively, to reflect their educational results.

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INTEGRATING ESSENTIAL TECHNOLOGY AS EDUCATIONAL TOOLS INTO FOREIGN LANGUAGE TEACHING IN MODERN LEARNING ENVIRONMENT

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Introduction

In the modern system of language education there is an active research on didactic properties and functions of new multimedia and hypermedia technologies used in the foreign language teaching; various Internet resources to improve students' foreign language communication competence are developed, educational systems in foreign languages based on ICT or network technologies are built.

Today no one doubts that the use of e-learning technologies in foreign languages is accessible and necessary, due to the general education informatization and the efficial use of pedagogical, educational and methodological research developments focused on the implementation of the functualities of information and communication technologies, used in a comfortable and health-saving conditions.

Today's younger generation exists in an environment of global digitalization, so the task of teachers and methodologists is to use familiar to students digital tools for educational purposes, which, as research shows, has a positive effect on student motivation and the effectiveness of the learning process as a whole.

Materials and Methods

During the study the following methods were used: analysis of methodological, psychological, pedagogical, methodological and special literature on the problem of research; study of normative and program and pedagogical documents on education; design and modelling of complex training tools; analysis, synthesis, comparison, generalization.

Theoretical and methodological basis of the study at the methodological level: systemic, comprehensive, person-centred and activity-based approaches (N.A. Alexeev, U.K. Babansky, V. P. Bespalko, G.A. Bordovsky, L.S. Vigotsky, V.I. Zagvyazinsky, L.V., Solomin and Z.I. Tumaseva.). The study is based on theoretical works in the field of ICT use in the educational process in foreign languages (M.N. Evsyigneev, I.A. Evsyigneeva, U.V. Cohenderfer, D.A. Ezhikov, T. V. Karamysheva, E.S. Polat, N.S. Baron, S. Cameron, D. Chun and U. Felix). The problem of using technical tolls in the educational process in the works of many authors is related to the problem of effective organization of the teaching process (V.P. Bespalko, E.A. Khamraeva, D.K. Bartosh, N.D. Galskova, N.V. Kuzmina, T.A. Ilyina and others).

Findings

As we know, today's students - the students of the 21st century - are constantly surrounded by technical devices. They spend a significant part of their learning time and leisure time using the information presented on electronic devices. Most of the life of a modern person is associated with the use of electronic devices, which create the possibility of his constant presence in the virtual environment. For the modern student social networks, instant messengers are an integral part of life.

There are several definitions of electronic learning. The extremely simple definition is given by the experts of UNESCO: E-learning is training by means of the Internet and multimedia. Some associate the term only with distance learning.

In our opinion, foreign language e-learning is a way of organizing the educational process with the use of electronic devices, where students can form and improve their language and speech skills, develop socio-cultural and intercultural competence, to use a foreign language as a means of communication in the interpersonal and intercultural spaces.

Often e-learning is associated exclusively with distance learning, but in fact they are different concepts.

By e-learning we mean "the organization of educational activities with the information contained in databases and used in the implementation of educational programs and information technologies, technical means, and information and telecommunications networks that provide the transfer of communication lines specified information, the interaction of students and teachers,

By distance learning technologies we mean "educational technologies implemented mainly with the use of information and telecommunication networks with indirect (at a distance) interaction of students and teachers". (Federal Law "On Education in the Russian Federation")

E-learning means a fundamentally different approach to foreign language learning and performs specific linguodidactic functions, which are shown in Figure 1.

Modern teaching tools are usually combined into a set of manuals designed to work on a particular foreign language with a particular group of students and united by a single methodological concept of teaching foreign languages. The central component of the set is the textbook, which is interpreted in didactics as "a mass training book that sets out the subject content of education and defines the types of activities intended by the program for compulsory mastering by students, depending on their age or other characteristics" (Yakushev, 2014). According to this didactic position, the textbook is a linguistic expression of the educational content and guides the teacher and students in their activities, but this does not exclude a certain interpretation of the educational content by the subjects of the educational process.

Figure 1 Linguodidactic functions of e-learning

All other means, including technical ones, are "built" around the textbook. Leontiev wrote that the textbook, combining statics (it indirectly presents the program content of the subject) and dynamics (it simulates the learning process itself), "... is a 'transversal', permanent manual for every student, a manual not only for his class work, but also for his home work, while all the other components of the educational complex are used selectively, sporadically, fragmentarily". (Leontyev, 1988, p. 18–20). All technical tools (audiovisual, auditory, visual) along with a number of traditional (non-technical) belong to the so-called auxiliary means meant to "concretize and complete the content of the textbook without going beyond the limits of the educational material fixed in the program" (Schukin, 2008, p. 321-322), "optimize the educational process and create a more or less pronounced illusion of exposure to the language environment as far as it turns out possible" (Gez & Frolova, 2008).

So, we see that the textbook can be electronic, and in this case the work with it is carried out with the help of technical means, while it can be in the centre of the educational and methodical complex, belonging to the basic teaching tools designed for students to work in the classroom and at home. Thus, the "hardware" (Zimnaya, 1989, p. 100) electronic textbook (ET) gives reason to refer it to the technical means of learning.

Inclusion in the register of foreign language teaching tools electronic textbook, which has the potential as a traditional textbook and modern digital learning tool, puts this technical means of learning from the category of auxiliary to the main. By its nature, an electronic textbook can be classified as an educational technical tool specially created for learning (Zimnyaya, 1989, p. 100-101).

In addition to training technical means of learning, there are two other groups, the so-called “natural” ones. The first includes channels of mass communication adapted to the learning environment, the second includes those channels of mass communication that are included in the training (Ibid., p. 101). We mean, first of all, educational and authentic Internet resources. Educational Internet-resources, i.e. “text, audio-visual materials on various topics aimed at the formation of foreign language communicative competence and development of communicative-cognitive skills of students to search, select, classify, analyze and summarize information” (Sysoev & Evstigneev, 2010, p. 42), are traditionally divided into five classes,

1. hotlist – a list of links to textual Internet resources to be studied. The hotlist enables students to develop the ability to search for information, highlight keywords, identify the topic or problem, separate the main information from the secondary one, record the necessary information from what they have read, and express in detail/shortly the content of what they have read.
2. multimedia scrapbook – a list of links to multimedia resources: text sites, photographs, audio files and video clips, graphic information and animated virtual tours. Scrapbook - is designed to develop students, in addition to the above skills, the ability to summarize the information contained in the text; in detail or briefly state the content of what they have heard or seen; to record the necessary information.
3. treasure hunt – links to various sites on the topic under study, with questions.
4. subject sampler – links to text and multimedia materials on the Internet, after studying which students need to answer questions, express and argue their own opinions on the issue under study;
5. WebQuest - a list of links to multimedia and text sources, formulated questions by section, an assignment to formulate one’s own opinion and a general discussion question, a project involving all students and using Internet resources.

All Internet resources should be aimed at achieving the main goals of teaching foreign languages and improving the quality of education in foreign languages: the formation of students’ foreign language communicative competence in four types of speech activity, as well as information competence, which is based on the important skills of extracting information from different sources, analysing, structuring, fixing, identifying the main and excluding the secondary, finding examples in a text, argumentation etc.

Let us move on to consider a group of essential technical means, adapted to the conditions of teaching a particular foreign language, which includes such a multimedia tool as “synchronous video-internet communication”, which is understood as “real-time communication through Internet programs, providing video and audio communication” (Ezhikov, 2013, p. 11). From this definition it is clear that the means of synchronous video-internet communication provide an opportunity in the learning process to organize video and audio communication between two or more users in real time, thereby contributing to the development of participants in the communication process auditory, dialogic and monological skills. Because these tools allow you to leave video and audio messages online and offline, they give students the ability to post their comments on the content they’ve viewed in chat, record, send their video or audio content, organize a group chat discussion, etc.

Essential technical means also include authentic Internet resources, which are classified as additional tools of teaching foreign languages. It should be said that these resources, as it is considered in the methodology of teaching foreign languages, are the most valuable for learning a foreign language and another culture, as they contain significant linguo-sociocultural information. The material created by native speakers of the target language is a reflection of a modern, living language. That is why authentic resources can be effectively used to develop a student’s ability to work with various sources of information, improve his socio-cultural competence, expand his general and linguistic outlook, vocabulary, develop skills in the field of different types of reading and listening.

Among the main advantages of authentic foreign-language Internet resources are the relevance of the information obtained, the possibility of permanent and unlimited access to the source of information, the availability of several channels of information (auditory and visual) and its various sources (audio, video, printed, electronic materials, etc.), genre and stylistic diversity of materials, the opportunity to get acquainted with the opinions of leading experts in different fields of knowledge (scientists, politicians, economists, artists, etc.) and the diversity of the information received. Authentic resources are not tested for the quality of the material offered, do not receive an objective assessment of its level of complexity, the possibility of its use for pedagogical purposes, so the responsibility for their quality and methodology of their use in the learning process is the teacher, who, turning to these tools, must understand how to integrate them into the process of teaching foreign languages. Authentic information should not just be selected, it should be didacticized, first of all, in terms of removing difficulties. After all, along with the obvious advantages, authentic resources have negative aspects that should be reduced and excluded from the learning process, because any resource has an impact on the consciousness and worldview of the student.

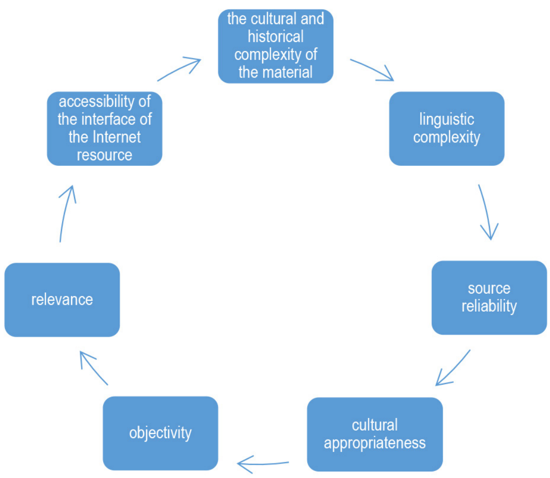

Figure 2 Criteria for assessing the quality of authentic resources

There is experience in computer-based foreign language teaching methodology in substantiating criteria for evaluating the quality of authentic resources to assist the teacher in their selection (Figure 2) (Sysoev, 2008). These criteria include linguistic and cultural and historical complexity of the material. The cultural component is complicated by the presence of language means (words, phrases, grammatical phenomena) unfamiliar to students, while the cultural component is complicated by the presence of references to historical and cultural events and facts, ignorance of which by students may have a negative impact on the understanding of information. The following criteria for assessing an authentic Internet resource are the reliability of the source, which is expressed in the degree of trust in its author, as well as the reliability of the information determined by the validity of the author's conclusions, the presence of references to other authoritative sources. No less significant are such criteria as relevance, cultural appropriateness and objectivity of the information. The first characteristic dictates the need to pay attention to the date of posting information, the second - the potential of this information in terms of personal development, compliance with a particular age group, students' interests, and, finally, the third - the possibility of forming a holistic pluralistic view of the world by the student. The last criteria for assessing the quality of an authentic Internet resource is the structure of the site, its graphic design, the presence of icons that fully reflect the content, the presence of direct links to search engines, etc.

Polat identifies four areas of use of Internet resources, 1) the Internet as a means of receiving information; 2) the Internet as a means of communication; 3) the Internet as a means of education; 4) the Internet as a means of entertainment; speaks of three groups of services provided by this computer medium: broadcasting (advertising, electronic newspapers and magazines, electronic libraries and databases, electronic learning systems), interactive (e-mail, teleconferences, chat rooms, etc.), search (electronic catalogues, search engines and mega-search engines) (2001, p. 14).

Authentic Internet resources allow us to solve a whole range of pedagogical and methodological problems. Among the first are the development of the student's ability to work with various sources of information, to search for the necessary material in a foreign language. The methodological tasks include increasing the level of socio-cultural competence of the student, expanding his general and linguistic outlook, vocabulary, as well as developing skills in different types of speech activity.

The relevance and diversity of information, constant and unlimited access to its source, the genre and stylistic diversity of materials - these are the undeniable advantages of authentic foreign-language Internet resources. Among them, resources related to mass media are of particular interest. Severova and Bartosh (2009) rightly point out that almost every periodical is now represented to some extent online. Virtually all radio and television stations have online channels. On their sites you can read and/or listen to current news and programs. At the same time, the materials of all sites are periodically updated, which allows the teacher to use relevant information. The most popular resource among young people today is YouTube, where you can find interesting video clips, including those related to country studies and/or professionally oriented topics.

Speaking about essential e-learning tools, it should be kept in mind that the same tool can be classified as an educational Internet resource and as an authentic one. From this point of view, podcast is a good example, it is an audio or video file (either a single audio file or a regularly updated series of such files) which is published online for listening on a personal computer or mobile devices at any time convenient for the user (Solomatina, 2011; Dudeney, Hockly, 2007). In other words, a podcast is a way of distributing audio or video information online, usually in AAC or Ogg/Vorbis format for audio and Flash Video and others for video broadcasts. Emerged in early 2005 to broadcast news, as well as part of the entertainment industry, podcasts very soon gained recognition by foreign language teachers, who noticed and appreciated their high educational potential. Later, podcasts were used by dubbing video files and became known as video podcasts, and then the name was shortened to videocasts (Severova, 2012, p. 171).

Bartosh divides all podcasts into two groups: educational podcasts and authentic podcasts. The former, educational podcasts, are specially designed for educational purposes, and are usually accompanied by a script with a transcription of the speech, and in some cases, exercises to consolidate the material. The latter, authentic podcasts, require didacticization, primarily in terms of removing difficulties (Bartosh, 2017, p. 13). There are three types of podcasts: audio podcast, video podcast, and screencast. The latter is a new phenomenon that has made it easier for people to learn online. The essence of screencast is that actions are recorded on the computer screen along with audio comments, which is ideal for explaining computer programs and applications.

Podcasts allow you to solve a number of methodological problems of foreign language learning associated with the expansion and enrichment of vocabulary, the formation and improvement of comprehension, listening, pronunciation, speaking and writing skills. For example, after listening to news and understanding its content, you can discuss it in a group. Like all foreign-language Internet resources, podcasts are authentic, up-to-date, new, available for download, and easy to use. All of this together allows podcasts to provide an opportunity to assimilate and “appropriate” the features of authentic audio speech, as well as to form and maintain motivation for learning a foreign language, to develop the ability to extract information of a different nature from the text. Another undeniable advantage of podcasts is that they provide students with a great opportunity to listen to current contemporary authentic texts of different genres on any topic of interest to students in a variety of performances (accent, timbre, rhythm, fluency of the speaker).

Currently, there are different ways to use podcasts, namely listening online with or without downloading files, creating your own podcasts, which can then be distributed among Internet users. Therefore, students can act both as consumers of information (listening to ready-made podcasts and performing tasks for them, prepared by the teacher), and as the author, when they themselves create and, publish their podcasts online for other listeners.

The use of podcast technology requires solving certain problems. For example, when selecting or developing exercises for podcasts it is necessary to consider the levels of difficulty of different types of tasks. Finding the right podcast might be challenging and time consuming.

Thus, if we talk about e-learning, the concept of “medium of instruction” can be used in two meanings: medium as information and medium as a tool or tool for learning and communication. The first meaning refers to the content of the e-learning tool. This content can be included in the lesson or it can be used by students to find information on their own, e.g., as part of a project activity. From this point of view, authentic Internet resources are especially valuable because they carry significant sociolinguistic and socio-cultural potential, clearly present linguistic, speech socio-cultural facts and phenomena. The textual material of these resources, created by a native speaker of the language studied, reflects the modern “live” language. As for the second meaning, as Polat writes (2003), we are talking about both special equipment (for example, video recording, radio broadcasting, computer program, network course, etc.) and the equipment itself (computer, interactive whiteboard, projector, mobile communication device, multimedia, etc.).

Thus, e-learning involves the interaction of learning information, didactic innovations and new information technologies. “The result will be new learning products in which the formula is realized: “information + didactics + computer” (Pichkurenko & Podberezkina, 2013). They have a rich potential, as compared to traditional teaching tools, to increase the level of socio-cultural competence of students and create effective conditions for introducing students to the linguistic and cultural diversity of the countries of the studied languages (Sysoev, 2008). They also expand the range of real communicative situations, increase students’ motivation, allow teachers to realize their creative teaching ideas, including the individualization of the educational process in a foreign language, allowing each student to choose their own system of training assignments, ways of control and correction of their skills and abilities. Internet search services can be divided into three groups,

1. electronic catalogues, which store information provided to them by servers in a special form;
2. search engines that process the web and catalogue all textual information;
3. mega-search systems that summarize and accumulate information processed by many other search engines (Polat, 2001, p. 6).

If we consider the information potential of Internet resources, it is necessary to highlight, first of all, the problem of finding and using information that can be used in the educational process. Polat notes: "Unfortunately, at present most of the information online is in its original, unordered form, which reduces the efficiency of its use and takes a lot of time for the user to find the necessary information" (2001, p. 6). It seems that educational Internet resources and allows to some extent solve this situation, because, as shown above, the teacher classifies and systematizes Internet sources and the information they contain, and offers the students selected material in a foreign language.

Consequently, Internet resources with their proper implementation in the process of teaching a foreign language are designed to implement the main requirement of modern language education - the development of the subjects of the educational process of individual style of activity, the culture of self-determination, stimulating their personal development. However, in almost all the works the researchers talk about the Internet resources as additional or auxiliary educational materials. It is true that recently the educational resources of the Internet have been rightly regarded as an analogue of traditional printed textbooks and teaching aids. At the same time, the nomenclature of didactic tasks based on Internet materials is diverse.

Working with Internet resources not only develops students' skills of finding, summarizing, critically evaluating information, and interpreting it in accordance with assigned tasks, but also, as Azimov (2004), contributes to the development of their reading skills and abilities, listening skills on the basis of authentic audio texts, skills of monological and dialogic speech based on problematic discussion of Internet data, as well as enriching their vocabulary with vocabulary found in authentic Internet texts, familiarization with the socio-cultural aspect of language, features of speech behavior, including speech etiquette, functioning in the channels of computer interaction, forming a sustainable motivation based on the systematic study of "live" materials.

Working with the Internet technologies described above implies knowledge of the components of the Internet, as well as an understanding of what these components can bring to the learning process and how they can be used in the educational process. Various instructional technologies can be implemented with the help of Internet resources. These include, for example, distance learning, which involves independent and independent language learning with information and methodological support from a particular learning centre, and Internet support for a traditional course, Internet support for project and research activities, etc.

The Internet resources listed above are aimed at developing a variety of general academic and communicative skills in students. The need to work with a fairly large amount of information implies the development of their information competence because, as noted above, working with these resources, students acquire the skills of extracting information from various sources, analysing it, structuring it, fixing it. It is important for students to be able to highlight the main and exclude the secondary, compress and expand textual material, look for examples in the text, formulate arguments and draw conclusions. In turn, the discussion of information extracted from Internet resources in a foreign language allows students to develop their communicative skills: to engage in oral-speech communication, to ask questions of the interlocutor, to argue their position. The use of these Internet resources may involve the development of students' skills not only in speaking, but also in reading and listening.

As for educational Internet resources, the teacher can create them independently. Website constructor is a special service through which a professional website can be created. Such programs are equipped with extensive functionality, allowing the site to be developed in detail. To work with this service does not need to have design knowledge and possess certain skills. All you need to do - step by step through the steps of development, guided by the instructions and tips of the service. The teacher needs to determine the desired format of the resource to be developed, search for suitable authentic resources, assess their content in terms of appropriateness in the educational process, and evaluate the linguistic level of difficulty. Then it is important to structure the found material and formulate general comprehension and discussion questions. The constructed learning resource can be presented to the student both in printed and electronic form, for example, on the page of the teacher's website, his blog, etc. It is not difficult to create authoring sites, using specialized and easy-to-use website builders and placing them on free host-servers.

The list of the most popular website constructors with a detailed consideration of their advantages and disadvantages is presented in Table 1. Websites created by teachers can contain both pages that are hotlists, web quests, and other things, and links to pages for assessing language proficiency (language tests), tutorials and audio-visual applications, a variety of presentations, and so on. Website development programs are deservedly gaining popularity, because they greatly facilitate and speed up the process of getting your own site. Usually, services of this type contain a large selection of thematic and classic templates, which allows you to quickly find a suitable basis for the future site. In addition, ready-made templates are possible to modify, adding to the rubrics and images, video and audio materials. Most constructors can handle high volume sites that can be edited completely or modify individual components: video, text, graphics, etc. Site data is stored on a third-party service, so the user always has constant access from any device. In addition, some services allow you to transfer sites from one hosting to another. Website builders can be divided into two categories: blogging platforms and universal website builders. Content management system (CMS) platforms serve to create text blogs of different directions: personal, commercial, corporate, which causes them to have a special structure and set of tools. Constructors of universal sites is optimal to use when developing standard websites. Such designers are characterized by a wide choice of tools and simple functionality. So, now there is a great choice of online site designers. Therefore, users are trying to choose a service that offers good conditions and is characterized by convenient and simple functionality. In addition, the selected CMS must meet the requirements and fully perform the tasks. To create personal sites, it is optimal to use services provided for free. For example, Google Sites, Site123, Web Flow, WordPress, etc. If these sites do not suit you, you can use a free trial period on one of the paid services.

Table 1 Analysis of the site designers

CMS	
WordPress	One of the first online services has been in operation since 2003. This constructor is aimed at developing sites with predominantly text and graphic content. The majority of sites are developed specifically on WordPress (these include such well-known portals as CNN, New York Post, TechCrunch, TED, USA Today, and others). Currently, this builder acts as a universal service for creating any type of website. WordPress includes a built-in visual and text editor and has open source code, which helps you create unique sites and manually pick up every detail of the final product. The service also offers users a wide library of templates and plugins and makes it possible to configure remote access to the site and install it on any hosting. In addition, the builder provides basic functions absolutely free of charge, while the paid plans are quite varied. The disadvantage of this site is that the templates and plugins presented quite low quality. Also, the service has problems with the download speed of some sites, especially with a large number of plugins and permissions, and after the completion of the development process is necessary to customize the site: to select the desired language, translate the chosen topic, to connect plugins, etc. Thus, the site will be adapted to the target audience as much as possible.
BlogEngine.ru	BlogEngine.ru was created primarily for the development and maintenance of blogs. Therefore functions of this service are aimed mainly at processing and publishing text content, pictures, music, video, codes. This CMS is optimal for creating compact blogs of different directions: personal, professional, corporate. Websites created by BlogEngine.ru are notable for their simplicity and lack of extra functions: the main components are posts and comments. The service is popular among users thanks to its user-friendly and well-thought-out interface. The functionality of the site allows for the necessary text design using the built-in editor and without difficulties to publish it. In addition, it is possible to add photos, audio and video files to the posts, and the management of the blog becomes accessible from any device (PC or mobile). Also a significant plus of BlogEngine.ru is a free service for creating personal blogs. The main disadvantage of the service is that it is not a full-fledged constructor and to apply it, you need to have your own developed site with an existing database. We can say that BlogEngine is suitable only for blogging, and for other purposes this site will be useless.

cont... **Table** 1

Universal website builders	
Weebly	Weebly service is the most popular among American users. With the help of this builder you can create a site of any profile: portfolio, business card, own blog, etc. The designer offers a large selection of built-in widgets, which allows you to develop a site with the desired design literally piece by piece. In addition, you don't need to have programming knowledge and skills to use this feature. The simplicity of the interface makes it understandable for any user. Weebly contains an extensive range of design layouts (paid and free) that you can edit yourself. In addition, the designer offers additional functions: statistics, import and export of content, advertising and marketing tools. The main drawback of the service is that since 2018 it is only available to users from a limited number of countries.
Wix	One of the most popular online platforms with which you can create and edit sites of almost any profile: portfolios, blogs, communities, personal business card sites, etc. The simplicity and functionality of the designer makes it popular among users around the world. In addition, this service allows you to develop even large professional sites with a lot of elements. All this can be done even without programming skills. Wix Designer has artificial intelligence for web design, i.e. it can independently generate a site according to the specified requirements with minimal interference in the process. This site contains more than 500 design templates for users to choose from. In addition, the designer has about 200 offers and services to promote and expand the site. The overloaded interface of the service slightly reduces its popularity among users, but the popularity of Wix has persisted for many years. In addition, the service does not provide statistics on site visits and has difficulties with SEO optimization.
Webflow	With CMS Webflow online constructor you can create business cards, portfolios, blogs and web pages. The functionality and simplicity of the visual editor allows customers to work with it even if they have no programming skills. The designer also makes it possible to create web pages with a number of blocks (columns, forms, lists, different animations, sliders, etc.). Designer contains a large number of free and paid templates of different designs. Also on the service you can find a library of animations and video tutorials and use the export code function. The disadvantage of the service is compatibility issues with many browsers. For example, you are guaranteed to be able to use the created sites only with Google Chrome.
Strikingly	This SaaS-platform contains a basic set of functions for the development of the site online, for the creation of which you do not need to know the basics of programming. Development of all types of sites on this platform is absolutely free. There is no limit on the number of developments. Convenience and simplicity of the editor makes the designer adapted to all users. You can create a one-page site first, and then add more elements to it. The main advantage of websites developed with Strikingly is that it has an adapted default design that allows it to display optimally on mobile devices.
Tilda	With Tilda, you can create company portals, organization websites, web pages, web portfolios, blogs, personal pages, and presentations. This website builder uses a block model with the ability to add extensions in the form of animations and videos. The total number of extensions and modules is about 450. The service contains a built-in Zero Block graphic editor, with which you can draw your own website design from scratch. You can also choose a design template from a wide range of ready-made options. For convenience, they are divided into categories. Additionally, the designer offers SEO promotion functions. A disadvantage of the service is the limitation in the development of complex sites. But the designer is optimal for creating single-page pages. Another disadvantage of Tilda is the risk of deleting the site if you do not switch to another service within 6 months after the end of the purchased subscription.

cont... **Table** 1

Universal website builders	
Mozello	This designer refers to a number of free services to create websites. Mozello's main specialization is designing business card sites and blogs. The service contains 48 high-quality design layouts (including paid ones). Each of them is structured by type of site and has the ability to change the layout of the home page. You can also edit the created product yourself using Javascript, HTML or CSS. The service has a control panel adapted enough for ordinary users. The service has a rather poor selection of extensions and modules, and the formatting can get confused when placing ready-made text or images.
Bookmark	Bookmark is a cloud-based web builder that allows you to develop web pages. The service stands out because of the powerful built-in editor with an AI base. The main advantage of the site is the unique AIDA artificial intelligence system, which allows you to create and design a site without too much effort. All you have to do is specify the basic requirements for the final product. After completing the questionnaire, AI selects the best option for the structure of the site based on the data entered earlier. In addition, at this stage the service will provide several selected design templates. Bookmark contains a large library of images and videos (more than 1.5 million), which you can use to design your site. Multilingual localization is available in Bookmark (more than 50 languages available). Powerful marketing and SEO tools help you promote your site and get more hits. The drawbacks include the following: the inconvenience of creating blocks yourself on one-page sites, unreadable fonts in Bookmark's visual editor and the fairly high prices of plans.
Site123	It is considered a constructor with the simplest functionality and provides a full free service. This service is optimal for the development of a web site, blog, or business card site. This site is especially in demand among users who do not have programming and design skills. Designer has a simple visual editor, which is easy to work with. When developing the site, you can choose its type: one-page or multi-page. In addition, users have the ability to add modules to specific pages. And the built-in app store has a large number of different plugins: analytics tools, marketing, live chat, etc. The service automatically selects the optimal design templates for the theme of the site you choose. Also available are customization tools, with which you can change the layout, style, fonts, menu options, etc. The service is also equipped with multilingual localization, which contains more than 20 languages. Users highlight several disadvantages of Site123. First, many note the extreme simplicity of the interface and limited functionality. Second, the built-in design templates are rather monotonous. In addition, there is no opportunity to edit layouts manually.
Jimdo	This online builder has its own Dolphin AI platform. It allows you to create websites almost automatically. All you have to do is specify the necessary information about the direction, goals and other factors. The service Jimdo you can find 16 basic design templates, among which you can choose the appropriate. In this case, the chosen version of the template can be edited to your own parameters. Revision of the site is possible manually through the editor HTML / CSS. But you can choose a ready-made layout of the number of proposed. In addition, you can download your own template. The service is equipped with a powerful visual editor that allows you to quickly create an online store of any type, portfolio or blog. Development can be carried out by the block method or by using the WYSIWYG interface. A significant disadvantage of Jimdo is a small selection of ready-made design templates. Because of this is quite difficult to create a unique site. Also, users note that the free rate is practically useless for creating a site. This is due to the fact that the functions of the service in this tariff plan is very limited.

Let's move on to the analysis of the second group of e-learning technologies, singled out in terms of their intended use. These technologies provide communication, i.e. communication between participants of communication in a foreign language. Traditionally, these technologies are divided into two classes,

1. technologies of synchronous communication, that involve an instant response from the user partner;
2. technologies of asynchronous communication, that involve a delayed response.

However, modern messaging programs (messengers, including WhatsApp, Viber, Skype, etc.) often combine the capabilities of both technologies. Since communication in the virtual space is tightly integrated into the life of modern man, learning to communicate in a foreign language online seems quite logical.

In recent years, mobile language learning has been of particular scientific interest. The use of mobile devices has gained a new direction in the system of computer-assisted learning, which mainly refers to as "learning on the go" and is defined as language learning with mobile devices (MALL - mobile assisted language learning).

By mobile learning a foreign language we mean "a form of organization of the learning and control process based on the use of mobile communication devices (smartphones, tablets, etc.), in which students at any place and at any time can form and improve language speech skills (based on the means of synchronous and asynchronous communication), form socio-cultural and intercultural competence to use a foreign language as a means of communication in the social and professional spheres (Kapranchikova, 2014, p. 8). Mobile devices make virtual communication accessible, allow you to store and transmit information in different formats (text, graphics, video, audio information, etc.), make comments or make changes to content. They are easy and convenient to use as information and reference resources.

Mobile technologies include instant messaging (email, chat rooms, forums, Internet video communication) and technologies such as blogs, wikis, podcasts, YouTube, and social media. The use of these technologies allows students to develop different skills, such as reading, writing (reading and commenting on entries, wiki), listening (watching clips), and speaking (creating their own clips).

As the use of digital technologies becomes more and more mobile in nature, the activity with which mobile devices and their applications will be used in foreign language teaching will also increase. Currently, some of the most important research questions are: what language and speech skills can be most successfully formed when working with mobile devices, and what didactic functions can be optimally realized when using them.

The use of mobile devices has greatly expanded learning opportunities. Mobile Assistive Language Learning (MALL) is one of the most current, interesting, and attractive fields of study. When considering MALL, reference is usually made to the use of any mobile device that allows reading, listening, studying, or practicing a foreign language, whether in the classroom or anywhere else, and sometimes even on the go. Despite the increasing presence of mobile devices in education, there is still no single definition of the phenomenon. Many researchers use the term "mobile learning," others prefer to call it "m-learning. In any case, there are advantages of using mobile devices, such as: attractiveness, portability, productivity, versatility, and accessibility. Smartphones and tablet mobile devices are increasingly being used in a variety of educational environments because of their relatively high screen resolution and excellent multimedia capabilities, as well as their ability to easily connect to the Internet. Research on the use of mobile devices in the context of foreign language learning suggests that these devices can help improve student motivation, time management, organization of group and individual work, as well as interactive control of knowledge with subsequent adjustment of the teacher's content and language teaching methodology. Another distinct advantage of mobile learning is that it allows students in rural and remote areas to have easier access to learning materials.

It should be noted that even at the very beginning of the use of mobile devices, the literature outlined certain advantages of using mobile learning. As Heyoung & Yeonhee point out (2012, p. 39), mobile devices allow students to easily and quickly access language learning materials and communicate with people anywhere in the world, anytime and from anywhere. The nature of digital technology facilitates student participation, both collaborative and individual, synchronously and/or asynchronously, facilitating faster speech development as well as improvement in listening, reading, and writing skills. Mobile technology provides a variety of resources and tools for language learning that encourage students to be more interested, independent, content-focused, and socially active at the same time.

Many studies in the last few decades have reported the successful use of mobile devices to build language skills. Thornton & Houser (2005) studied the use of cell phones in English classes and argued that, compared to traditional teaching and computer lessons, mobile learning allowed students to absorb more information, and therefore students preferred smartphones for learning. Levy & Kennedy (2005, p. 78) used SMS messages in Italian vocabulary as one of the ways to convey word knowledge and request feedback. At the same time, 94.4% of students rated this project positively. Kiernan & Aizawa (2004) studied the use of cell phones for task-based learning and concluded that this approach can promote better foreign language learning and encourage students to focus on its basic components and concepts.

One major problem, however, is that much of the research on "mobile learning" in foreign language learning has been based on learning in the classroom, which is not the typical environment where people use their smartphones and other mobile devices. To gain insight into the true nature and impact of mobile learning, more attention needs to be paid to research that examines mobile learning not only in the classroom, but also in mobile environments appropriate for that learning. Research beyond the classroom reveals that not all aspects of language can be successfully learned through mobile devices. For example, some work shows that when deciding whether to use their cell phone or computer to learn and build vocabulary, most students still choose the personal computer. There is also evidence that individual typical language classes take longer on mobile devices than on computers.

Nevertheless, the use of mobile devices can help teachers solve major practical problems such as the lack of time in which learners use language for communicative tasks and the lack of opportunities in which learners are exposed to various authentic materials. Through the use of mobile devices, students can get more opportunities to interact with other students as well as native speakers and authentic materials outside the classroom. Basically, research on mobile devices shows that the additional practice provided by the use of these devices can increase the quantity and quality of students' oral proficiency. For example, using tablets to improve language experiences helps improve knowledge and skills in syntax. The use of personal mobile devices gives students autonomy in learning, which in turn leads to a positive language experience.

It should be noted the high effectiveness of mobile devices in assessing students' knowledge in an interactive or game form directly in the classroom or outside of it. For example, such apps as Kahoot (www.getkahoot.com), Nearpod (www.nearpod.com), Plickers (www.plickers.com), and many others are currently very popular in American schools.

When we talk about virtual communication technologies, we often refer to computer telecommunication, which is interpreted as a means of transmitting information over a distance. With regard to learning it means interaction of people at a distance, for example, interaction in the conditions of joint projects, exchange of educational information (between a teacher and students, between students or groups of students), quick access to electronic resources related to foreign language learning (Severova, 2012, p. 188-189).

It should be said that with the advent of Web 2.0 applications, the way digital information is created, exchanged, stored, distributed and processed has changed significantly. Web 2.0 applications have democratized the Internet in a certain way, prioritizing content, ownership and social connection. We don't just receive information online, rather we are constantly communicating with other people in the format of social networks such as Facebook, Snapchat, VKontakte, Telegram, Twitter and Instagram. A key aspect of such online applications is that they are social in nature. With Google Docs, for example, users can interact and collaborate in real time in a single document without downloading any software. Not only can we access an educational Internet resource, but we can even create our own. A study by Evstigneev (2012) shows that the integration of Web 2.0 social services into the foreign language learning process on a par with educational Internet resources helps to improve the quality of language training.

Web 2.0 applications such as Wikis and blogs have been used for several years as tools for e-learning and improving foreign language skills. As you know, a Wiki is an online resource that allows users to collaboratively edit its content and structure. The most obvious example is Wikipedia, which is a collaborative online encyclopaedia. Educational Wiki's are now being used for collaborative writing and editing to improve language and speech skills. Educators can find many free wiki spaces to use in the educational process. Blogs are Web sites that are usually run by one person, they are similar to traditional journals, where ideas and experiences can be published and updated regularly by the author. Not only text, but also videos and other types of media can be posted to the blog. Users can receive automatic updates every time the blog is updated, and they can post comments on each entry, making it interactive. There are many free blogs, like the Wiki, that teachers can effectively use. It is important to note that many learners have "grown up" with Web 2.0 applications. Social networking platforms such as Facebook and Instagram, which allow users to create a public profile and share ideas, texts, images, and videos with others. Virtual worlds, on the contrary, such as Minecraft, are computer-based 3D simulated environments where users take the form of so-called avatars (virtual images) that are visible to others. This has made it possible, for teachers and students alike, to use all of these tools - blogs, wikis, podcasts, web services, and social media - to some degree or another to gain and provide access to authentic sources in the language being studied.

For example, blog technologies, which have such types as a teacher's blog, a student's blog, a study group blog, provide great opportunities for developing and improving students' skills in both generating written statements (stating the content of the read/listened to foreign language text in abstracts or short messages, expressing an opinion about something, making analogies, comparisons, comparisons by available linguistic means, etc.), and understand information while reading (identify necessary facts/information, separate main information from secondary information, determine the temporal and causal connection between events and phenomena, summarize the described facts and phenomena, evaluate the importance, novelty, and reliability of information, etc.). While composing a blog text, the student acquires the skills of selecting and using the necessary linguistic means to present personal information about themselves in writing, represent their native country (town, school) and culture in a foreign language environment, express their opinion, consent or disagreement, etc.

The use of blogs in foreign language teaching has significant educational potential, as they keep students motivated to communicate in the language studied outside of school hours, as it develops the students' ability not only to fill out pages of a blog in writing, but also to comment on the messages of their learning partners and responses to comments. In addition, this technology allows you to organize an online discussion of the studied problem in a foreign language.

Ilyina notes that blogging technology has certain didactic properties, which include publicity, linearity, hypertext structure, multimedia, the ability to moderate by one person (2013, p. 12).

Blogging in the learning process can be used for almost any age group, regardless of the level of language proficiency. However, here it is important, as Sysoev notes, to keep in mind that excessively exaggerated requirements for linguistic design of written statements may reduce the motivation of students to discuss them. Therefore, when evaluating students' written texts it would be better to explain to them that spelling will not be evaluated. And if the text compiled by the student is posted for the purpose of its further discussion, the teacher should make its preliminary corrections and remove the existing errors that may distract students from its content (2012, p. 124).

A wiki is another kind of social service Web.2, a name borrowed from the Hawaiian language ("wiki-wiki"), which means "quickly", and which allows one person or group of people to create and post their content online. Wiki technology, as well as blogging technology, has great potential in terms of developing the skills of reading, speaking and writing in a foreign language, both directly in foreign language classes and as part of language elective courses and elective courses.

Ilyina (2013) writes that this technology, in addition to publicity, hypertext structure and multimedia, which are also characteristic of blog technology, is characterized by nonlinearity and the possibility to access the history of the creation of a particular document. Wiki technology in the educational process should be aimed at developing students' writing and reading skills and provide an opportunity to organize extracurricular network work on a language/cultural project. It should be noted that all the developed speech skills of understanding and generating a foreign language text correspond to the skills specified in the state standards as requirements for the subject results.

It is important to note that each technology is aimed at developing speech skills and the ability to understand the information read/heard/seen, to record the necessary information, to convey the main content of what is read and/or heard, etc. Technology provides educational practices not only the opportunity to work with information of all kinds, but also to participate in webinars, work on blogs, and take part in online conferences. These forms of work are aimed at the development of skills to participate in conversation/discussion; request and exchange information; predict the development/result of the facts/events presented, etc. For example, blogs, social networks, and wikis can be important for reading and writing, and podcasts and YouTube can be important for developing listening comprehension and oral comprehension skills. It is important for the teacher to determine for what purposes the opportunities and resources of the Internet will be used, either to incorporate the web materials into the content of the lesson, or for students' independent search for information as part of the project work, or to eliminate gaps in knowledge, etc.

The use of the Internet in the teaching of foreign languages enables its users, who are at a distance from each other, to communicate or organize communication with a particular learning databank. In this connection, let us recall the words of Polat: "Only with the help of the Internet it is possible to create a genuine language environment and to set the task of forming the need to learn a foreign language on the basis of intensive communication with native speakers, work with authentic literature of a wide variety of genres, listening to original texts recorded by native speakers. This is, perhaps, the most important possibility of forming socio-cultural competence on the basis of a dialogue of cultures" (2001, p. 6).

Conclusion

It is an undeniable fact that in a globalized world, learning can and should be tailored to the needs and preferences of learners. Modern technology, including e-learning, offers incredible opportunities to enhance individualization. They allow learning without being bound by time or place and facilitate autonomous and meaningful education.

So, the use of essential educational technical means in foreign language teaching involves learning through activity and in active practice, which leads to the development of new knowledge by communicating with others, built on the basis of the methodology of learning in collaboration.

Educational digital technology helps intensify the communication process, promoting the development of interpersonal communication skills and abilities, the enrichment of ideas, the exchange of knowledge, which leads to a deeper understanding of the learning content. In addition, when using essential technical means of learning, students are highly motivated to learn and develop a sense of individual responsibility for group learning activities, enrich the learning experience, gain experience in communication in a learning microsociety, combine learning and personal experience in a social context, and provide emotional, psychological support to each other, which is especially important in the current epidemiological situation. It is also important to note that when using essential technical learning tools, students do not have the sense of loneliness and isolation that is typical for some online learning courses.

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KINDERGARTEN TEACHERS' PREPAREDNESS FOR EMERGENCY ONLINE LEARNING: CHALLENGES AND ATTITUDES TOWARDS ONLINE LEARNING

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Introduction

The outbreak of the Covid 19 virus and its subsequent spread worldwide led it to be declared a global pandemic in March 2020. Most governments decided to close all educational institutions in an effort to contain the spread of the virus. Ministries of Education in these countries, thus, made it mandatory for all educational institutions to continue the learning for students through online platforms. UNESCO (2020) recommended that online learning be used as the substitute for face-to-face learning and made available a directory of free online educational platforms and resources that could be utilized for distance learning according to the needs of each educational institution.

Kindergartens in Malaysia were similarly affected as preschool children had to stay at home. With the directive to move into online learning, kindergarten teachers, who had previously, employed traditional methods of learning such as demonstrations, role-play, and directed teaching in face-to-face sessions, found it hard to replicate such teaching and learning. Additionally, kindergarten teachers highlighted the struggle of the young learners to cope with online learning due to limited interaction and attention span (Positive Parenting, 2020). Parents also have been anxious about their children's progress and have higher expectations of online learning to at least be more promising if not more effective than a physical classroom in the future. Ali (2020) highlighted how some perceived that face to face classroom is much more effective than online and blended learning.

Aim

Therefore, there is an urgency to better understand the kindergarten teachers' challenges in navigating the new landscape of online learning. The teachers are expected to be competent in the use of different technological applications and to be using different teaching approaches to teach online. As this research study is still being conducted, it seeks to investigate the kindergarten teachers' challenges, acceptance of technology and their attitudes towards emergency online learning as factors that comprise their preparedness for emergency online learning.

Research Questions

1. What are the factors affecting kindergarten teachers' preparedness for online learning?
2. What is the relationship between kindergarten teachers' attitude and preparedness for online learning?

Hypothesis

1. The teachers' preparedness is affected by attitudes towards online learning that might differ based on the teachers' background (e.g. Age, Academic Qualification and Years of Teaching Experience).
2. There is a positive relationship between kindergarten teachers' attitudes and preparedness for online learning.

Methodology

This research study used a mixed-method design. The quantitative approach was primarily used with the survey method. The survey questionnaire had 10 closed-ended questions to measure the respondents' preparedness towards emergency online learning: the challenges, technology acceptance and attitudes towards online learning.

The qualitative portion of this study was in the 2 open-ended questions that were given to respondents. The questions are,

1. To reveal which feature or app that the kindergarten teachers found most useful.
2. To learn more of the factors that will make a better online teacher including the qualities of the kindergarten teachers that can be tapped further

A thematic analysis will be conducted based on two qualitative questions stated to give further insights on the kindergarten teachers' preparedness and attitude towards online learning. Snowball and expert sampling were employed for the selection of sampling. 73 respondents were kindergarten teachers from different kindergartens in Malaysia. The respondents' details did not contain information that identifies respondents to keep their confidentiality and anonymity. The data collected were analyzed using SPSS. Both descriptive and inferential analyses were conducted.

Significance of Research Findings

The research findings will further contribute to the betterment of online learning especially for kindergarten teachers and young learners. The future of education is unpredictable and if online learning is the future of education, the kindergarten teachers' competencies and flexibility must be accelerated. Rasmitadila et al. (2020) highlighted those teachers have the responsibility to ensure their instructional pedagogy will be more adaptive with the changes of curriculum, have better technological readiness and collaboration to contribute to the success of online learning. Accordingly, the findings will be useful for researchers to further investigate the factors that will influence the teachers' readiness and digital competence in online learning in the long term as the kindergarten teachers' need to be able to engage the young learners whose enthusiasm and attention span might pose as a challenge if online learning is here to stay.

Acknowledgement

This research paper would not have been possible without the exceptional support of our colleagues in the School of English and Education in Quest International University. We are thankful for the effort and the guide from the Dean of the Faculty of Social Sciences, the contribution of the kindergarten principals and teachers and the university for giving us the opportunity and permission to publish.

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DEVELOPMENT OF VIRTUAL ELECTRICAL ENGINEERING LABS FOR REMOTE LEARNING

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Introduction

Since the first quarter of 2020, most of the Teaching and Learning (TnL) process across the globe is impeded due to the outbreak of the Corona Virus Disease 19 (Covid-19). In response to the pandemic, global citizens are advised by the medical authority to wear masks in public and avoid close-distance social interactions. With the introduction of remote learning, engineering students, specifically, are missing out on TnL programs such as laboratory experiments that involve psychomotor skills and provide hands-on experience. The most ideal solution would be for the students to attend face-to-face sessions for courses that require practical learning, however that is technically and financially unfeasible in the pandemic situation. Therefore, in overcoming a few identified problems, this paper proposes the use of Virtual Reality (VR) technology as the best alternative to the remote learning method.

Problem Statement

This research is addressing the following problems:

a. The psychomotor skills development from experimental laboratories will be greatly affected.
b. There is no credible alternative for experimental laboratories apart from software simulation.
c. The quality of engineering graduates will depreciate hence underachieving the program outcome.

Objectives

This experimental based study aims to achieve the following objectives:

a. To develop a virtual environment for Electrical Circuit Analysis Lab.
b. To verify the reading of the developed devices and compare with the actual and simulated results

Literature Review

VR technology has been gaining prominence because it enables consumers to experience products or learn tasks realistically in different virtual environments that are accessible from the internet. This has the potential to mitigate the problems associated with consumers' lack of presence (Berntsen et al., 2016) or honing difficult skills in workplaces (Abu Hasan et al., 2021)and this can lead to decreased job performance followed by detrimental clinical health problems. Advancement of sensor technologies has allowed the electroencephalography (EEG. In some studies, VR technology is reported to be used in cognitive-based learning and treatment (Hafeez et al., 2019).

Advantages of Virtual Reality

1. Active Learning
   The strength of VR lies in its ability to immensely engage and immerse with the user via the 3D environment interfaces. VR encourages users to participate actively during the learning sessions, while immersion has the potential to increase learning experiences and improve creativity and engagement which are essential in learning (Garcia Fracaro et al., 2021; Grajewski et al., 2015)

2. Psychomotor Skills
   Literatures have reported the cognitive influences and outcomes of VR learning on user skills such as psychomotor (Carrieri et al., 2016; Chang & Lai, 2021) and mental skills (Anopas & Wongsawat, 2014). Findings by (Chang & Lai, 2021) indicated that the VR module significantly improved psychomotor skills of nursing students. Psychomotor skills are crucial for engineering students as they learn to use various laboratory equipment with proper care. In a study observing the role of integrated VR training for diagnosing faulty rail cabin door condition, the improvement in cognitive and psychomotor skills of the engineering students were observed (Randeniya et al., 2019).

3. Equal Opportunities
   A VR-based experimental laboratory environment does not require all students to be present at the same time. All assessments can be done individually within a flexible time period and are not restricted to a fixed class schedule. This allows students to progress at their own pace without the pressure to complete the assessment within a short time span whilst at the same time being constrained by other personal commitments. They would be able to repeat any modules and experiments without any time limitation and therefore adjust the learning process based on their time and available resources (Georgiou et al., 2007).

Engagement Sustaining Methods for Virtual Reality

1. Gamification
   According to (Garcia Fracaro et al., 2021)operator training is facing some challenges, such as high costs, safety limitations and time constraints. Also, there have been some indications of a lack of engagement of employees during mandatory training. Immersive technologies can provide solutions to these challenges. Specifically, virtual reality (VR, games are widely known for effectively sustaining the engagement and entertainment of the user within the virtual environment. Researchers have suggested that playing games for educational purposes lead to greater involvement with the learning experience than the traditional teaching method (Wan et al., 2021). Recent research on neurofeedback stimulus contents for stress mitigation has reported the improved efficacy of treatment by using games for neurofeedback (Hafeez et al., 2021; Hafeez, Ali, Mumtaz, et al., 2019). Gamification encompasses the design of an environment that controls the flow of learning by including the instructions, game levels, and task completion percentage bar for users to track their progress.

2. Learning Analytics
   Learning analytics are methods used to quantify and analyse learning measures gained from lesson modules. With the analytics, students will be more motivated to complete the tasks, to gain more experience points throughout the lab module. When students interact with the game objects, it would store data of students' activities. Instructors can track the performance and interaction of each student with specific objects, time taken to complete a task and the difficulties faced by the students hence allowing them to improve the game and address specific challenges faced by the students.

Methodology

Electrical Circuit Analysis Lab (ECAL) is a subject taught in the First Year of Electrical Engineering studies. This experiment based study is aimed to transform the ECAL module into a Virtual Circuit Analysis Lab (VCAL) by outlining the same content. Unity 3D (Unity Technologies, U.S) and Oculus Quest (Facebook Technologies, LLC) are used as the main software and hardware for the development and testing. Several basic devices are needed in the virtual environment such as DC power supply, digital multimeter, breadboard, and resistors. Figure 1 shows the startup scene of the virtual lab. The monitor presents a list of experiments that can be selected based on the current module taught according to the remote learning schedule.

Figure 1 Startup scene of the VCAL

Results and Discussion

The following basic electrical devices developed for VCAL are tested in VR environment and then VR results are compared with the theoretical results obtained from LTSpice simulation.

Breadboard, Wire and Resistors

The breadboard is equipped with holes that allows connections between wires and resistors, are created using procedural mesh and spawn in the Unity3D. Values of the resistors are predefined at the beginning of the experiment. Figure 2 shows the connection between wires and resistors, with the colours of wires changed according to ground and power terminals.

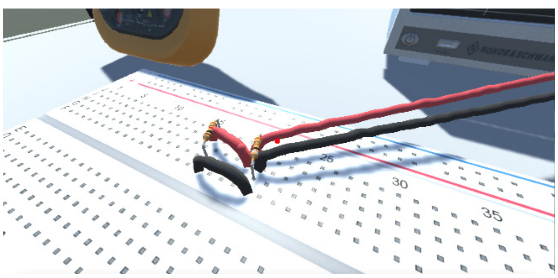

Figure 2 Sample connection of wires and resistors on a breadboard

Power Supply

A power supply is designed in Unity3D with realistic visuals where the operating interface has fine functionality that mimics the real-power supply with buttons, knobs, and channels (Figure 3). The interface is user friendly in the VR environment with arrow keys for channel selection and voltage/current control (Figure 4).

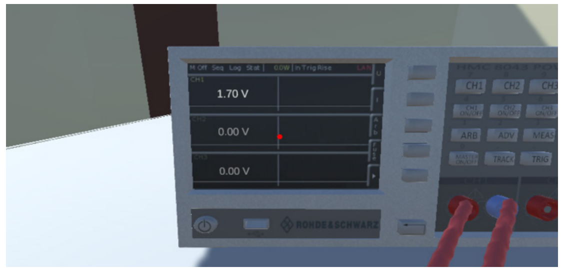

Figure 3 Voltage supply from each channel displayed on the screen

Figure 4 Arrow keys used for channel selection and value assignment

Digital Multimeter

This device is equipped with on/off button, measurement mode dial, wire holes and display screen (Figure 5). The values of voltage measurement across 1KΩ resistor is 4.098V (Figure 5) and across 220Ω resister is 0.902V (Figure 6). A series circuit comprised of two resistors was built to compare with the results from simulation software, LTSpice (Analog Devices, Inc) (Figure 7). The voltages measured across two resistors in LTSpice are 4.098V (1KΩ) and 0.902V (220Ω). An experiment is also performed with real equipment in the laboratory for the same circuit. The result of all experiments from Unity simulations, LTSpice, and real experiments returned the same.

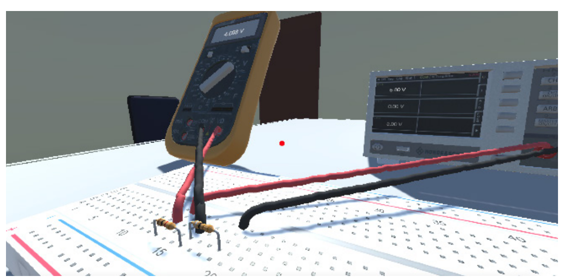

Figure 5 Voltage measurement for 1kΩ from virtual environment (V1 = 4.098)

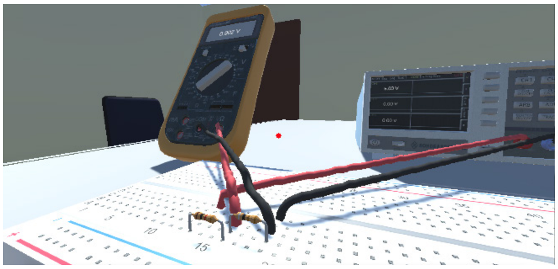

Figure 6 Voltage measurement for 220Ω from virtual environment (V2 = 0.902)

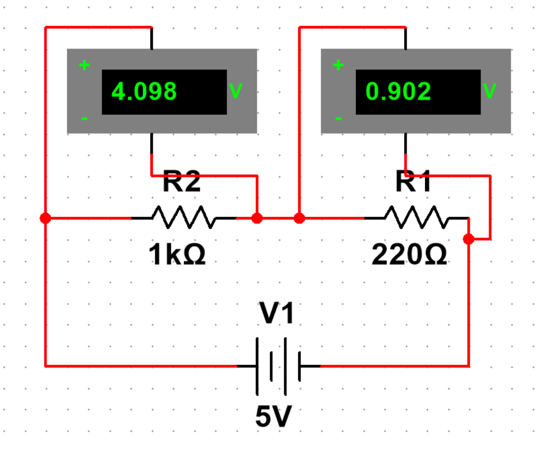

Figure 7 Voltage measurements from LTSpice simulation (V1 = 4.098, V2 = 0.902)

TV Display

A virtual TV display is designed to show the Lab instructions (Figure 8). The instructions appear on the TV display in the form of menu-driven user interface where different experiments can be selected for training.

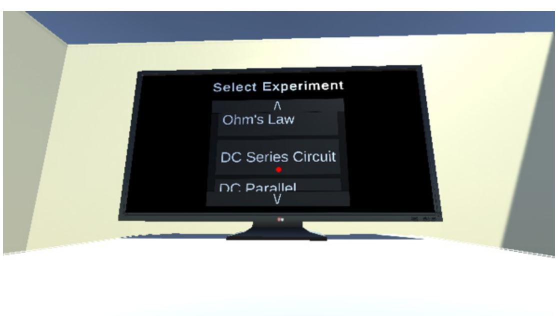

Figure 8 Menu user interface presented on the TV display

User Experience

A practice session was done for the VCAL on 19 undergraduate students to test the usability of the module (Table 1). The participants were asked to wear the Oculus Quest headset and perform the laboratory tasks made available in the VCAL. After completing the tasks, participants were asked to fill a user-experience form.

Table 1 Details of participants

	No. of participants	Age			
		Mean	SD	Min	Max
Female	7	20.1	2.8	17	22
Male	12	19.4	2.3	17	23

Findings from the user-experience show that the participants felt excited to use the VCAL. After performing the 15-minute session of laboratory task in the VCAL, 14 participants rated the laboratory session as the best they have experienced, five reported it as good, whilst no participant rated it as bad (Figure 9). Five participants reported of slight difficulty in performing in the beginning, but a few minutes later, they became familiarized with the VCAL. No participant reported any dizziness after the 15-minute session (Figure 10).

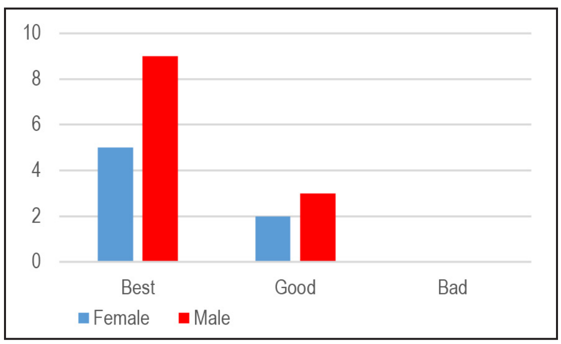

Figure 9 User experience of lab experiment in VCAL

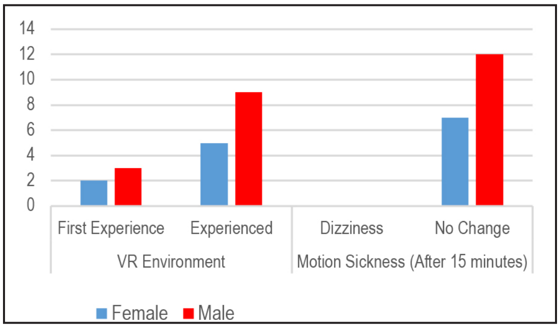

Figure 10 Number of participants according to familiarity with VR environment and motion sickness after the 15-minute VCAL session.

Conclusion

In conclusion, VR has a high prospect to be implemented in engineering education especially as an alternative to the online video conferencing normally used for TnL. It can address the lack of use of psychomotor skills in conventional online learning methods or computer simulations. This research is conducted with the hope to deliver a working prototype of the VCAL for engineering students and instructors.

Acknowledgement

The research was funded by Yayasan Universiti Teknologi PETRONAS grant 015LC0-235. The authors would also like to express their heartiest gratitude towards the Electrical and Electronics Engineering Department, Universiti Teknologi PETRONAS for supporting and providing the facilities to conduct the experiments.

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ACCEPTANCE AND USABILITY OF WEB 3D VIRTUAL REALITY IN UNDERGRADUATE PALAEONTOLOGY COURSE UTP

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Introduction

Palaeontology course is one of the core subjects taught at the undergraduate level at Universiti Teknologi Petronas. The course includes lectures and practical hands-on of physical fossil observations in the palaeontology laboratory. Typically, this course used physical fossil samples in the laboratory and these practical activities will be graded as the fossil report assignment together with the other assessment components such as quizzes, tests and final exam. However, with the prolonged Covid-19 pandemic, the accessibility to the physical palaeontology lab was limited which has impacted the activities of teaching and learning of this course that led to the use of 3D Virtual Reality of digitized fossil. The fossil digitization was carried out last year (Jamin et al., 2020) with all the 3D fossils were initially created as Augmented Reality in android version but later they were incorporated into 3D Virtual Reality in website access or 3D Web-based framework to make sure accessibility to all students considering the limitation on student mobile phone in using Augmented Reality. The website is created as http://digitalgeomuseum.com and an open-source web3D fossils of https://www.digitalatlasofancientlife.org/vc/ also been used to support the T&L activities. 3D WebView is more flexible and practical at the time being considering the students were accessing it from different locations and multiple devices. Providing this application, students experienced a new way of self-directed learning with interactive 3D media. In this contribution, the analysis of the usability evaluation of the 3D virtual reality in supporting T&L in the Palaeontology course is presented to analyse the acceptance of the first batch of ten students in the January 2021 semester.

Methodology

The methodology in this research emphasized student experience using the incorporated 3D VR application in their T&L activities with designated graded report assessment. The interactive 3D VR (Figure 1) was self-directed learning with supported lectures and students were instructed to provide a fossil report individually during the semester T&L activities from week 5-10 of January 2021 semester. The fossil report must include sketching and describing 10 selected fossils based on their taxonomy and characteristics as shown in figure 2a and figure 2b the excerption from student reports submission. At the end of the semester, the reports were graded with a rubric shown in figure 3 and the questionnaire survey was carried out using the online form. The marks and reflective questionnaires from a student were analysed and presented here. The workflow of this analysis is shown in figure 4.

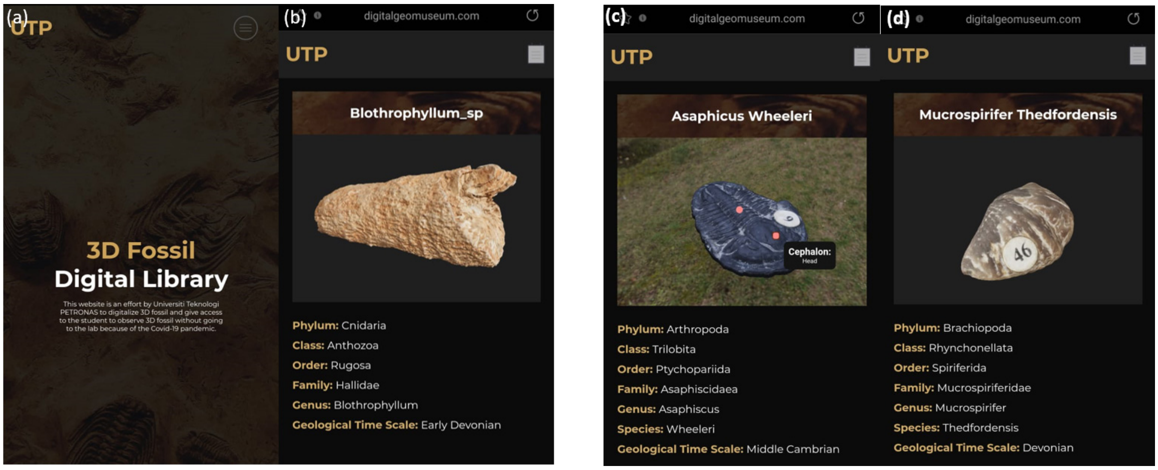
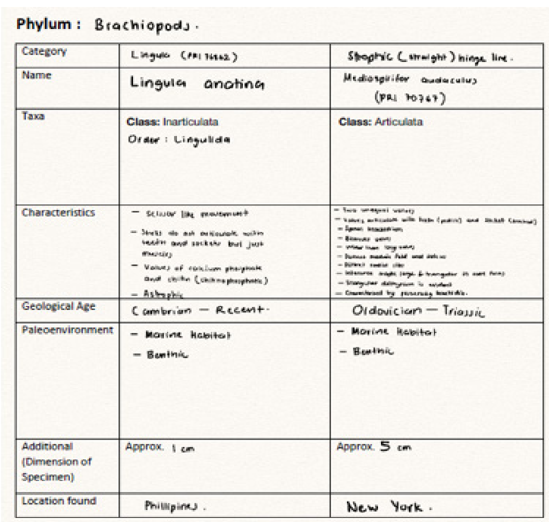


Figure 1 The interactive 3D web-based virtual fossil http://digitalgeomuseum.com with example sample of different phyla: a) page layout; b) fossil from phylum Cnidaria(coral); c) fossil from phylum Arthropod and d) fossil from phylum Brachiopod



Phylum : Brachiopods .

Category	Lingula (PRI 76662)	Strophic (straight) hinge line .
Name	Lingula anotina	Mediospirifer audaculus (PRI 70767)
Taxa	Class: Inarticulata Order : Lingulida	Class: Articulata
Characteristics	– Scissor like movement – Shells do not articulate with teeth and sockets but just muscles – Valves of calcium phosphate and chitin (chitinophosphate) – Astrophic	[illegible]
Geological Age	Cambrian – Recent.	Ordovician – Triassic
Paleoenvironment	– Marine Habitat – Benthic	– Marine Habitat – Benthic
Additional (Dimension of Specimen)	Approx. 1 cm	Approx. 5 cm
Location found	Philippines .	New York .

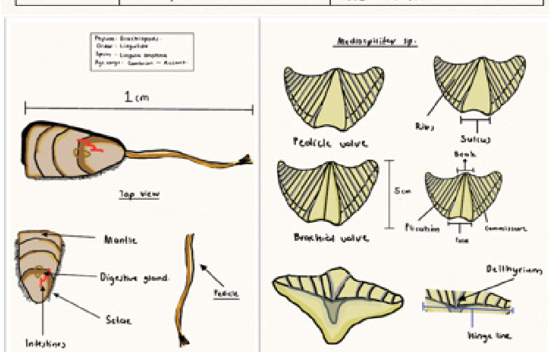
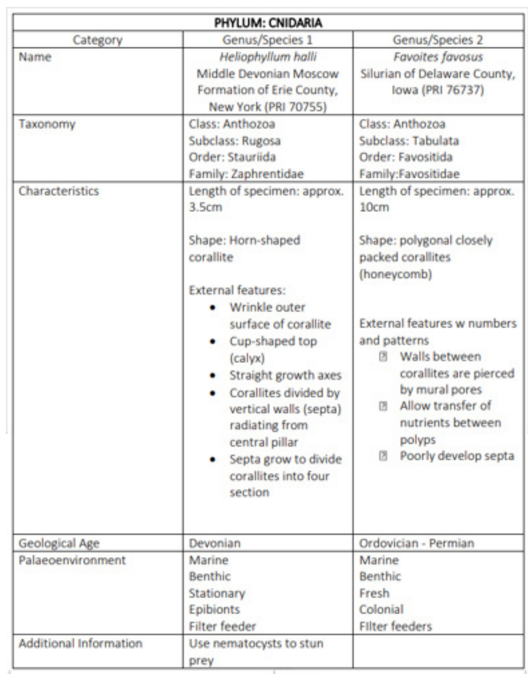


Figure 2a Excerption student report of sample brachiopods



PHYLUM: CNIDARIA		
Category	Genus/Species 1	Genus/Species 2
Name	*Heliophyllum halli* Middle Devonian Moscow Formation of Erie County, New York (PRI 70755)	*Favoites favosus* Silurian of Delaware County, Iowa (PRI 76737)
Taxonomy	Class: Anthozoa Subclass: Rugosa Order: Stauriida Family: Zaphrentidae	Class: Anthozoa Subclass: Tabulata Order: Favositida Family:Favositidae
Characteristics	Length of specimen: approx. 3.5cm Shape: Horn-shaped corallite External features: • Wrinkle outer surface of corallite • Cup-shaped top (calyx) • Straight growth axes • Corallites divided by vertical walls (septa) radiating from central pillar • Septa grow to divide corallites into four section	Length of specimen: approx. 10cm Shape: polygonal closely packed corallites (honeycomb) External features w numbers and patterns • Walls between corallites are pierced by mural pores • Allow transfer of nutrients between polyps • Poorly develop septa
Geological Age	Devonian	Ordovician - Permian
Palaeoenvironment	Marine Benthic Stationary Epibionts Filter feeder	Marine Benthic Fresh Colonial Filter feeders
Additional Information	Use nematocysts to stun prey	

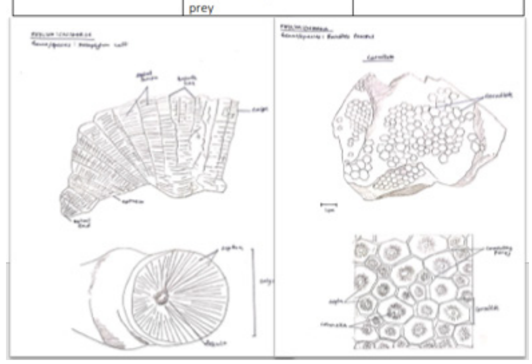


Figure 2b Excerption from student report of sample cnidaria

Results and Discussion

The results of the questionnaire survey on the student acceptance and usability of web 3D virtual reality in palaeontology courses are presented in Table 1. There is a total of 13 questions evaluated based on a Likert scale of 1= strongly disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly agree. The analysis of mean results of all the questions from 10 students shows that almost most students agree on the useability of web 3D virtual reality based on the range of mean value above 4. Exception on the mean value below 4 showing students prefer the use of laptop over mobile phone and combination of virtual-conventional practical hands-on fossil observation compared to fully virtual activities. This is shown by the high standard deviation value of more than 1 interpreted as mixed agreement between these students.
The result of this analysis provides evidence for the acceptance and usefulness of 3D virtual reality fossils in supporting Teaching and Learning in Palaeontology course especially during the prolonged Movement Control Order (MCO) period of pandemic Covid 19. Considering the students involved in this study were in their first-year undergraduate and were experiencing online learning from home only so far, the limited exposure to fossil studies prevented them to appreciate the wide application of 3D virtual fossils such as providing a better characterization of their anatomy and accessibility to the rare fossil material (Cunningham et al., 2014).

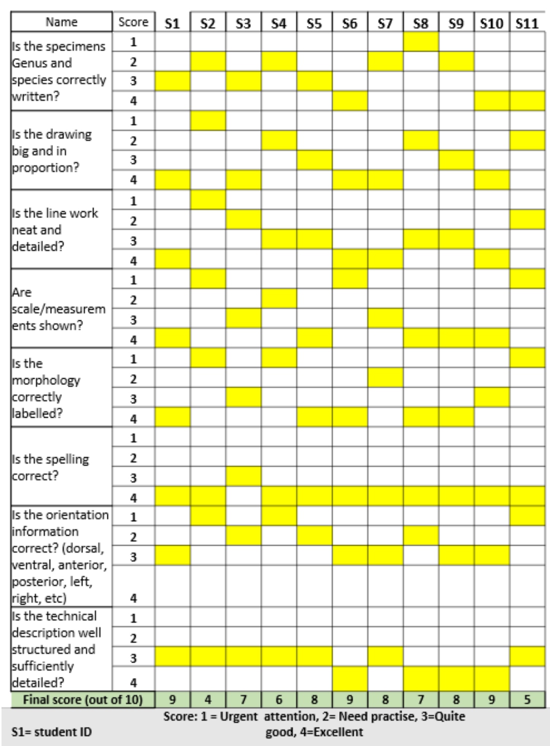


Figure 3 Rubric assessment for student report focusing on formative assessment which was monitoring student learning

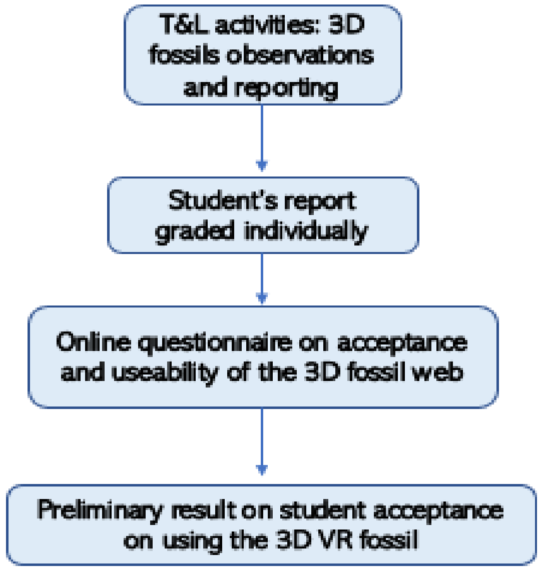


Figure 4 The workflow of the analysis of student acceptance and usability of 3D WebView

The project of digitalizing all the physical fossil in palaeontology lab UTP and customizing it through the web-based platform will support the continuation of the long-term effect of acquiring and retaining knowledge in fossil learning where students can visit the actual physical specimens when they return to the campus. This is important as both virtual and conventional practical hands-on provide significantly better knowledge acquisition and retention in learning and will spark interest in the palaeontology field of studies. (Sommerauer & Müller (2018))

Table 5 Result of questionnaire survey involving 10 students using Likert scale.

ID	Statements	N	Mean	SD
Q1	I would like to use the Virtual Reality fossil in my Palaeontology course	10	4.1	1.20
Q2	I wish this technology was incorporated into other classes and subjects	10	4.7	0.48
Q3	Virtual Reality program on the computer seems easy to handle	10	4.3	0.67
Q4	Virtual Reality program on the mobile phone seems easy to handle	10	3.5	1.08
Q5	Use of VR is useful for this kind of hands-on activity	10	4.2	1.23
Q6	I have learnt more with VR than in conventional fossil manual observation	10	3.8	1.40
Q7	When compared to ppt lecture slides, the VR fossil models show better features and characteristics of the species	10	4.5	0.71
Q8	Practical activities with VR are more entertaining than conventional	10	3.8	1.23
Q9	I better understand spatial (relations of fossils) concepts with VR compared to other methods	10	4.1	1.20
Q10	Virtual Reality program on the computer is more useful than on mobile	10	4.5	0.71
Q11	Virtual Reality program on the mobile phone is more useful than on computer.	10	3.1	0.88
Q12	I will use the program frequently to study palaeontology/view virtual fossils.	10	4.6	0.52
Q13	I will strongly recommend others to use the program/application	10	4.6	0.52

N= No of student, M=Mean, SD= standard deviation

Conclusion

This paper successfully demonstrated the application of 3D virtual reality in Teaching and Learning in Palaeontology course at Universiti Teknologi Petronas which can be an example for other courses to digitally enrich their T&L style. The paper also evaluated the students' experience and acceptance of the usage that give us important information on how to improve the style of teaching and website performance especially. The website platform itself will be improvised to provide information to the UTP students and public on knowledge-based interactivity in learning fossils and spread the digital resolution in palaeontology.

Acknowledgement

This project was supported by CETAL grant 015LF0 039 of Sotl 2020 cycle. I also thank Mr. Muhammad Aqqid Saparin, graduate assistant in assisting the T&L activities and Department of Geosciences for the permission to use the fossils and support.

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MOODLE QUIZ AS SELF-ASSESSMENT TOOL: EVALUATING EFFECTIVENESS FOR ONLINE ENGINEERING COURSE

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Introduction

The challenge of delivering engineering course online is to sustain the students' interest to learn the material while at the same time making sure the material is delivered effectively. In the traditional classroom setting the instructor could prepare paper-based quiz as one type of formative assessment tool to check students' understanding which also reflects the effectiveness of material delivery. In the online setting, learning can happen both synchronous and asynchronous mode. Often assignment or take-home homework constitutes the asynchronous learning expected to be completed by the students. The downside of this activity is that feedback on the students' performance and understanding is often deferred until the graded work is returned to the students. From the authors' experience, this gap between the completion of formative assessment activity and feedback from the instructor can be closed through the creative use of the quiz module in Moodle. Specifically, this paper elaborates the application of WIRIS plug-in in Moodle's quiz construction to design course-specific questions with embedded mathematical content. The paper describes the features of WIRIS plug-in particularly useful when creating Moodle quizzes and shows how the quizzes were administered in a second-year engineering course. Built-in psychometric tools from Moodle are described to measure the effectiveness of the quiz questions for assessment and how it relates with the students' performance in achieving Course Learning Outcome (CLO) for the course. The paper will also discuss responses from students taking the quizzes and how it reflects their learning experience.

Literature Review

Continuous assessment of students to evaluate their understanding has been suggested to effect better retention of the materials delivered in class (Gibbs, 2000). In this regard, Gibbs asserted that better retention and understanding of class materials can be achieved by providing regular assessments in the form of online homework and quizzes. Apart from immediate feedback offered after completing each quiz, Thiel et al. (2008) mentioned the online quizzes allow students to learn from their mistakes and make corrections, thus improving their success in the course. Other benefits of online quizzes according to Lawson (2002) includes continuous availability of time to offer the quizzes, even outside regular class hours; and the facility to provide repeated practice to build students' competence in the subject matter. However, Lawson (2002) also discussed possible downsides which include the quizzes suitability to assess higher-order thinking; and students gaming the system by guessing the answer instead of putting their effort. Despite the shortcomings, Lawson (2002) asserted that the benefits outweigh the downsides, and the problems can be ameliorated when the quizzes are intended as formative assessments.

Several studies have documented implementation of online quizzes using Moodle as the LMS (Learning Management Platform). The following demonstrate diversity of approaches practiced by instructors from different institutions when administering online quizzes to their courses.

Mora et al. (2011) discussed the application of WIRIS plug-in for Moodle. This plug-in provides extra features to Moodle quizzes such as the ability to compose and manipulate mathematical objects, built-in mathematical libraries, and randomized variables in the quiz questions. All these features are lacking in the original Moodle setup. The author elaborates that by having these features enable teachers to design assessment with mathematical contents with ease, because WIRIS provides built-in calculator that can check the students' answers and give immediate feedback. Furthermore, by incorporating the randomized variables in the quiz questions, instructors can provide endless practice questions that can help to improve students' confidence in a particular topic.

Gaona et al. (2018) studied the effect of types of feedback when conducting online quizzes with Moodle. The online quizzes were administered using WIRIS plug-in in the Moodle LMS. They found that giving quizzes with deferred back resulted in higher grades for the unit chapter compared to quizzes with immediate feedback. This is because with deferred feedback, students actually attempted all the quiz questions, thus their practice effort is distributed before getting answers. This allows them to get adequate practice for the unit chapter, thus boosting their overall grades. In contrast, students receiving immediate feedback tends to repeat the same questions when they made mistake, to get a better grade at the expense of having to spend longer time completing the quiz.

Martins (2018) investigated the best approach to apply online quizzes in their Mathematics classes. They found that running the quizzes as formative assessment and in weekly format works best for their classes. They also make the quizzes not mandatory, and the best marks obtained from the quizzes only count if the students get more than 45% in their regular coursework. They analyzed results from Moodle and survey the students to get their feedback regarding the quiz implementation. It was found there was an increase in the grades, and most students agreed that the quizzes were found to be useful and cause them to study more for the courses.

Drawing upon insights on the above study, it was found that most focused on administering online quizzes to pure Mathematics courses, particularly with the assistance of a special plug-in in the Moodle platform to allow easy implementation of mathematical formulation and real-time computation. This offers opportunities to explore similar implementation to engineering courses. The benefits of such approach would be evident, particularly when the course contains long and repetitive applications of engineering formulas. Making the continuous assessment process automated in the form of online quizzes would enable feedback on the students' performance to be given immediately and free the lecturers' time from manually grading the quizzes and allow them to focus on other aspects of the teaching and learning process. Moreover, another gap in the existing study is the lack of discussion on how online quizzes can be used as a tool to improve course learning outcomes (CLO) attainment in an outcome-based education (OBE) framework.

In this paper, we present the approaches taken to implement online quizzes using WIRIS plug-in for Moodle LMS in a second-year engineering course. Although the course content itself was delivered through regular class hours, the quizzes were intended to complement asynchronous learning. The notable contribution of this paper is to measure the effectiveness of the constructed quiz questions to evaluate students, using built-in Moodle statistics, namely Facility Index (FI) and Discrimination Index (DI). Students' performance in tests, as related to course outcomes (CLO) achievement, will be compared between cohort taking the online quizzes and another cohort from the semester before as control group. Feedback from students will be analyzed to assess their learning experiences for the next cycle of implementation.

The contributions of this paper are based on the following research questions:

1. RQ1: How can Moodle statistics be used to measure the efficacy of online quiz questions for self-assessment?
2. RQ2: How effective is the online quizzes as a self-assessment tool to improve students' achievement of CLO?
3. RQ3: What is the student's perception of the online quizzes?

Methodology

Background of the course: Reservoir Engineering 2

Reservoir Engineering 2 is taken by Petroleum Engineering students in the second year of the degree program. The course contents cover the following: solution of diffusivity equation for predicting pressure distribution in a reservoir; application of material balance equation to calculate the original volumes of hydrocarbons in the reservoir and to estimate the future performance; application of water influx models to simulate and predict reservoir's aquifer performance; and application of decline curve empirical models to predict future oil and gas wells production based on past production history. As such, the four of course learning outcomes (CLO): 1) Develop various flow equations based on the different fluid and reservoir properties; 2). Apply material balance concepts for reserve and recovery factor estimation; 3). Evaluate various water influx models; and 4) Apply decline curve analysis models to forecast production.

The assessment includes four assignments, four quizzes, two tests and one take-home final examination for total coursework marks distribution of 30% (assignments), 20% (quizzes), 20% (tests) and 30% (final examination) respectively. In this study, the quizzes were designed to be delivered online throughout a 12-week semester. Each quiz targeted one CLO for a total of four quizzes and two tests each covered CLO 1 & 2 and CLO 3 & 4 respectively. The interval for quiz delivery was set after the completion of each CLO. To make the quizzes serve as formative assessment, students were allowed to attempt each quiz maximum of three times and the highest score for the attempts was counted towards coursework marks.

Implementation of WIRIS Quizzes in Moodle

WIRIS plug-in (https://www.wiris.com) is a third-party module that is developed to provide additional mathematical and scientific functionalities when designing quiz questions in Moodle. When the plug-in is enabled, it allows easy representation of mathematical formulas, and provides mathematical computation in real-time. For example, when setting-up quiz questions that use mathematical formulation that is specific to the subject, a lecturer can design algorithms through the WIRIS quiz editor to check students' answers intelligently. The same algorithms can be replicated in different types of questions: True/False, Multiple Choice, Matching, Short Answer and Embedded Answer (Cloze questions).

In this course, the quizzes were designed according to the process shown below in Figure 1.

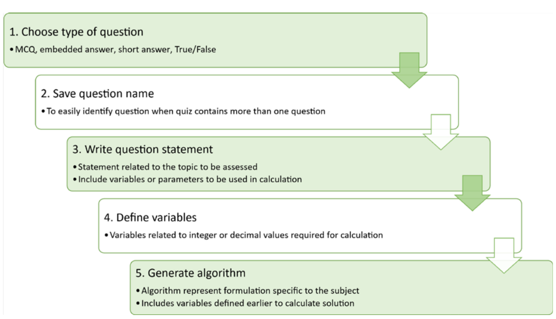

Figure 1 Process flow for quiz creation with WIRIS plug-in

Since the quiz questions were constructed as formative assessments after each CLO was covered, we chose True/False (T/F) and Short Answer question types. The topics covered for each quiz and the question types are shown in Table 1.

Table 1 Topics coverage and question types for each quiz

Item	Topics covered	Question Types
Quiz 1	CLO 1	T/F: 8 questions; Short answer: 1 question
Quiz 2	CLO 2	T/F: 8 questions; Short answer: 2 questions
Quiz 3	CLO 3	T/F: 8 questions; Short answer: 2 questions
Quiz 4	CLO 4	T/F: 6 questions; Short answer: 1 question

Figure 2 shows one of the short answer questions in Quiz 3. Using WIRIS plug-in allows values of the variables to be defined in a table when writing the problem statement, and the short answer can be broken down into sub-questions to guide the students when completing the quiz question. The sub-questions can be programmed with specific algorithms to allow automatic checking of student's answers. The problem statement for this question contains a table with parameter values. These values are the variables that will be used in the algorithm to solve the problem.

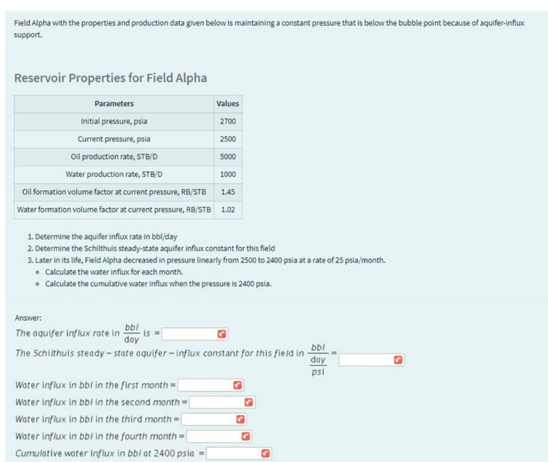

Figure 2 Screen capture of short answer question created with WIRIS Quizzes

The parameter values used to populate the table in Figure 2 is an array ‘a’ used in the algorithm, here written as a script file in the WIRIS quiz editor (see Figure 3). The algorithm for this question solves the trapezoid rule for the area under the curve to calculate the monthly volume of water from the aquifer that encroaches into the oil reservoir.

Schilthuis water influx Sheet 1

$a = \{2700, 2500, 5000, 1000, 1.45, 1.02\}$ Define

$a = \{a_1, a_2, a_3, a_4, a_5, a_6\}$ Define

$soln1 = a_3 \cdot a_5 + a_4 \cdot a_6$ Define

$soln2 = \frac{soln1}{a_1 - a_2}$ Define

$soln3 = soln2 \cdot 25 \cdot 0.5 \cdot 30$ Define

$soln4 = soln2 \cdot (25+50) \cdot 0.5 \cdot 30$ Define

$soln5 = soln2 \cdot (50+75) \cdot 0.5 \cdot 30$ Define

$soln6 = soln2 \cdot (75+100) \cdot 0.5 \cdot 30$ Define

$soln7 = soln3 + soln4 + soln5 + soln6$ Define

Figure 3 Algorithm created to solve the question in Figure 2

When setting up the quizzes, several decisions were made on how the quizzes would behave. These were: 1) Quiz deadline was set to close two weeks after each CLO has been covered; 2) Students could attempt the quiz maximum of three times and the highest score would count in the coursework marks; 3) Feedback type was set to be deferred feedback. All other options were set to default.

WIRIS quizzes provide functionality to randomize the variables, i.e., the parameter values in the table for Figure 2 appears as different numbers when another student opens the same quiz, or the same student attempts the quiz the second time. This feature provides opportunities for multiple practices using the same question. However, this involves an extra step in writing the algorithm, thus it was not used in the first iteration of implementing online quizzes for this course.

Moodle Statistics: Facility Index (FI) and Discrimination Index (DI)

The quiz questions were analyzed using Moodle built-in statistical tool. This is found by going to the quiz page and clicking the “Actions Menu (gear icon)” followed by “Results” and “Statistics”. The statistics will be available once all students have attempted the quiz and the deadline is up.

Two psychometrics measures will be used: Facility Index (FI) and Discrimination Index (DI). According to Gamage (2019) psychometric analysis is used to evaluate the quality of test questions when grading the students. It considers student responses and the interaction with the rest of the responses. The FI is an item analysis to show the number of students who attempted the question and got it correct. As such, it can be used to gauge the question’s difficulty based on the scale of extremely difficult (<5%) to extremely easy (95-100%). Typically question that falls on both extremes can be considered as not useful for instrument of measurement (Blanco & Ginovart, 2012). Therefore, the question needs to be revised and rewritten. In this study, the interpretation of FI is based on Butcher (2010) as shown in Table 2.

Table 2 Interpretation of FI score

Index	FI Score	Interpretation
F9	5 or less	Extremely difficult or something wrong with the question
F8	6 – 10	Very difficult
F7	11 – 20	Difficult
F6	21 – 34	Moderately difficult
F5	35 – 65	About right for the average student
F4	66 – 80	Fairly easy
F3	81 – 89	Easy
F2	90 – 94	Very easy
F1	95 – 100	Extremely easy

The DI is used to represent the quality of a question to distinguish between able and weak students (Hogan, 2018). The measurement is based on the correlation between the weighted scores on the question and those on the rest of the rest (Butcher, 2010). This means for a question with good DI, students who scored high in other parts of the quiz should also have high score on this question. The interpretation of DI score based on Butcher (2010) is shown in Table 3.

Table 3 Interpretation of DI score

Index	DI Score	Interpretation
D5	-ve	Question probably invalid
D4	0 – 19	Very weak discrimination
D3	20 – 29	Weak discrimination
D2	30 – 50	Adequate discrimination
D1	50 and above	Very good discrimination

Although both measures are suggested to be used with questions intended for summative assessment (Butcher, 2010), we decided to use the FI and DI scores from the statistics report of the first attempt to provide insights for future improvement of the quiz questions.

Students' Responses from Survey Questions

Survey questionnaires created in Microsoft Forms were distributed to the students after the deadline of Quiz 4 and before the start of final exams. A total of 13 respondents out of total class size of 17 returned the questionnaire. The survey contains four questions structured with Likert 5-point responses from strongly disagree to strongly agree.

Results and Discussion

How can Moodle statistics be used to measure the efficacy of online quiz questions for self-assessment?

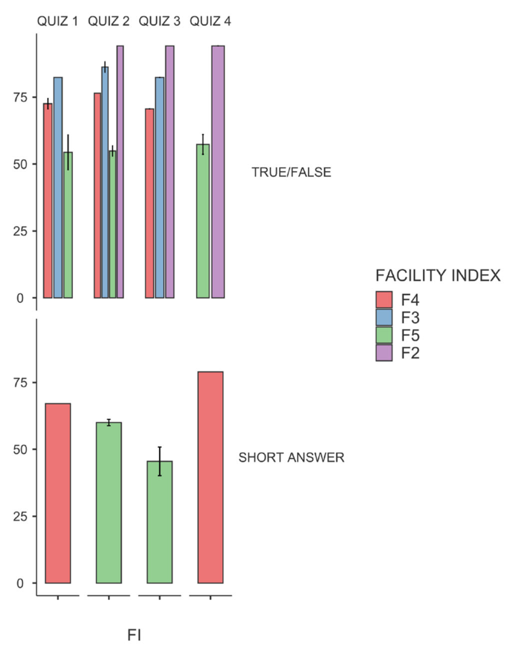

Figure 4 FI scores for online quizzes sorted according to question types

Results from the statistics reports for FI scores for each quiz is summarized in Figure 4. In True/False type of question, only the following quizzes contain questions with band F5: Quiz 1 (4 questions out of 8); Quiz 2 (2 out of 8); and Quiz 4 (4 out of 6). Meanwhile for questions of short answer type, only Quiz 2 and Quiz 3 exhibit FI scores in band F5.

Since FI scores measure the difficulty of the questions, having scores within the band F5 to F6 are desirable if the quiz questions are intended to be used as a self-assessment tool. This means for the next iteration of the quiz implementation, some questions notably those that fall within F2 – F4 band need to be redesigned to achieve the appropriate difficulty level. Moreover, it is noted that short answer type questions are more suitable and effective for achieving target FI.

DI results for the same quiz sets is shown in Figure 5. For True/False questions, only Quiz 1 (5 questions out of 8) and Quiz 3 (6 out of 7) achieved DI scores in the band D1 – D2. Likewise for short answer questions, almost all in the D1 band except the question in Quiz 4.

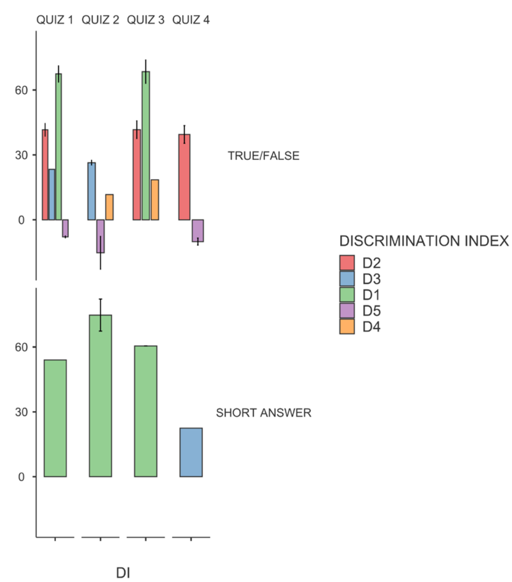

Figure 5 DI scores for Quiz 1 to Quiz 4 sorted according to question types

DI scores provide a quantitative measure of the question's ability to differentiate students between weak to proficient spectrum. Questions with scores that fall in D1 band are generally good to test the student's competency in mastering the subject matter. In Figure 5, questions of the short answer type are suitable for this purpose. On the contrary, questions with negative DI scores (band D5) should be removed and replaced with a new one in band D1.

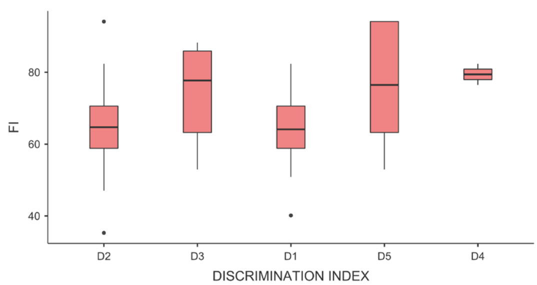

Figure 6 Ranges of FI scores for different bands of DI scores

When analyzing the quiz questions for efficacy as student's self-assessment tool, valuable insights can be gained by looking at both perspectives of FI and DI scores. For example, in Figure 6 questions with good discrimination index (band D1 and D2) simultaneously correspond to those questions that have median FI scores of 64.1 and 64.7 respectively. These scores correspond to band F5 ("About right for the average student"). Performing such analysis will help the lecturers to design better quiz questions for the next cohort.

How effective are the online quizzes as a self-assessment tool to improve students' achievement of CLO?

To evaluate the effectiveness of the online quizzes we performed correlation analysis between the scores of each quiz and the portion of marks in Test 1 and Test 2 that corresponds to each CLO. For example, out of the Test 1 total marks of 100, 50% of that belongs to questions that assess CLO 1 and the remaining for CLO 2. The same setup applies to Test 2 (50% of the marks for CLO 3, the rest for CLO 4). Here each quiz represents the assessment for different CLO (see Table 1). The correlation matrix is shown in Table 4.

Since multiple attempts were allowed for each quiz, this resulted in the students eventually obtaining the highest marks. Consequently, it was expected the quiz marks would not correlate to the test marks. This was evident from the results of non-parametric Spearman's rho for : Test 1 (CLO1) – Quiz 1 pair (; Test 1 (CLO2) – Quiz 2 pair (; Test 2 (CLO3) – Quiz 3 pair (; and Test 2 (CLO4) – Quiz 4 pair (. Thus, the strength of the correlation can be considered very weak to moderate.

Alternative way to evaluate whether the intervention (online quizzes) is successful is by comparing Test 1 and Test 2 marks, separated by their CLO components, between cohort taking the online quizzes (May semester,) and control group (January semester,) for significant relationship. If the online quizzes improved students' achievement of CLO, that should be reflected in the test marks. An independent samples t-test for non-parametric distribution was conducted using the Mann-Whitney U procedures. The results are shown in Table 5.

Table 4 Results of correlation matrix between each quiz and CLO marks for each test

Correlation Matrix

		QUIZ 1	QUIZ 2	QUIZ 3	QUIZ 4	TEST 1 (CO1)	TEST 1 (CO2)	TEST 2 (CO3)	TEST 2 (CO4)
QUIZ 1	Spearman's rho	—							
	p-value	—							
QUIZ 2	Spearman's rho	-0.074	—						
	p-value	0.778	—						
QUIZ 3	Spearman's rho	-0.169	0.606	—					
	p-value	0.517	0.010	—					
QUIZ 4	Spearman's rho	-0.116	-0.180	-0.091	—				
	p-value	0.658	0.490	0.728	—				
TEST 1 (CO1)	Spearman's rho	-0.619	-0.016	0.126	-0.103	—			
	p-value	0.008	0.952	0.631	0.695	—			
TEST 1 (CO2)	Spearman's rho	-0.418	0.554	0.572	0.052	0.339	—		
	p-value	0.095	0.021	0.016	0.843	0.184	—		
TEST 2 (CO3)	Spearman's rho	-0.350	0.167	0.188	-0.103	0.434	0.060	—	
	p-value	0.168	0.521	0.470	0.694	0.082	0.819	—	
TEST 2 (CO4)	Spearman's rho	0.000	-0.475	-0.246	0.478	-0.145	-0.259	0.092	—
	p-value	1.000	0.054	0.341	0.052	0.580	0.316	0.725	—

Table 5 Results of Mann-Whitney U tests for Test 1 and Test 2 marks of cohort January and May semester, separated by the CLO components

Independent Samples T-Test

		Statistic	p
TEST 1 (CO1)	Mann-Whitney U	111.50	0.002
TEST 1 (CO2)	Mann-Whitney U	85.50	< .001
TEST 2 (CO3)	Mann-Whitney U	112.50	0.002
TEST 2 (CO4)	Mann-Whitney U	2.50	< .001

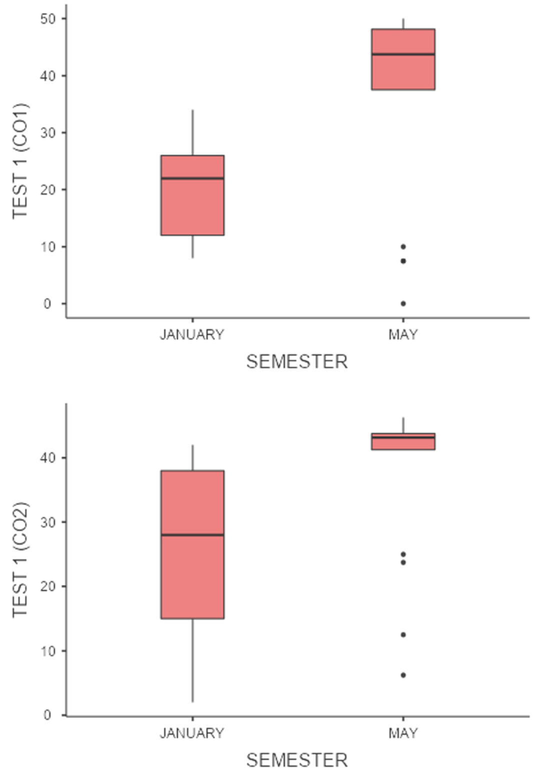

Figure 7 Test 1 marks for January and May cohort according to course outcome components in the test questions

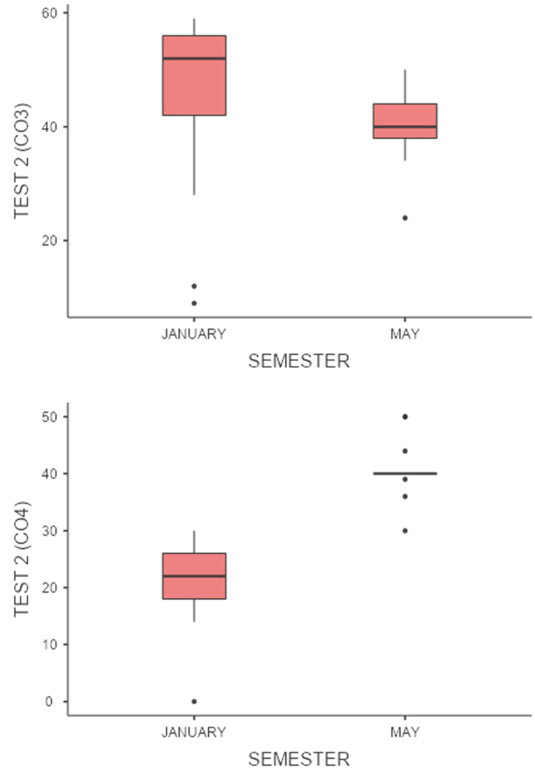

Figure 8 Test 2 marks for January and May cohort according to course outcome components in the test questions

From the results in Table 5, there were significant differences for CLO 1 and CLO 2 (achievement respectively in Test 1 marks between the cohort taking the online quizzes compared to the control group. This was evident in Figure 7 where the median CLO 1 mark was 43.8 for May cohort compared to 22.0 for January cohort. Similarly, Figure 7 also shows the median CLO 2 marks was 43.1 for May compared to 28.0 for January respectively. These results indirectly suggest that implementation of Quiz 1 and Quiz 2 is effective for the improved achievement of CLO 1 and CLO 2 for this course.

A similar conclusion can be said for the achievement of CLO 3 and CLO 4 in Test 2 between both cohorts. The Mann-Whitney U test, showed there existed significant differences as well (. However, after plotting box plots of the data (see Figure 8) it was revealed that the significant difference was only notable for CLO 4. For CLO 3 the relationship was significant in the opposite direction i.e., cohort January semester.

This could mean the online quiz is effective for improving the achievement of CLO 4, while another approach (using question of different types) might be more suitable for CLO 3 achievement. Nevertheless, a more rigorous assessment with a bigger sample size is suggested at this point for further validation.

What is the student's perception of the online quizzes?

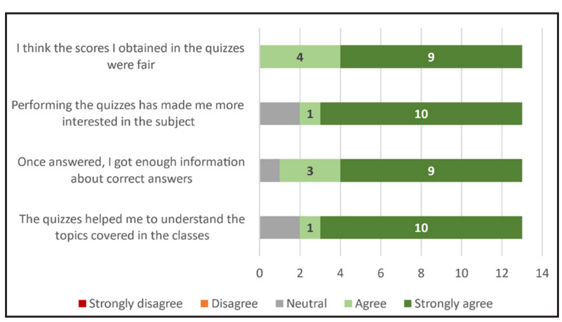

Figure 9 Survey results of students' responses to implementation of online quizzes

The results of the survey indicated favorable responses when the online quizzes were implemented in class. Most respondents (85%) agreed that the quizzes helped them to become more interested in the course. The same percentage of respondents also agreed that the quizzes achieved the purpose of helping the students to understand the materials covered in class. Positive responses overall motivated us to improve the quiz delivery for future cohorts taking the course.

Conclusion

Online quiz implementation using WIRIS quizzes was evaluated using built-in psychometric measures Facility Index (FI) and Discrimination Index (DI). Both measures are equally important to provide a quantitative assessment of the quality of the quiz questions. Statistical tests conducted have shown significant improvement in Course Learning Outcomes (CLO) achievement for this course when the online quiz components are part of the coursework. Overall feedback from students is positive, indicating that the online quizzes served their purpose as an effective self-assessment tool. This provides opportunities for implementation to future cohorts.

Acknowledgement

The authors would like to acknowledge Centre for Teaching and Learning (CETaL), Universiti Teknologi PETRONAS for providing support through SoTL grant 015LF0-042 to conduct this study.

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A REVIEW STUDIES: THE BEST COLOUR SCHEME IN 2D ANIMATION LEARNING ENVIRONMENT

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Introduction

This study aims to gain a deeper understanding of the use of colour schemes in 2D animation. The director typically chooses the lighting and design of an animated video very carefully to convey the plot or message. The colour scheme of the scene influences how the colour appears in the final shot, which has a psychological impact on the viewer. There are a few methods and practices used by an artist to influence audience emotion, such as sadness can be felt through a scene with blue light colour.

Lighting and colour are two fundamental visual stimuli that provide meaning for the story being told. A good lighting design is both an aesthetic and narrative option that immerses the viewer in the fictional world's atmosphere. Both art theory and human experience demonstrate that illumination and colour have a significant effect on the viewer's understanding. Jeremy Birn (2006) in his book Digital Lighting and Rendering, discusses the importance of lighting and colour extensively. The colours used in a film evoke specific feelings from the spectator. Mostly, the correlations emerge subconsciously.

Colours will have a bigger effect on audiences if filmmakers choose them wisely. The colour red is associated with alarm or anxiety. Yellow evokes joyful feelings and gives the listener the impression that the plot will end on a positive note. Warmer shades, in general, attract more interest than colder colours, which is why they feature so often in commercials. A warm colour scheme adds excitement and energy to the picture. Cool shades, on the other hand, make the audience feel more at ease. Nature-themed outdoor scenes are characterized by cool colours and therefore go well with neutral backgrounds. Blue may imply sorrow or coldness. Green is unusual in that it is the quintessential hue of nature.

However, a green light may also make a location seem creepy or depict disease. While there are defined colour conventions, they must also be used with care and consideration for their effects. Giving the protagonist of a story red eyes, for example, is an immediate visual indication that the character is evil, but it is a clichéd tactic that may irritate the audience. Colour in lighting is an effective medium, but it should not be the only artistic outlet for the plot.

According to El-Nasr (2006), there is a new development in the influence of lighting on stress in the virtual environment i.e. the methods learned in the film industry are applied to games to produce similar results. Light mechanisms such as light flashing or oversaturation are used in games, much as they are in films, to enhance the scene and communicate with the viewer. Unfortunately, because of the game design and other immersive worlds, the consumer must engage with the world rather than passively watching it like in movies.

Efficient lighting strategies are used in sports, they also often cause significant distraction to players. The author aimed to create a lighting scheme that varies dynamically to create an acceptable amount of suspense while also adhering to proper lighting standards that do not adversely impact the user's experience.

A lighting effects analysis was carried out to determine the most common lighting strategies used to create suspense that could be applied in a game engine. The distinguishing factor was contrast. High contrast between light and dark, contrasts in colour scheme, and variations in contrast over time have all been related to user tension. As the level of contrast grew over time, it created a lot of anxiety in the audience, and when it diminished over time, it relieved a lot of tension. The author took these findings and used them to create a custom lighting engine that altered the lighting properties of the current environment to create anxiety in the user (El-Nasr, 2006).

There was no systematic analysis, but preliminary testing of the lighting engine revealed that using these lighting methods resulted in the expected increased anxiety in the customer. Despite the lack of formal research, these findings were to be anticipated considering their origins in existing film techniques (El-Nasr, 2006).

Colour Schemes

Huchendorf's (2007) study showed that the world that we live in is full of colour. Colour is not an emotional phenomenon, but rather a physical phenomenon. People who live in a vivid environment and accumulate several sensory and/or auditory impressions stimulate certain types of emotional thought when corresponding with colours in response to external colour stimulation. Colour schemes, whether colour or achromatic, each have their emotional characteristics.

Through using symbolic features of colour association, visual animation makers can invoke the viewer's impression of life and compassion. As a result, the plotline excitement of the animation was increased by using the colour language presentation process. It may also help to understand the metaphor sense of scene colour in an animation narrative.

The material analysis approach primarily stressed analytic principles. In other words, the main features of content analysis are objectivity, systematicity, and quantitative. As a result, the technique of material analysis was used in this work to determine the effect of the colour picture on the animation scene. The writers would like to summarise certain instructions for the use of colours in animated scenes and better explain the emotional sense of colour built-in animation. Due to the limitations of certain variables such as finances, materials, composition, and so on, the use of animated-scene colours was only discussed in this research, while other ways of expressions designed in animation were excluded.

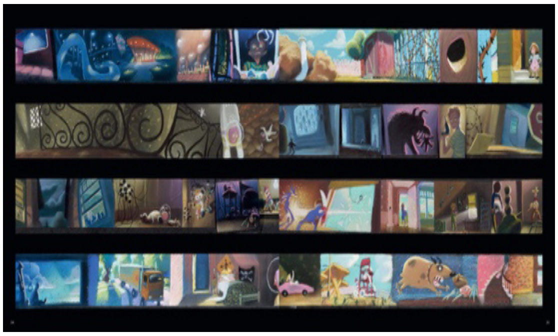

Figure 1 Scene from the Art of Pixar, Chronicle Books, 2020

Colour scripts describe the emotional beats of a story, encouraging anyone who is involved in the animation process in understanding the key vision. The ones Eggleston would create, which "planned out scenes on long stripes of black paper with chalk pastel, [as] a sort of 'stream of consciousness map of colour, value, and visual drama," would prove crucial to the film's direction and production as a whole. Though Eggleston and Pixar did not invent colour scripts, the studio would go on to become the first to create one for each of its films, influencing the animation industry at large.

Colour Mood

The cute aliens, called Boov, featured within the movie change their colour looking at their mood and emotions. They turn red when they're angry, green after they lie, yellow when they're scared, orange once they get excited or happy, and pink after they feel love. They also go psychedelic once they dance.

Figure 2 Scene from DreamWorks 'HOME'

Also as providing DreamWorks with an enormous opportunity for colour-changing movie merchandise (yes, I know, I'm the cynical parent!), was genuinely an effective tool for magnifying the character's feelings. The children identified very quickly which colour meant which mood and that I found myself fascinated by the colour choices of the moviemakers to indicate certain emotions.

Traditional Animation

Traditional animation, which may even be called cell animation or hand-drawn animation, was first used for animated films within the 20th century. The individual frame of a standard animated film is a photograph of drawings which firstly drawn by animators on paper. To form the performance of movement, each drawing differs slightly from the previous one.

The animators' drawings are traced or photocopied onto a transparent acetate sheet which is named cells. The cells are filled in with assigned colours or tones on the side opposite the road drawings. The completed character cells are photographed one by one into the film in front of a painted background by a rostrum camera.

Traditional cell animation production became obsolete at the start of the 21st century. Nowadays, animators' drawings and therefore the backgrounds are scanned into or drawn online directly on a computer. Various lighting tricks software (such as "Toon boom", "Amino") are wont to colour the drawings and simulate camera movement and effects.

The ultimate animated image sequence is output to many types of media, including traditional film and newer media like digital video. The visual feeling of traditional cell animation remains preserved, and therefore the variety of animators' work has remained essentially identical as before. Some animation production studios used the term "tradigital" to explain cell animation which makes extensive use of pc graphics tech.

According to the survey by Robertson (1994) and Sykora (2006), in advanced cartoon studios, two types of industrial computer graphics core systems are used to create 2D animation: Ink and Paint and Automated in Between. The autonomous function of computers is marked by a dark background. Most phases in each have an exposure sheet that lists all of the frames in a scene. Each line contains the phoneme pronounced by the characters as well as the location from which the cartoon figures will be shot. Each scene also has a series of levels, only the background of which can be painted along with the animation stages.

In general, 2D animation is classified into two categories: conventional 2D character animation and non-traditional 2D animation. (It is also known as cartoon animation or cell animation.) The other method is to do direct processing on a 2D image, such as physical model-based simulation, which can be used to produce natural phenomenon animation. The methodology in our study falls into the first grouping, but certain methods from the second are also used. There is a substantial body of prior work devoted to 2D animation. By far the most relevant developments to ours are discussed here.

It was the first animation method to use vector-based artwork and graphs. Kort (2002) presented a computer-aided inbetweening algorithm the layer-based algorithm divides the drawing into strokes, chains of strokes, and connections between them. To balance the various parts between sketches, certain restrictions are added. He also created a cost feature to decide the best match.

Agarwala et al. (2004) presented a method for tracking character contours in a video series second, the consumer locates curves in two or three frames. These curves are then used as keyframes by a monitoring algorithm based on computer vision. This approach blends computer vision and user interaction to solve a space-time optimization problem for time-varying curve forms with user-specified constraints. A video can be automatically converted to non-photorealistic animation using the built framework.

However, one drawback of this technique is that it cannot handle contour occlusion or absence. Chuang et al. (2005) presented a mechanism for automatically generating the "stochastic motion texture" in static 2D images It used physical models to mimic natural phenomena. Using this method, they can animate images containing passive elements with motion driven, such as water, trees, and ships.

Xu et al. (2007) the phase period of animals was inferred from snapshots of various individuals caught in a still image. They can infer the order of motion snapshots and construct the motion cycle by searching the motion path in the graph connecting motion snapshots. Then, by morphing among the arranged snapshots, they animated a still image of a moving animal party, such as birds and fish.

Emotion

Colour is emotional from various perspectives; our sentiments as a result of specific tones are regularly established in our encounters and recollections even as our character. There are some shading impacts anyway that appear to possess a far and wide significance.

One of the ultimate aims of a film is to express sentiment through artistic choices in each scene. There is a wealth of evidence to support the belief that graphics improve the emotional experience. This segment discusses the emotional reactions that can be elicited by movies and photographs. The Kuleshov effect is a well-known example of how the meaning of a film can affect our understanding of emotion.

Prince & Hensley (1992) recreate this classic experiment to raise questions and further investigate it. The Kuleshov Effect is a phenomenon discovered by Lev Kuleshov in which a shot will take on a different interpretation depending on the video sequence in which it is placed. By merely showing a video of a man with food, at a funeral, or with a woman, his facial expression may reflect hunger, sorrow, or desire. His theories, on the other hand, were largely speculative, and the original film used to experiment has since been lost. The scientists revisited the experiment by carrying out their own and testing it using modern scientific techniques.

The findings they discovered were unexpected. A new reconstruction of Kuleshov's experiment revealed that there was no emotion attribution dependent on video editing. They give some reasons for why they think this is the case. A significant thing to note is that there is no explicit explanation of Kuleshov's experiment. It may have been more complicated than previously stated. Furthermore, the time frame during which the tests were carried out is an obvious consideration.

Kuleshov's audience was already captivated by the novelty of film as a medium, and traditional storytelling practices had not yet developed themselves (Prince & Hensley, 1992). Nonetheless, Kuleshov's work is still significant today. He left such an impression on the world of cinema that Alfred Hitchcock quoted him as an influence for his methods. This study supports the notion that the quality of each shot is crucial for conveying sentiment and that visual signals cannot be derived solely from the series of shots (Prince & Hensley, 1992).

Using Film To Elicit Emotions

Gross & Levenson (1995) were concerned with compiling a definitive list of films that would elicit one of ten distinct emotions. These emotions were amusement, rage, hatred, disdain, terror, enjoyment, curiosity, sorrow, excitement, and astonishment as well as stress. A five-year study involving approximately 500 participants and 250 films yielded a compilation of 16 films that were found to be the best at eliciting these emotions.

Throughout the process, however, a considerable amount of information about how films represent emotion was acquired. Emotions are better represented in the film when they are discrete. To be strongly represented, emotion must be both extreme and distinct from other emotions. A film that elicits both anger and anxiety will not elicit as intense feelings for each as a film that elicits only one of the emotions.

Additionally, the previous viewing influences the viewer's emotional reaction. Following the viewings of a film can elicit a stronger emotional reaction. Amusement, disgust, and sorrow were the best feelings to express. The most difficult emotions were rage, contentment, and terror, with anger being the most difficult. (Gross & Levenson, 1995).

Captioning and Adding Emotions to Pictures

Lee, Fels & Udo (2007) investigated how closed captioning can be improved to help express the feelings of the speaker's Colourization of vocabulary was one of the methods investigated. The writers agreed that feelings should be graphically expressed to improve the captioning environment for both deaf and hearing-impaired people. In psychological research, emotions have been found to have a direct connection to colour. They can confuse communication because the context and emotion from which a person communicates will completely alter the meaning of the words.

Furthermore, one of the most often unaddressed topics of captioning is feeling. Participants in the study viewed scenes from a film using the authors' new captioning methods and completed a questionnaire about their experience. A cross-tabulation examination was performed, and it was discovered that colour had a mostly favorable reaction when it came to transmitting sentiment.

However, some users complained that the colourized text detracted from the overall experience (Lee, Fels & Udo 2007). There are two ramifications of this. The first is that cinematography does not always express sentiment in dialogue through imagery alone, and it is important to understand the limitations. Second, while colour can be used to express sentiment, it is not necessarily the right choice in any situation.

In cases where illustrations are poorly or incorrectly coloured, Hauff & Trieschnigg (2011) propose that images may be dynamically recoloured to convey the desired sentiment. The advent of a vast number of illustrated children's books being widely available in electronic format influenced the breakthrough. Even though the text is accompanied by illustrations, some of the illustrations do not express the necessary feelings mentioned in the text. Since children may identify emotional meaning based on colour, it is critical that the image appeal to the reader (Hauff & Trieschnigg, 2011).

A variety of colour schemes classified as joyful, negative, or angry were selected for their technique. The joyful schemes used more vibrant colours, while furious schemes used stark contrast between opposing colours, and sad schemes used mostly dark and desaturated colours. The intended emotion for the illustration is defined using contextual hints in the text, and a colour transformation is applied to the picture. (Hauff & Trieschnigg, 2011). There is yet to be a review, and the next step in the test will be to assess the technique's impact on the target audience.

Emotional Reactions to Non-Photorealistic Images Are Evaluated

Mandryk, Mould & Li (2011) studied the impact of non-photorealistic rendering on emotion representation. Non-photorealistic rendering (NPR) is a method used to give a film or photograph a distinct stylization, although it was unknown whether or not it affected the emotional reaction it was meant to elicit. Using a picture library, the authors conducted an analysis in which users evaluated a sequence of pictures that had been analyzed with a variety of various NPR algorithms (Mandryk, Mould & Li, 2011).

Overall, NPR rendering was seen to reduce the user's emotional reaction. Just line drawing and photo abstraction elicited a greater level of emotional arousal. Blurred images had the greatest negative effects on emotional reaction than other approaches and received the most negative responses. Since NPR algorithms are typically inspired by science considerations, it is unsurprising that they hurt emotional responses. More analysis is needed to determine whether the rendering technique alters the emotional effect and what those low-level specifics (Mandryk, Mould & Li, 2011).

Research Methodology

The research methodology is a process of how the research was being conducted. This chapter explains the steps that were taken and the methodology as a guideline to achieve the objective for colour scheme in a 2d animation production. In any project, the methodology is critical because it can assist the developer in completing the project quickly.

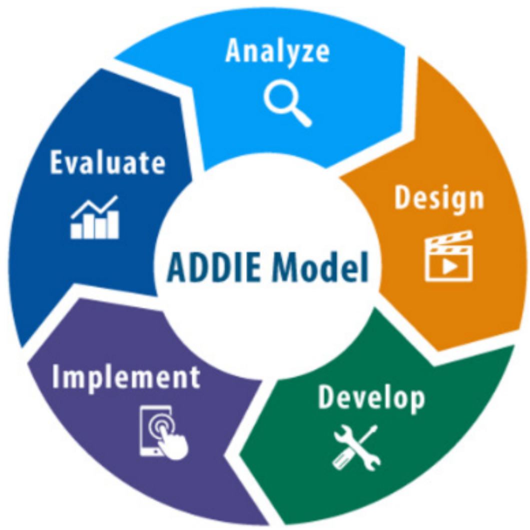

Figure 3 ADDIE model

The project will be highlighted by using the ADDIE method; analysis, design, development, implementation, and evaluation phase as shown in Figure 3. The ADDIE model is widely used in educational design projects to improve project productivity while lowering the costs and time also will be explaining all the questions that have been issued in this research paper.

The research instrument is a collective term for the structured process of conducting research and utilized both the quantitative and qualitative research methodology. The techniques used to complete the project are the steps and methods necessary to achieve this project's aim. The first approach is to adopt the principle of analysis, design, development, implementation, and evaluation (ADDIE), which represents the entire project in this methodology.

Phase 1 : Analysis

The function of the analysis phase is to set the goal of where we will focus on the target audience. For the analysis, to make sure who is the participant of the projects where we must set whether the target will be randomly or selective. It also up to us to set the range of the participant for our study which who will we include to help us with the study where to set the participant age range or their knowledge on the topic that we study. From them, what will we get that will help with our studies, and will they help to achieve our objective.

Phase one is a step of research that involves certain critical sections before the concept and product are created or planned. This is to determine the title of the research. In addition to deciding the title of the research, it must ensure that the title selected is acceptable for the existing challenges and problems. After deciding the project title, the next task is to determine the issue statement alongside the project object to guarantee that any aspect of the issue is caused by the research scenario.

After that, study the research background of the case study that needed to be prepared to cover the study case's knowledge area. In addition, the target audience often needs to know about the colour and choose their colour. When the target audience is clear, it can be see the world from their perspective. The challenges they have and the unique difficulties they need to resolve to overcome such problems can be described in this matter that has been distributed to the targeted respondent which has been located around the area of the society in Kuala Lumpur, Malaysia.

Phase 2 : Design

For the design phase, this is where we will deal with learning objective, content, instrument used, and media selection and should use the realistic method of identifying and developing the plan and strategies which aimed to achieve the goal. The design phases will be included is by creating the design of the character that will be used and each character will have their personality and quirks. A storyboard will be created and the character will be implemented to give the flow of the story.

Phase two is a design phase that is the second most important part for the designer after analysis of the research background of the target audience. It is important to determine what the designer and developer need to deliver the message that they want to talk about. After the study, the research background the designer has to know the objective that affected the readers which that they have to create the storyline and the storyboard before developing. First, read through the design brief with the several time that needed delivering in the project. Then, as analyze the brief, scanning, and deliverables, it considers how long that the designer to design will be process and factor into work plan.

Second, understanding the target demographic will be a better by saving a lot of thinking time. This phase is a crucial time by making us design far superior to the other designer. Lastly, with the brainstorm and sketch concepts, now it is time to pull all of the ideas altogether. As well as explore the graphic design trends that keep in mind during working. It will make sure that all the idea are jot down.

Phase 3 : Development

In the development phases, the content will be made based on the design phases. A cleaner product will be produce from the storyboard into a legit project to be presented. This phase will be required a lot of use of software that will help in working the development process. For animation, Toon boom Harmony will be used to animate the character which their activities will be made in the software. For the background and character design, the software that will be used is Adobe Photoshop 2020. The software is also used during the design phases where it uses to design the storyboard.

Phase three is the development phase, which is the project development process in which all the processes will be based on the Gantt chart, storyboard, and storyline to ensure successful implementation. The project interface built in the context of 2-dimensional architecture has been identified in the design process based on requirements design.

The steps of the 2D animation development process are presented in this project. This 2D animation is a very different animation technique, but it has steps that go from a basic concept to a fully animated film that is the same as others. Based on the scope of the project, this animation process is completely different, it is the kind of animation used that is based on the size of making it.

The first stage in 2D animation is to create a storyboard in the design process that was in the previous stage. By painting out a storyboard as part of an important first step to making a finished product, it must adopt a screenplay or an original concept. As a graphic organizer, a storyboard is to pre-visualize and pitch their concept to the production directors and the other animator who have to work on the movie in their work, it is thought of as a visual script or stage directions for animated characters.

In 2D animation, the second step is the production of animated audio. Once a storyboard has been set out in the script, it is time to start documenting the dialogue. In addition, after the script has been finished, the voice talent for the film with the personality of each character is provided.

The third step in 2D animation is visual development. Artists and animators that have drawn thousands of sketches of the characters, scenes and object to the perfect the aesthetic of the film. These sketches would only be slightly more detailed than the original storyboard and it also sorts of a halfway point between the extremely rough storyboard and the actual animation of the film.

Producing animation is the fourth step in 2D animation. This is the important stage of production during the golden age of animation with a highly labor-related process. In addition, any shot of an animated film will have between ten and twenty sketches, all of which must be inked and drawn by the artists before the process of shooting can begin. For any shot in the video, this procedure will be replicated, sometimes creating hundreds of thousands of final sketches, each involving a sketch, painting, inking, and photography.

The final step of the 2D animation process, last but not least, is post-production animation. The characters are drawn, animated, and set in the background. Each of the scenes has been composed and configured painstakingly.

Using Adobe Photoshop 2021, the creators created a digital image, when using Toon Boom Harmony, digital animations and tween were created. Eventually, Toon Boom Harmony combines all elements that are produced material animation, sound effects, music, and voice.

Phase 4: Implementation

For the implementation, the final product will be presented to the audience for them to examine the story. The learning outcome should be included in the phases to make sure the viewer understands the objective of the story. Several viewers will be chosen to judge the story whether the story is accepted or not. If the viewer cannot comprehend the story then it will be repaired until it will satisfy the viewer.

Phase fourth is the development phase that corresponds to the final execution of the project. This is the goal of presenting the performance and effectiveness of the project in this phase I. In addition, the development involves more of the assessment of the method and designs required to present the content being produced. Also, the researchers will present the proposal to the target group for the development process.

In addition, this phase requires Kuala Lumpur, Malaysia between 9 years old until 13 years old age who know about colour. Researchers will provide social media or mass media for the target audience to understands the projects that have been already been developed.

Phase 5 : Evaluation

The last part is the evaluation phases where in this stage is the final testing of our entire projects. This process can be separated into two parts which are formative and summative. Formative is part where the evaluation process happens during the presentation process while summative is when evaluation occurs after the presentation. In this process, viewers will judge and give feedback from the story that will be presented after they have been presented with the projects.

The assessment phase is the last stage of the Addie model. A critical aspect of the end of the process is the assessment point. In this project, by using the survey form and quantitative data analysis as the summative evaluation, researchers assess the project in comparison. The quantitative research methods are related to the qualification of variables and the portion of the review was done by collecting the outcome by administering the questionnaires to all those watching this animation to gather all the answers from the crowd watching this 2D animation.

Research Workflow

As shown in the figure 4, a new research model framework is outlined on the method for the research on studying the best colour schemes in 2D animation. The three main topics on studying the best colour schemes in 2D animation in the research by both DreamWorks Studio and Pixar Studio will be the Colour schemes, Colour mood, and Emotion.

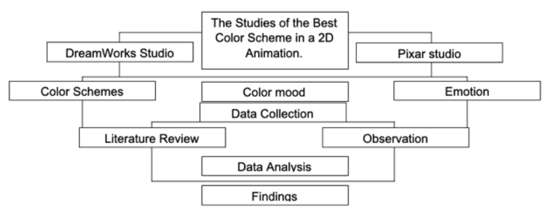

Figure 4 Research model workflow for colour scheme in a 2d animation production.

These three points would be the biggest influence in focusing on the best colour schemes in 2D animation. The connections between these aspects will be investigated, analyzed, and explained in detail. From there, we can summarize the colour schemes between these two studios and see the importance of these methods in colour schemes in animations.

Conclusion

The research model framework will going to act as a guideline as to get the research to be done as mentioned above. The framework will be focusing on three important key which is colour schemes, colour mood, and emotion to learning on how DreamWorks Studio and Pixar Studio colour in their work. The results of the studied keys are then going to be matched with each other and explained how they are the important parts of how both DreamWorks and Pixar Studio interpreting colour pallets in their animation. The data are gathered through literature research and film observations. Lastly, the discussion on the conclusion of the data will be analyzed through the findings.

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EDUCATING GENERATION Z: ACHIEVING LEARNING ENGAGEMENT AND ACADEMIC RESILIENCE IN A VIRTUAL CLASSROOM.

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Introduction

This paper presents effective ways in integrating technological learning tools and platforms in the virtual classroom to achieve learning engagement and academic resilience among Generation Z. This is a pilot study conducted in Universiti Tenaga Nasional on 23-third semester foundation students. The study utilized survey questions and interviews to gauge the learners' responses to the effectiveness of the integration of technological tools in their virtual classrooms. The results suggest that the integration of technological tools in the virtual classroom is effective, observed through increased engagement, positive responses from learners and excellent learners' performance for the course.

Literature Review

The changing landscape of teaching and learning.

The fourth industrial revolution has impacted the landscape of higher education resulting to the emergence of Education 4.0. Education 4.0 brings new and relevant teaching and learning method that customizes learning to equip learners with the relevant 21st century skills while meeting the need of the current generation of young adult learners- Generation Z (Philip, 2020). As a response to the Industrial Revolution 4.0, the institute of higher learning has begun to encourage and support educators to utilize modern methods and curricular and integrate technological tools in their teaching and learning process (Shahroom & Hussin, 2018). It is an applauded change to ensure that teaching and learning stay relevant during emerging disruptive technologies. In addition, embarking on education 4.0 are able to prepare graduates for their future life and vocation ensuring that these learners can graduate with the needed skills in the workforce such as leadership, teamwork, problem solving and communication (Indira et al., 2019: Philip, 2020). In an era where emerging smart robots could readily replace humans, education should harness the irreplaceable human qualities of educators (Shahroom & Hussin, 2018; Indira et al., 2019) because educators' roles in the classroom are still relevant and needed by learners to build into their characters and value while fostering imagination and creativity.

Nonetheless, the rapid changes in the education system have impacted the role of educators. Educators are required to have high competence in integrating various technological tools and platforms by upgrading their teaching method to meet the current changes in the education system. As education becomes more digitized, educators need to be competent and creative in utilizing various educational innovation tools to upgrade the future of learning (Shahroom & Hussin, 2018). The use of orthodox teaching method is perceived as ineffective and obsolete because it is dominated by rigid curriculum that employs passive teaching strategies such as lengthy PowerPoint slides and lecturer talk and textbook reading (Rickes, 2016, Shatto & Erwin, 2016; Philip, 2020). Consequently, young adult learners are burdened with a large number of readings, lesson contents are presented using unappealing, monotonous and lengthy PowerPoint slides. This definitely creates disengagement in the classroom, particularly in the virtual learning environment.

These conventional methods of teaching are not optimal in meeting the needs of the current generation of young adult learners thus educators may be challenged to align with the needs of this cohort of young adult learners to ensure optimal engagement in the classroom. (Carter, Creedy & Sidebotham, 2016; Rickes, 2016; Shatto & Erwin, 2016). Generation Z are inclined to learning that utilizes video-based learning, integration of online and electronic study materials, use of aesthetically pleasing infographic notes, making use of mobile applications in and out of the classroom (Cilliers, 2017; Chicca & Shellenbarger, 2018). This indicates Generation Z's preference for flip instructional approach and experiential learning because their learning is individualized, immediate, technologically advanced, and visually based (Chicca & Shellenbarger, 2018; Seemiller & Grace, 2017; Demir & Sonmez, 2021) which indirectly can make their learning exciting, meaningful and engaging while ensuring retention of the key concept of the lesson is achieved. Therefore, there is a requirement for educators to re-examine their conservative thinking style and conventional teaching methods to meet the requirements of Education 4.0.

The challenges of teaching and learning during COVID-19 crisis

In addition, integrating technological tools in teaching and learning has become more relevant during the COVID-19 crisis. It has forced educators to employ virtual teaching and learning by integrating various technological tools and platform to ensure effective learning take place. Undeniably the sudden shift to implement virtual teaching and learning has created unwanted stress among educators (Ashour et al., 2021). The abrupt need for educators to re-imagine their teaching and learning without being adequately trained to adopt virtual teaching methods may cause a strain amongst educators (Hassan et al., 2020; Rashid & Yadav, 2020). The obligation to integrate technological tools in their teaching and learning. has created a challenge to teach among educators who are trying to adapt to virtual teaching while being forced to choose the right technological tools and approaches that can build an effective virtual classroom engagement among learners (Hassan et al., 2020; Rashid & Yadav, 2020). Educators who are not competent in utilizing virtual teaching platforms may seem to struggle to create effective e-content that can attract their learners. Furthermore, these educators also struggle in providing effective online delivery of instruction causing learners to switch off from the learning process. As a result, educators are distraught to be teaching online because they do not receive feedback from their learners.

The challenges to virtual learning are not only limited to educators, but the young adult learners also face many obstacles in virtual learning. Although the current generation of learners are claimed by scholars to be technologically savvy because they are born into a globally connected world (Prensky, 2001; Tapscott, 2009; Cilliers, 2017); they do lack digital skills. This group of learners' face difficulties in adopting and using new educational technological tools. They find it difficult to get accustomed to these tools resulting in struggling in the virtual classroom. Despite being born with access to technology, most of the current generation of learners also known as Generational Z learners has a limited scope in the use of technology. Most of these cohorts of learners use technology for personal and social activities such as texting, music, watching videos, and playing games (Lai & Hong, 2015). Holman (2021) reveal that the influence on the debate between digital native and digital immigrant leads to the misconception about Generation Z's readiness to use technology for learning (Waycott et al., 2010). Consequently, the unexpected change from physical class to virtual class causes these learners to face challenges to adapt to the various technological tools used in their virtual classroom resulting in their struggle to cope with virtual learning.

Moreover, virtual learning is also a burden to learners from the lower end of the socio-economic background. This group of learners face problems related to accessibility and affordability to participate in virtual learning. The lack of availability of digital devices and the inaccessibility to high-speed internet connections hinder them from being involved in the teaching and learning process during the virtual classroom sessions. Other pertinent problems that affect learners who are at disadvantage is the lack of physical spaces to learn online such as overcrowding spaces, unconducive space for learning (Ferri, Grifoni & Guzzo, 2020; Doyle, 2020). In a study conducted by Soria et al. (2020) reported that learners from low income and working-class backgrounds experience more hurdles in their adjustment to virtual learning compared to students from middle/upper-class backgrounds. The study reports that almost one-third of undergraduate learners from low-income families lack access to technology compared to only 11% of students from upper-middle class and wealthy families. The study also reports 66% of students from the low-income group claim that learning virtually is an obstacle due to non-conducive home environments such as distraction to noises, family responsibilities and lack of access to appropriate study space. Hence, when these basic conditions required for a virtual learning environment (Eyles, Gibbons & Montebruno, 2020) are not met, it potentially creates inequality and amplify the gap in learning between the different socio-economic group of learners.

Consequently, the various challenges faced by a different group of learners led to their beliefs about their inability to learn effectively in the virtual classroom. The study by Soria et al. (2020) indicated that 61% of learners believed that they are unable to learn effectively through the virtual learning format. Soria et al. (2020) further explained that the cause for this belief to emerge amongst learners are due to unclear expectations in virtual learning from their educators while the other reason is the learners believe that the e-course content design by their educators is not relevant and appropriate for virtual classroom.

In relation to the problems in virtual learning affecting both educators and learners elaborated above, this paper will show some technological integrated tools and platforms that are feasible for educators to support teaching and learning and develop learning engagement among young adult learners despite facing challenges in learning in the virtual environment.

Research Objectives

The current study will show effective technological tools and platforms that can be used by educators to attract learners and build on to classroom engagement during teaching and learning in a virtual environment. Accordingly, the following aims are developed for this study,

1. To identify the effectiveness of integrating technological learning tools in a virtual classroom.
2. To gauge learners' learning engagement through the integration of technological learning tools in a virtual classroom.
3. To identify ways to overcome learning issues among learners through the integration of technological learning tools in a virtual classroom.
4. To investigate learners' perception of the utilization of technological tools in a virtual classroom.

Technological learning tools and platforms utilized

The technological learning tools and platforms used in this study are simple and straightforward. It does not require a lot of effort in learning to use the tools and platforms by both educators and learners. Thus, these tools and platforms can easily be adopted by educators to be incorporated into their teaching and learning. By using these tools and platforms, educators are able to create effective content to help with better instructions delivery while students reap the benefits through better learning engagement. A better engagement ensures that a better comprehension of the lessons. The following are the technological tools and platforms utilized in the virtual classroom for this study.

Brighten: Brighten is a learning management system of Universiti Tenaga Nasional. The platform is a secure and integrated system for personalised learning environments. Educators can upload or embed multiple learning materials such as documents, weblinks, videos and images from various resources such as Youtube, The World Wide Web or even from the personal computer of the educators. Students can easily access these materials as they already enrolled automatically into the learning management system upon registration for the subject. Integration of Brighten in the virtual classrooms cater to the learning preference of Generation Z because it encourages an independent learning environment that supports flip learning instructional approach and experiential learning.

Canva: Canva is a graphic design platform used to create presentations, posters, documents and other visual content. It also includes a template for users to use. In regards to this study, the Canva application is used by educators to design aesthetically pleasing graphical notes for students in the form of presentation slides.

Google Jamboard: Google Jamboard is a digital interactive whiteboard developed by Google. It is a cloud-based innovative tool that allows for virtual collaborative discussion among learners. In this study, Jamboard is used together with M.S. Team's breakout room function for in class discussion. It is an easy to use, interactive tool for learners to collaborate and discuss among their peers.

M.S. Teams – Breakout room: Breakout room function in M. S. Teams allow educators to create temporary rooms for in class discussion. It is easy to create a breakout room in M. S Teams; the educators need to only know how many breakout rooms he or she intends to create. The educator may choose either to manually add students or let the system automatically add the learners into the respective breakout room. The breakout room function allows for learners to be in smaller groups for collaboration and participation in discussion.

M.S. Teams - Chatbox and Mic function: Chatbox and mic function in M.S. Teams allow the educator to gather feedback on teaching and learning from learners. It also allows learners to respond and ask questions in the virtual class.

Mentimeter: Mentimeter is easy-to-use interactive presentation software. It creates engagement with students through questioning, live polls, word cloud and more. This platform is also device friendly. Learners can access Mentimeter through their smartphones, tablets or laptops. In reference to this study, Mentimeter is used for feedback and reflection sessions.

Telegram: Telegram is a free and open-source, cross-platform, cloud-based instant messaging software. Telegram is also device friendly. The learners may access Telegram either from their smartphones or other devices such as tablets or laptops. The Telegram application does not require high-speed internet thus it is suitable teaching for learners who have difficulties with internet connection. In regard to this study, the educator set up a single class group for class announcements, out of the class discussion. It is also used as an asynchronous teaching tool particularly for learners who missed the class session.

Method

This study is a pilot study conducted on 23-third semester foundation students from Universiti Tenaga Nasional to evaluate the effectiveness of the integration of technological learning tools and platforms in the virtual classroom. The study employs a mixed-mode research design in which students are required to fill in surveys and join an online interview session. The students are randomly selected for this study.

Procedure

The integration of technological tools and platforms in the virtual classroom involves three stages namely the pre-class stage, the during class stage and the post-class stage.

The pre-class stage begins with the educator designing the learning notes using the Canva application. The learning materials are design to be aesthetically pleasing with simple and straightforward content. The educators incorporate visuals and examples to ensure easy comprehension of the learning materials. When the learning notes has been designed, the educator uses the learning notes to create a lecture video. Once the learning material is ready the instructor downloads the materials and uploads them into the learning management system Brighten. In Brighten, the educator introduces the lesson by stating the objectives of the lesson. The educator also includes instruction on pre-class activities. Then, the educator informs about the updated learning material to the learners using Telegram application. In the Telegram class group, the educator provides further instruction on the pre-class task and requires the learners to complete the pre-class task prior to the class session. Upon receiving the instruction, the learners proceed to log into Brigthen and complete the pre-class task, while the educators prepare discussion questions in Google Jamboard to be used the during-class stage. The diagram below summarizes the pre-class stage:

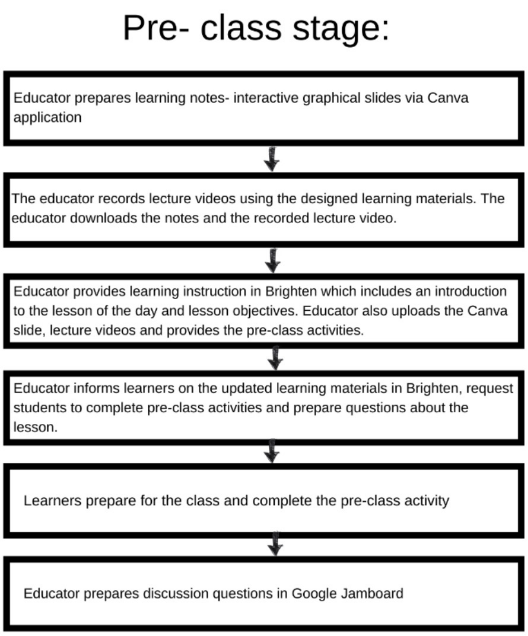


Figure 1 Pre-class stage

The during-class stage, the educator begins the lesson with a warm activity then proceeds to Mentimeter where the learners are given the option to post their questions and clarify their doubts about the lesson in Mentimeter. Alternatively, the learners can also use the M. S Teams chat box and mic to ask questions or clarify their doubts about the lesson. The whole class discussion begins with the educator clarifying the learners' doubts about the lesson and proceeds to explain the lesson of the day. Next, the educator provides instruction and explains the questions for breakout room discussion. Before the class moves into their respective breakout rooms, the educator instructs the class to gather their answers for the discussion individually. The educator creates the breakout room and the class moves into their respective breakout rooms to begin their discussion. The learners in each breakout room work collaboratively in Google Jamboard to complete the discussion question within the stipulated time. Once the stipulated time is over, the learners are moved back to the general channel where one member from each breakout room will present the output of their discussion and the educator comments on the output of their discussion.

Through this activity, the educator is able to identify parts of the lesson that needs more explanation and provide the necessary explanation Before the class session ends, the educator brings the learners to Mentimeter again for a reflection session. This is done to measure the learners' level of comprehension of the lesson and to identify the lack in the teaching and learning session so that improvement can be made in the next class session. The educator wraps the lesson of the day and ends the session. The summary of the during class stage is illustrated in the diagram below,

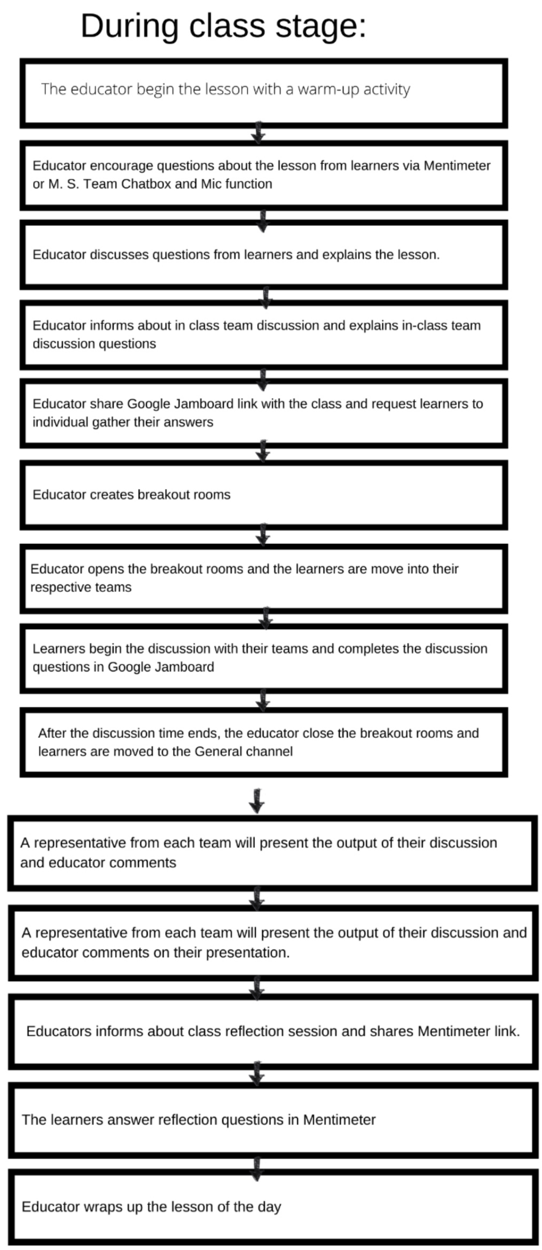


Figure 2 During class stage

In the post-class stage, the educator prepares practice questions to help the learners enhance their understanding of the lesson concept. This practice questions are created using the lesson path in Brighten. The educator informs the learners about the practice questions through the Telegram classroom and requests the learners to attempt the practice questions. Once the learners complete the practice questions. The lesson for the particular session ends. The summary of the post-class stage is illustrated in the diagram below,

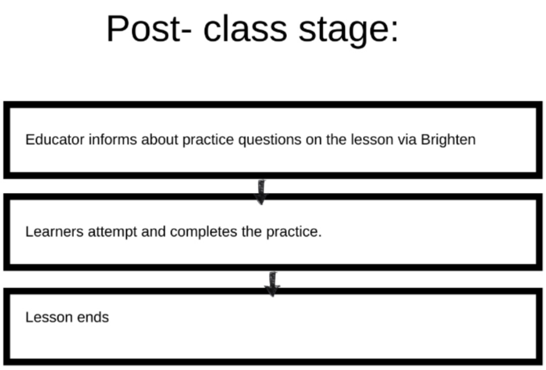


Figure 3 Post-class stage

Result & Discussion

The following section will present the result of the integration of various technological tools and platforms in the virtual class. The feedback from the interview conducted and the outcome of the survey are illustrated in this section. The study will analyse and synthesis the results and provide discussion about the results obtained from this study to show the effectiveness of the incorporation of technological tools and platforms to provide an effective learning engagement in the virtual learning environment.

Research Objective 1: Effectiveness of integrating technological learning tools in virtual classroom

In order to identify the effectiveness of integrating the technological tools and platform during the virtual classroom session; the study conducted an interview with randomly selected students. Through the interview session, the study was able to measure the effectiveness of integrating technological learning tools in the virtual classroom based on the responses from the selected learners. The study asked the following interview questions and obtained the following responses:

Interview question 1: How effective were the learning tools and apps (Brighten, Padlet, MS Teams, Jamboard, Mentimeter, Kahoot and Quizziz) in aiding your learning process? State YES or NO and your reasons

Student A: *Yes, using Brighten I could go through the notes beforehand so I know what will be expected from me and to feel prepared for the lecture. In Padlet we shared info about ourselves, which was good for knowing my classmates and their personality. Ms Teams was good for live sessions. Jamboard was cozy to illustrate our discussion results. Mentimeter was good for anonymity. Quizziz was amazing for making the class interactive and to check whether I understood the topic or not. Kahoot, as I mentioned earlier, wasn't really working for me.*

Student B: *Yes, it was helpful for me to understand and to read back the notes madam provided and also the games that madam provided makes stay even focus in class because is something fun happening.*

Student C: *I get the feel of a different learning environment despite learning virtually. The tools help me learn better.*

Student D: *Yes. It brings different approaches to the lesson which helps further enhance the understanding of the lessons.*

Interview question 2: Suggest improvements for the class

Student A: *No enhancement needed. Because I don't like the classes in which the only thing we do is listening but during your classes I could participate not just listen. Thank you for interactive and full of fun lectures.*

Student B: *I believe the class is improved already. I like the classes.*

Student C: *Maybe more learning through kahoot*

Student D: *All good!*

The interview responses from the selected participants suggest that despite learning virtually, the learners were able to enjoy learning in the virtual learning environment through the incorporation of technological tools and platforms that made the learning attractive and interactive. The technological tools and platforms utilized enable the learners to have a meaningful lesson.

Besides, it also builds an interactive and active learning environment where students are not the passive receiver of information instead students are active participants of the learning. This is because learners from Generation Z have preference for experiential learning (Holman, 2021) which suggest that their ideal learning environment to be actively doing the learning to acquire information (Seemiller & Grace, 2017). Therefore, this cohort of young adult learners prefer hands-on learning that allows them to apply what they learn to real life. This enables the learners to stay focused during lesson.

In addition, by incorporating technological tools into the virtual learning environment, it acknowledges Generation Z learners have preference for flipped instructional approach (Demir & Sonmez, 2021). This generation of learners are more inclined to be self-directed learners (Seemiller & Grace, 2016) thus the utilization of technological tools into the virtual classroom promotes self-directed and independent learning to happen in the virtual class. The interactivity of the technological tools and platform create a fun and engaging lesson while assisting learners to understand learning materials effectively. The use of technological tools and platform that are device friendly and the incorporation of technological tools that supports low bandwidths internet connection such as Telegram brings about accessibility to learning for all learners. This ensures that no learners are left out in the learning process. The simple and easy to use technological learning tools and platforms enable learners to easily assimilate these tools into their learning making learning fun, attractive and engaging.

Research Objective 2: Learners' learning engagement through the integration of technological learning tools in virtual classroom

The study wanted to determine learners' engagement level through the integration of technological learning tools in the virtual learning environment. In order to measure the students' level of engagement, the study conducted a survey and interview to gather the participants' responses on their learning engagement through the utilisation of technological tools and platforms in their virtual classroom. Participants feedback from the interview session are recorded and are illustrated in the diagram below.

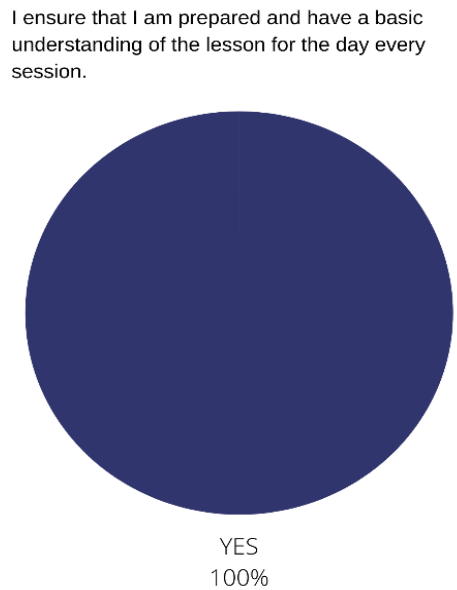


Figure 4 Preparedness

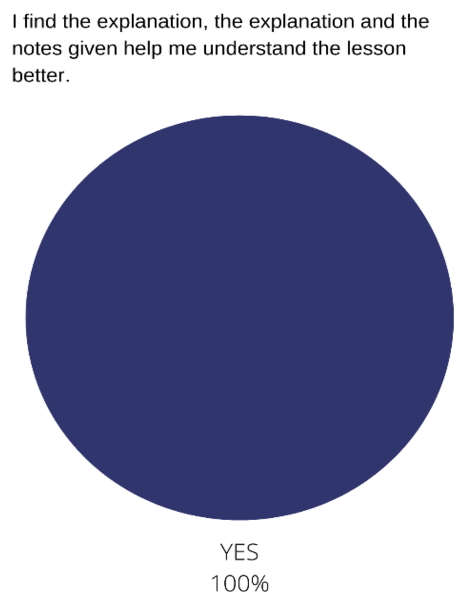


Figure 5 Understanding

The response from the survey indicated that 100% of the participants ensure that they are prepared prior to the virtual class session. The survey also shows that 100% of the participants find the activities, explanations and notes provided helped them to understand the lesson better. The survey also suggested that the participants did not attend the class for the sake of attendance but the attraction of

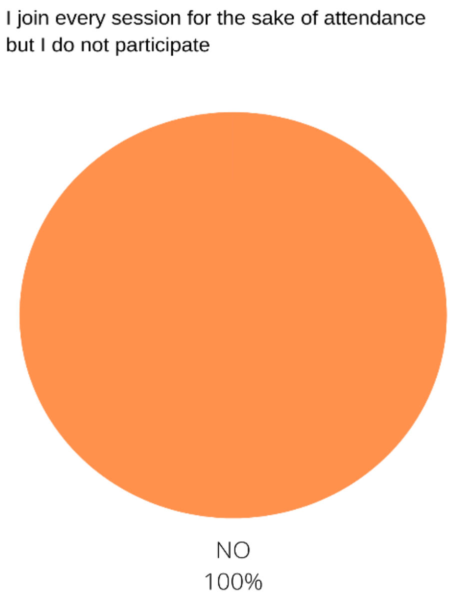


Figure 6 Participation

the interactive and active class motivated them to attend and participate in class activities. The responses from the participants indicate that the integration of technological tools and platforms do ensure that the learners are engaged in the virtual classroom. The availability of learning materials in the learning management system-Brighten prior to class session supports Generation Z's preference to intrapersonal learning. The e-content that are made readily available make the learners to be motivated to be prepared prior to class. Moreover, the individual nature of these learners allows for this cohort of learners to be accustomed to learning independently thus they typically prefer to engage in learning in an individual setting because they can focus, set their own pace, and make meaning of their learning before having to share that meaning with others (Seemiller and Grace, 2017; Demir and Sonmez, 2021). Their ability to equip themselves with the knowledge from the pre- class notes and lecture video help these learners to be better prepared to attend the class session. The learners are mentally ready to learn and participate during class session. Consequently, the active class session motivates learners to participate and contribute actively in their virtual class session. The contribution and participation of the learners in the virtual class session suggest their engagement with the lesson. Indirectly, this results to a better retention of key concept of the lesson. Therefore, the integration of technological tools and platforms in the virtual learning environment make virtual learning attractive, interactive and interesting for the young adult learners.

Research Objective 3: Overcoming learning issues among learners through the integration of technological learning tools in virtual classroom

It is undeniable that a virtual learning environment does cause lots of challenges to young adult learners particularly learners who are at disadvantage. Therefore, this study investigates the obstacles face by learners and determines whether these challenges are solved with the utilisation of technological tools and platforms coupled with the right assistance from the educator. To ensure that this research objective is met, the study conducted a survey and interviewed selected learners. The responses from the survey and the feedback from the interview are gathered and illustrated below:
Survey responses from participants are illustrated in the diagrams below,

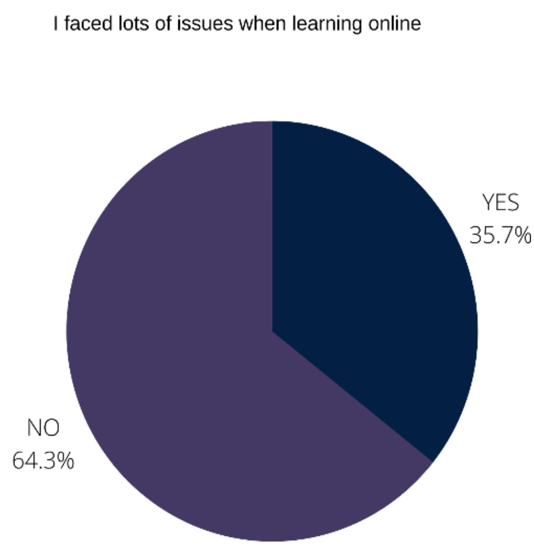


Figure 7 Online Learning Issues

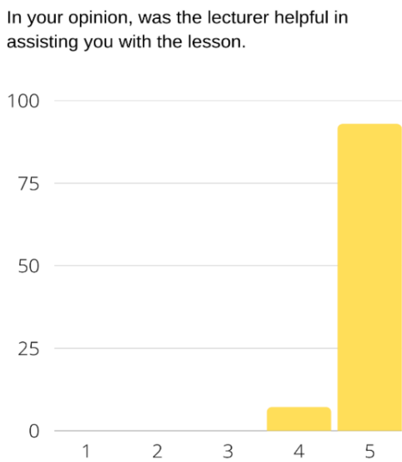


Figure 8 Lecturer assistance-lesson

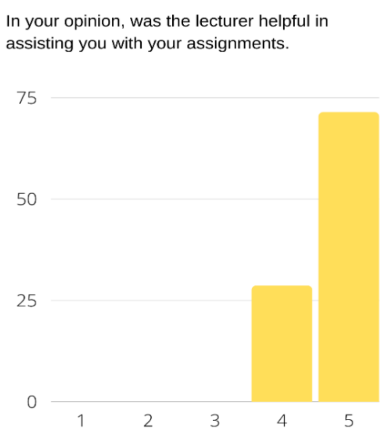


Figure 9 Lecturer assistance - assignment

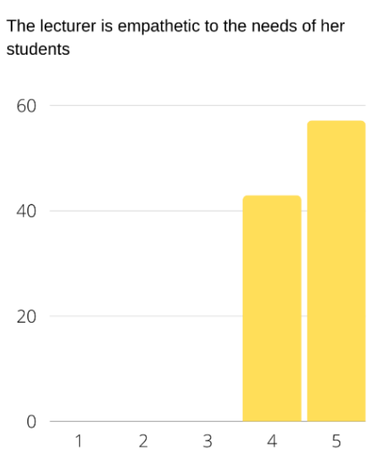


Figure 10 Empathy -Lecturer

The interview feedback from the selected participant is recorded as below:

Interview question: In the survey, you responded yes to the question "I face a lot of issues when learning online" Can you further explain your answer, what are the challenges you face while learning online?

Student A: *My study environment is not comfortable for me to learn. My surrounding is always noise and I have no proper place to study peacefully.*

Student B: *I face Internet connection issue. Moreover, being an international student, I have to wake up really early as classes starts too early for turkmen time. I also face electrical problems.*

Student C: *My internet connection is really bad that it causes me a problem joining the class or participating in the activities.*

Student D*: I cannot say that faced a lot of issues but sometimes I confronted with electricity problems. Moreover, could not participate in Kahoot activities due to VPN issues.*

Through the survey responses, the study identifies that there are 35.7% of students face challenges during virtual learning. Based on the interview, it is recognized that most of these challenges are related to the internet connection issue and non-conducive learning environment which makes it hard for the participants to join and participate in the activities during the virtual class session. However, these issues were recognized by the educator where the educator aided the participant who were challenged in learning virtually. The educator also shows empathy to learners who are facing challenges learning virtually. This is indicated through the survey question which shows that majority of participant agree that the educator provided the needed assistance in their learning particularly in completing their assignments. In addition, the survey also indicated that the educator was empathetic in understanding the challenges faced by these learners during the virtual learning session.

This study comes in agreement with Eyles, Gibbons & Montebruno (2020) who explained that the disadvantaged group of learners are often hindered from learning virtually due to challenges in accessibility to the internet and non-conducive learning environment. Therefore, educator plays a vital role in mitigating the negative consequences of virtual learning by harnessing the human quality of educators. These qualities play a bigger role in overcoming these challenges. Various studies have suggested that caregiving qualities are able to help young adult learners decrease the probability of negative outcome in learning and increase academic resilience in learning (Kuldas et al., 2015; Hashim et al., 2016: Romano et al., 2021). The caregiving nature shown by their educator help learners to increase their motivation to learn and change their self-belief that they are unable to learn effectively through the virtual learning format. Therefore, showing caregiving qualities to these learners by empathizing with them, providing scaffolded assistance, and selecting appropriate and suitable technological tools that can work in low bandwidth connection such as Telegram application can ensure that learning virtually is still possible despite the challenges in virtual learning.

Research objective 4: Learners' perception on the utilization of technological tools in virtual classroom

The current study aims to determine learners' perception on the incorporation of technological tools and platform for the virtual classroom. The study has collected responses from the survey and conducted interview session with selected participant to understand their point of view on the benefits of using these tools and platform to their learning.

The responses from the survey are illustrated in the diagrams below:

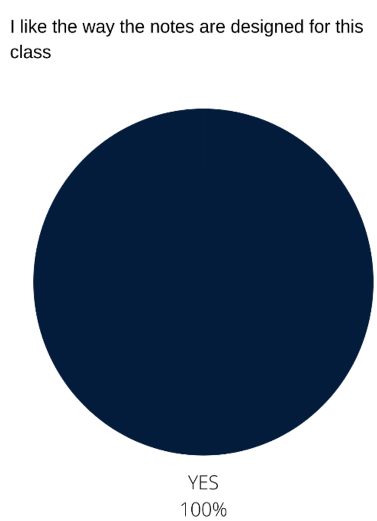


Figure 11 Notes design

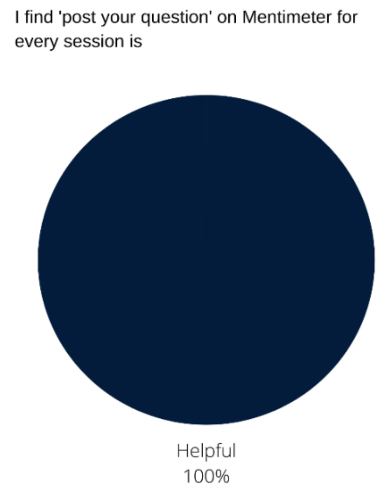


Figure 12 Class engagement- Question Mentimeter

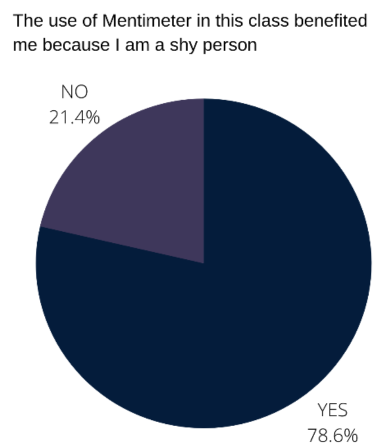
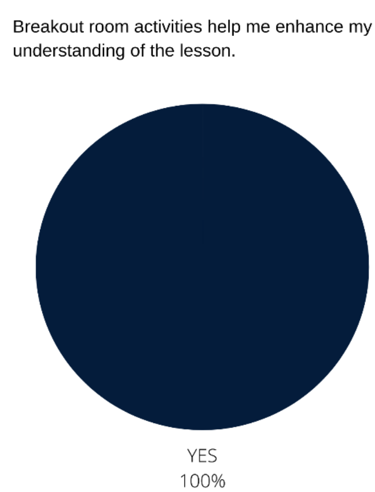


Figure 13 Class engagement- Mentimeter for introverted students



The interview feedback from selected participant are recorded as below:

Interview Question 1: In the survey you responded yes to the question "I like the way the notes for this class are designed" Can you further explain your answer?

Student A: *The notes can easy to understand and it's interesting. It motivates me to want to read the notes*.

Student B: *The notes are design in a very creative, colorful, simple which make it understandable. The attractive design notes make me eager to learn*.

Student C: *The notes design is very colourful and attractive. It is also straight to the point making me easily to understand the concept in one read*.

Student D: *It has the appropriate example of the lesson for me to understand.*

Interview Question 2: In the survey, you responded to the question "I find 'the post your questions' in Mentimeter for every session is helpful" Can you further explain your answer?

Student A: *Because it assisted me to clear my doubts. For instance, in other classes if I got a question I am shy to ask, thinking others already know the answer..but in Mentimeter I was asking everything that interested me since it is anonymous.*

Student B: *It provides shy students with an outlet to post questions and clear they doubts about the lesson.*

Student C: *For an introverted person like me. I tend to mostly keep the questions to myself because I am scared that I will make a fool of myself with my questions, however, this outlet gave me the courage to ask question because I can remain anonymous yet get my doubts about the lesson cleared.*

Student D*: I feel that this way everyone gets to clear their doubt about the lesson because their identity remains unknown. So, everyone can benefit from each other with all the questions asked during class session. It helps us learn better in class.*

The survey suggests that the participant responded positively to the use of technological tools and platforms in their virtual learning environment. The survey indicated that 100% of participants loved the way the notes are designed, the use of Mentimeter to clear their doubt about the lesson and the use of breakout room for discussion. The feedback from the interview suggests that the participants are motivated to read aesthetically pleasing and easy to understand infographic notes because it helps them to understand the concept of the lesson easily. Generation Z learners have a penchant for graphical attractive, simple and straightforward learning materials because they get easily distracted when their learning materials are lengthy and complex due to their reduced attention span (Seemiller and Grace, 2017; Demir and Sonmez, 2021). Therefore, providing these learners with easy to digest learning materials (Philip, 2020) help build learners motivation to learn and develop better comprehension to the lesson concept. Consequently, enabling these learners to be active participants of the learning process.

In addition, educator's ability to cater to different personalities of learners create an inclusive learning environment for the learners. The use of Mentimeter had provided a platform for introverted learners to clear their doubt on the lesson without fear because they remain anonymous. The inclusive learning environment is crucial to promote the feelings of inclusion and belonging to the class (Pener). In this way, it motivates learners to participate and engage in class activities because they feel that their presence in the class are given importance by the educator. The inclusive learning environment ensures that no learners feel that they are being left out during the teaching and learning process thus learning is optimized as all learners benefits from the inclusive nature of their virtual learning environment.

Moreover, the virtual learning environment is deemed to be lonely learning with lack of interaction between learners. The shift into virtual learning may create a feeling of isolation due to the lack of physical presence of their classmates. This situation may lead to a decrease level of motivation to participate in the teaching and learning process. Therefore, it is essential for educators to provide a platform for the learners to communicate, collaborate and network with each other. By providing such an avenue for collaboration and discussion, educators are recognising the transformative power of interaction between learners and their peers thereby fostering the dynamic of interaction between their peers and educators (Swansen, 2018, Holman, 2021). In addition, the collaborative and teamwork activities incorporated in the virtual classroom promotes the development of communication and social skills among their learners. Hence, the use of breakout room function in M. S Teams can provide such opportunity for communication while the use of Google Jamboard can promote collaboration among learners. As a result, the virtual learning environment can create a group learning experience that ensures that learning virtually are made exciting, meaningful through discussion and collaboration.

Conclusion

Educationist scholars have been advocating for a paradigm shift from the traditional method of teaching to the integration of technology in teaching and learning in line with education 4.0. However, the COVID-19 crisis has surely accelerated the changes in the ways of teaching and learning delivery and instructors by forcing educators to embark into technologically integrated instruction and delivery. Thus, educators who are not technologically competent are challenged to ensure optimal learning takes place in their classrooms. These educators are forced to develop relevant and suitable e- content and provide engaging delivery instruction for their learners. In addition, educators are also required to practice empathetic teaching and inclusive teaching so that learners from the low socio-economic group are not left out from the virtual teaching and learning. The various demands of virtual teaching and learning may cause unnecessary strain and stress among educators. Therefore, this study provides guidance in integrating simple and easy technological tools to meet the demands of a virtual learning environment while ensuring that optimal learning is achieved and learners are able to develop academic resilience despite the challenges of learning virtually.

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INTERACTIVE VIRTUAL REALITY: THE HISTORICAL BUILDING WALKTHROUGH DEVELOPMENT PROCESS

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Introduction

In accordance to Visit Malaysia 2020, the ongoing Industrial Revolution 4.0 and advances in artificial intelligence, Virtual Reality (VR) technology could also contribute to the enrichment of the country's tourism industry. Tourist arrival data for Malacca so far in 2018 is 17.02 million tourists compared to the previous year of 16.79 million tourists and 16.28 million tourists received in 2016 (Pavala, 2018).

These statistics indicate a rise in the number of visitors. The goal of the country to meet the mark of 20 million visitors has not yet been met. According to Malacca State Tourism Figures, of the 17.02 million tourists in 2018 and the 16.8 million tourists in 2017, almost 67% are domestic tourists. The data also indicates a decline in the number of foreign visitors. The importance have prompted this study to be implement. The objective of this study are to identify the attraction criteria for travelling to historical places for family tourist and to develop an interactive VR walkthrough application for The Stadthuys historical building in Malacca.

Interactive Virtual Reality Walktrough as A Tourism Platform

Virtual reality (VR) is not a new modern technology, but in the tourism industry, the platform is relatively new and not widely accessible in Malaysia. Some businesses have already made this product their own way as Google Inc. has developed Google Earth VR.

This technology is still relatively new in Malaysia and is not a major draw for Malaysians. The technology of VR is commonly used for video game players. However, it is a technology that can be used to attract tourists by introducing places of interest through the virtual world. Users will look around the destination 360 degrees without leaving the building.

There are many ways to further diversify the use of these VR technologies. There are many ways to further diversify the use of these VR technologies, for example by including an aspect of education. Other than traveling through a simulated world, users can get something out of their tour. It also does a little bit to get consumers interested in the technologies being tested.

Industrial Revolution 4.0 not only impacted business jobs, information technology, and so on, it also affected a variety of industries. Our nation also needs to innovate in the field of industry in the process of advancing the role of the country. The tourism market included. In addition, Malaysia has long been in the tourism industry, especially in the tourism and environmental sectors, but is also a well-known cultural reputation and historical country. The number of visitors arriving in our country will also increase with this.

Malaysia's former Prime Minister, Tun Dr. Mahathir Mohamad, said that the country desperately needs a new revolution for tourism. He added that in his trial, "Malaysia is conscious that the development of tourism technologies will overcome the current industry 's limits and open up opportunities for global growth." (5). Now he stressed that, through digital channels like social media and data analysis, the tourism industry is concentrating on economic sharing.

History Learning through Tourism

Learning has a wide range of forms and styles. It does not matter whether the channel is in print or digital, traditional or new, as long as it has the similar motivation to share information, no matter how it can be used as a means of presentation.

When time goes by, learning strategies in order to open the minds of learners, it is important to expand. The scope of tourism learning is inherently a matter of culture. Historical topics also sound tedious, since every single event they ought to read is in the past. Therefore, learning from and through learning visits is no longer seen as a mere extension or advancement in teaching in the classroom, but as an added benefit to teaching in the classroom and as the best way to prepare students for future learning (Li et al., 2017). Moving to a world full of digitalization, the dull way of learning needs to adapt to something more exciting.

In this region, techniques for digital teaching are also a necessity. Examples include interactive videos, applications, blogs, sports, and so on. Generally, this digital content distribution is provided through 'courseware,' an immersive learning application that includes a range of experiences such as videos, games, tutorials, and resources for reading. Typically, this program is used during classroom teaching and learning sessions. Since it's not so simple and welcoming, not many students use this strategy of studying on their own at home.

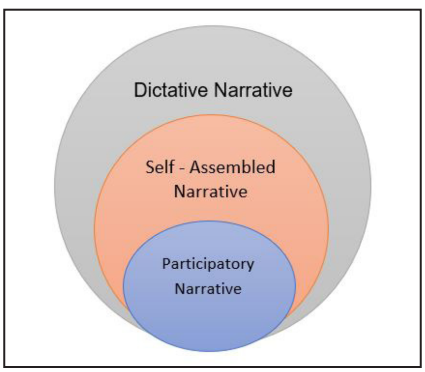

Figure 1 The way brain accept information through three types of narratives in the human mind

Figure 1 shows the way how human brain accept information through three types of narratives. It can provide another element for students or adolescents to learn, particularly in history, with the advent of VR technology like this. In this sense, by using visual elements, history is simpler to remember. This is because any occurrence can be experienced by the person. There are three layers of narrative that a person works with, the first is a dictated narrative, meaning that the plot will be known by most people who say stories.

A self-assembled narrative is the second. He gives the idea that when the information reaches them, a person makes their own story, and if the existing knowledge is arrived, they can reconstruct the story. Whereas the participatory narrative is the last sheet. This layer shows that people were in the story. When the person himself was in the story, they would easily get and remember the story because it happens to themself. That is how the human brain works. "Everything that happens to you is important to you because it happens to you," was an excerpt from his speech. This is a really good immersion phase.

Historical Architecture as Attraction

Architecture has been a kind of a major factor in creating an appealing, sustainable, and successful destination. Architecture and fine buildings have always been at the center of the international stage. An example of the Colosseum in Rome, Italy, where ancient architecture can be seen and that has drawn millions of tourists All over the world to see Italy's finest architecture for himself. When it gives aesthetic appeal, elements of architecture are one of the most valuable items in the tourism industry.

A building's aesthetics apply to the forms in which buildings will engage the minds of visitors. What people will see today is the iconic buildings that make cities instantly identifiable and landmark buildings that capture the celebration of famous events, people, galleries, and museums that illustrate cultural values and provide places of emphasis and inspiration that help bring communities together (Scerri et al., 2019).

Tourist Decision-Making

The decision to go on holiday is in the eyes of the visitor himself. For their travel destination, they will typically choose locations that are popular or trendy. For them and their families to make time, traveling is also a form of investment. Hence, when considering a tourist destination, they need to make the right decision. Figure 2 shows the factors in tourist decision making.

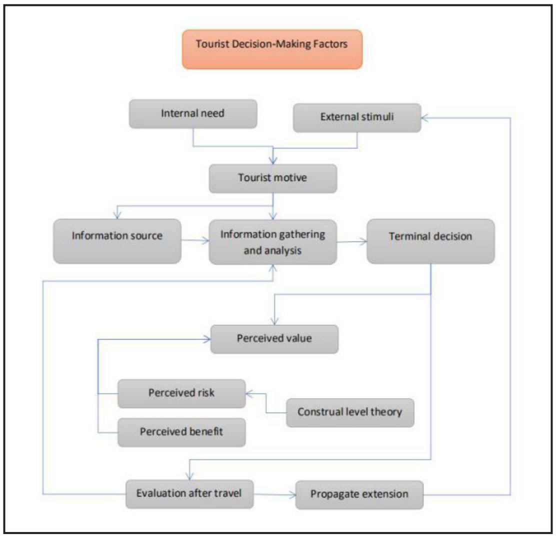

Figure 2 Tourist decision-making factors

The purpose of development

This project aims to develop a new tourism immersive VR walkthrough tour for the Stadthuys Malacca building. The selection of the building was due to historical factors recognized by UNESCO. Apart from that, Melaka did not reach the tourist target for two years. Therefore, this project is a platform to attract tourists and introduce Melaka to foreign tourists.

In this age of high technology, the tourism section also needed to move forward and create a new tourism product with digital features. In this chapter, which is education through tourism, the tourist attraction factors have also been addressed, meaning that learning history about Malacca or any historic place is part of learning.

Therefore, the problem that exist and encourage this study to be implement are, 1) Tourists lost interest in knowing the history of a certain important landmark in this country, and 2) Insufficient time for tourists especially families to travel due to their studies or work.

Methodology

This section will explain the phases of the methodology used to complete the project. The ADDIE method is a cyclical process that develops and continues throughout the process of instructional preparation and implementation (Peterson & Christine, 2003). A few stages of study, design, development, implementation, and evaluation (ADDIE) will be included in the techniques. This technique is called the ADDIE model.

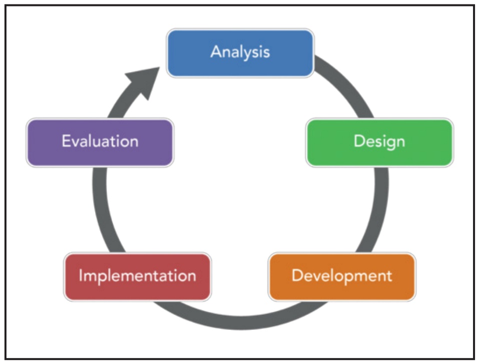

Figure 3 ADDIE Model

This project uses the ADDIE Model as a research methodology. These methods have five phases as shown in Figure 3. All phases are progressing. Started with the first steps of the research process, followed by the design phase, the production phase, the implementation phase, and the assessment phase.

Phases	2020							
	February	March	April	May	July	August	September	October
Analysis	20 days (17/2 - 13/3)							
Identify problems	Three (3) Days							
Goals, objectives and scope	Two (2) Days							
Content (Architecture studies)	Six (6) Days							
Content (Tourism and education)	Six (6) Days							
Case studies and comparison	Two (2) Days							
Platform studies (VR base)	Seven (7) Days							
Design	27 days (13/3 - 28/4)							
Flowchart	Two (2) Days							
Identify and design theme	Two (2) Days							
Outline content	Seven (7) Days							
Assets design/ Modeling	Six (6) Days							
Design interaction	Seven (7) Days							
Storyboarding	Ten (10) Days							
Development	115 days (17/5 - 23/8)							
Create assets (Buttons and panel)	Five (5) Days							
Create assets (3D Modelling)	Fifty-two (52) Days							
Build VR in Unity	Sixty-eight (68) Days							
Functionality (Coding)	Sixty-three (63) Days							
Create interactivity	Fifty-eight (58) Days							
Checking and correcting errors	Fifty-nine (59) Days							
Implementation	17 days (24/8 - 15/9)							
Prepare the application (Format)	Three (3) Days							
Conduct training	Four (4) Days							
Testing	Ten (10) Days							
Evaluation	23 days (15/9 - 18/10)							
Prepare the questionnaire	Seven (7) Days							
Distribute questionnaire	Seven (7) Days							
Collect data (Result)	Ten (10) Days							

Figure 4 Project development timeline

The Figure 4 shows the timeline for this construction project. This project took about eight months to complete. It begins in early February 2020 and is scheduled to complete in October 2020. Every timeline has been structured in accordance with the ADDIE model. Present planning was also given in the Gantt Chart.

Phase 1: Analysis
This is the one with the most critical level. The study enables the developer to perform research, such as the topic itself, on an important aspect of the project. A task

analysis is also necessary to identify the instructional content or the specific skills related to the job or course (Peterson & Christine, 2003).

The researcher is going to define the issue. Successfully found problems would be the researcher's project to find the best solution to the issue. The solution that comes from the developer is to carry out research into the new elements of tourism and education. and develop an Interactive VR Walkthrough Tour.

This step will include the process of investigating the framework that will be used as a tool for this application. Some things are being discussed at this point, comparing similar applications. In addition, define the medium for introducing this application to the audience and its functionality.

Phase 2: Design

This phase is a very critical phase in which It includes a plan that needs to be followed which should be conveniently and neatly carried out. It's to make sure it goes efficiently every step of the way. The advantages of the application often rely on the carefulness of the design process itself. The designers who decide how the aims will be measured and what types of measurement will be used prior to implementation. The objectives and evaluation should therefore be consistent and meaningful (Peterson & Christine, 2003).

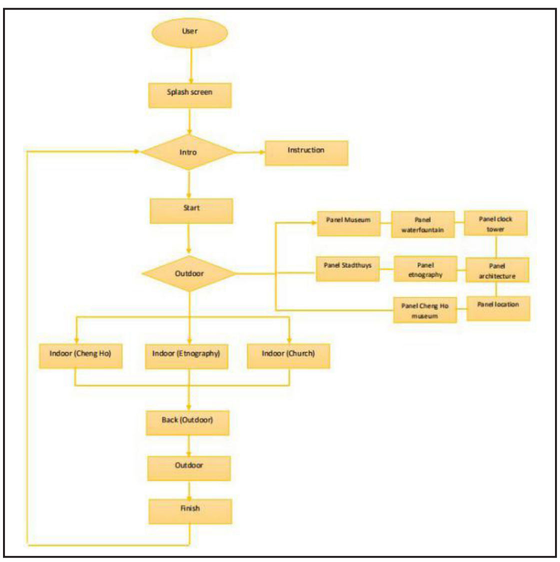

Figure 5 Flowchart for VR application

This step will include many items, the design of the flowchart (as shown in Figure 5), theme, storyboard (as shown in Figure 6), outline material as well as the design of assets for use in Unity Software.

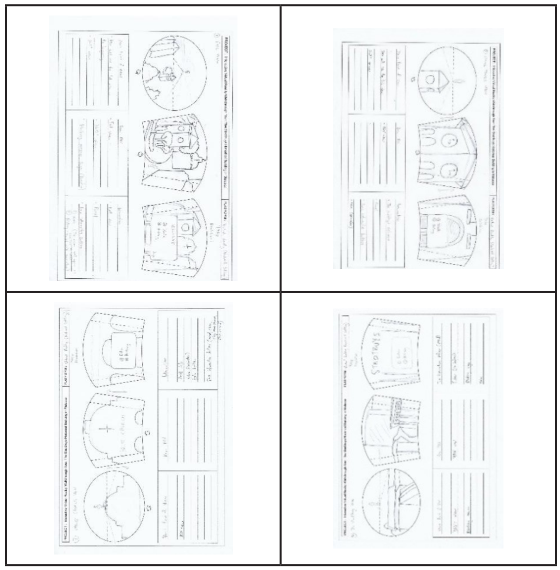

Figure 6 VR application storyboard

Phase 3: Development

In this phase, the developer will use all the experience and skills in the development of this application as planned in the previous phase, from the production of the three-dimensional model of audio and interactivity development. The production stage is the process of manufacturing the instruction materials, all the instruments to be used during instruction and some form of support materials, and the product developed during this stage and evaluation, which is mainly for correction (Arkun, et. al., 2008). The method of developing three-dimensional models using 3DS Max software.

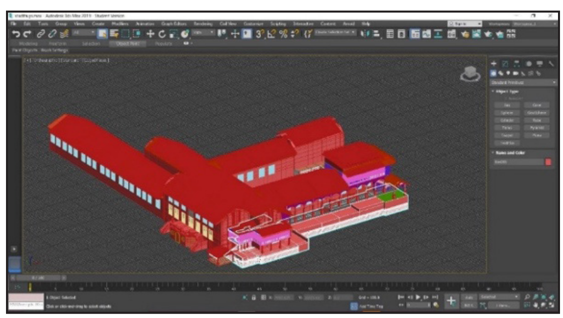

Figure 7 Modeling of the Stadthuys and the buildings opposite it

Figure 7 demonstrates the method for creating 3D models for the Stadthuys house. The same procedure is also carried out for the surrounding buildings. Development of these models using the 3DS Max 2019 software.

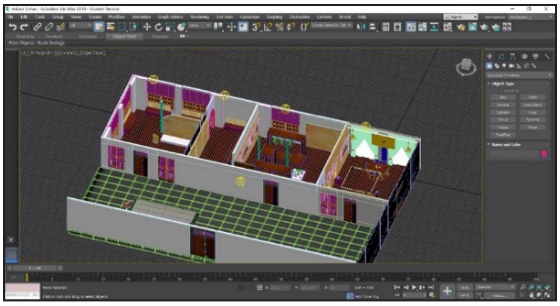

Figure 8 Porcelain Gallery, Weapon Gallery, Office Gallery of the Dutch Governor and Cheng Ho Gallery Modelling

Figure 8 illustrates the modelling process in a museum where there are three galleries on the first page and one gallery on the next page. The output of all of these models is not in the same register. But the museum's frame and interior are constructed on a single file, and the artifacts in each museum are created on a separate file.

The Info Panel is the most important aspect of this relational VR application because it is a way of conveying knowledge to users. It was first designed using Adobe Photoshop CC before it was created through Unity software.

Figure 9 Creating an Information Panel

As shown in Figure 9, which shows the design process of the info panel. This panel includes text and a few graphical elements to draw users ' attention so as not to get bored reading the details on this panel.

This step is where the storyboard is turned into a prototype. Walkthrough functions, page interaction, and interactive presentation of knowledge are performed at this level. All modules and assets that have been designed will be compiled into the Unity software to incorporate VR and interactivity.

The creation of 'Homepage' for this app, as shown in Figure 10. There is a splash screen at the opening of the submission, which is Visit Malaysia Truly Asia Logo. On the main screen, the prototype consists of the 'Start' button, the 'Instruction' button, the 'Guide' button, and the 'Galleries' button, which redirects the user to the page to select the museums they would like to visit.

Figure 10 Development of 'Homepage'

The 'Instruction' button is a brief description of the guidance on how to use this program. The 'Start' button is to redirect the user to the VR walkthrough, which takes the user to the virtual The Stadthuys exterior. The 'Guide' button is a clear description of the location of the VR program.

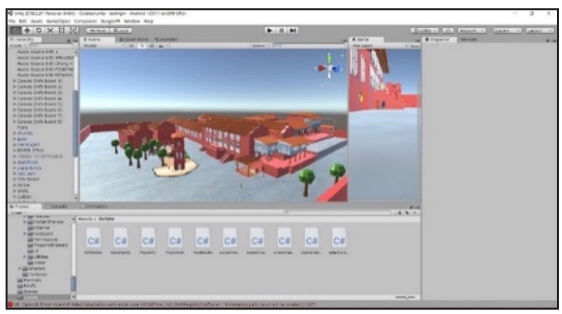

Figure 11 'Main page' production

Based on Figure 11, the main part of the walk is the outdoor or outdoor portion of the Stadthuys building. In this segment, the user needs to 'walk' using the given controller and only to turn left and right to see the surrounding conditions. Users are often given instructions to prevent confusion. The yellow and blinking directions will signify directions to a specific spot. There are also some info boards on each building and significant monuments in this section. There are several buttons on the ingo board, including 'Read Info,' which provides an info panel so that users can read information about the location.

Developers are expected to use the C# programming language in Microsoft Visual Studio to establish interactivity or functionality in Unity applications. When designing applications that use this program, it has been difficult for researchers to understand the language. Researchers have also referred to online forums to find answers to any problems in the development process.

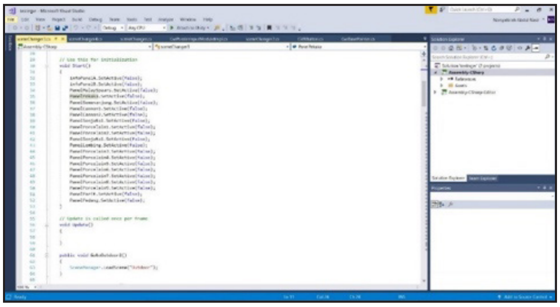

Figure 12 Microsoft Visual Studio's C# Script

Figure 12 demonstrates the C# coding used to create features in any interactivity in this VR application using Microsoft visual studio software. From this segment, many items can be omitted. To ensure the layout and flow of the project and app development runs smoothly and orderly, the planning and design process is very critical. The developer carries out the process of design and development in this section. In the design process, in the program, interface, and buttons, the developer compiles the path. The developer conducts the modelling process in the development process and then consolidates all models and uses Unity software and one language, which is C # programming, to run the VR function itself.

Phase 4: Implementation

This stage is about the strategy being turned into reality. The developer must take three major steps to go through this level, which are training the instructor, preparing the learners, and organising the learning environment (Aldoobie, 2015). In this section, the entire project results will be presented to the audience, but before it is completely published, it must be followed by a training phase and provide them with some training and guidance for the audience.

Phase 5: Evaluation

The aim of this process is to receive the answers from users who are using this application. The goal is to prepare changes and identify what can be applied to this application for a technological direction. This will be resolved by rating the audience itself through a questionnaire that will be distributed via this application to the audience.

Table 1 VR application evaluation result

No.	Question	Strongly disagree	Disagreed	Neither agree nor disagree	Agree	Strongly agree
1	This virtual reality application is user friendly				**24 (63%)**	14 (37%)
2	The content and information in this application are well presented			2 (5%)	**24 (63%)**	12 (32%)
3	The instructions provided in the application are easy to understand				**28 (74%)**	10 (26%)
4	Easy to see the environment in the virtual reality application			2 (5%)	**26 (68%)**	10 (26%)
5	The colours and 3D objects quality are pleased you			12 (32%)	**16 (42%)**	10 (26%)
6	The audio for information delivery is clear				**32 (84%)**	6 (16%)
7	The background sound is not disturbing			**16 (42%)**	**16 (42%)**	6 (16%)
8	Easy to move in this virtual reality application (using the controller)			6 (16%)	**24 (63%)**	8 (21%)
9	Interactivity Virtual Reality Walkthrough can help to attract more tourist to come to Malacca.			2 (5%)	**26 (68%)**	10 (26%)
10	Interactive Virtual Reality Walkthrough Tour could help you to decide your holiday destination			4 (11%)	**26 (68%)**	8 (21%)
11	Interactive Virtual Reality Walkthrough Tour could help you to get the information about the historical building The Stadthuys			2 (5%)	**26 (68%)**	10 (26%)
12	Virtual Reality Walkthrough Tour allows you to see the architecture of the historical building, The Stadthuys			6 (16%)	**24(63 %)**	8 (21%)
13	virtual reality apps helps you to travel without going to the actual places.			4 (11%)	**20 (53%)**	14 (37%)
14	virtual reality able to increase the amount of tourist in Malacca			4 (11%)	**28 (74%)**	6 (16%)
	TOTAL HIGHEST	**0**	**0**	**1 (7%)**	**14 (100%)**	**0**

Based on Table 1, the result shows that the respondent agree for all questions from number 1 until 14. Meanwhile, the answer neither agree nor disagree only for question 7. Total from the analysis shows 100% of respondent agree with VR walkthrough application is effective for tourism. From the result that has been conducted in evaluation phase, it means that,

1. The interface created in this app can be well received by users.
2. VR app is easy for users to understand.
3. This indicates that there is a need for some improvements in 3D modelling in this Interactive Virtual Reality Walkthrough Tour app.
4. the audio selection on this application is clear for user to listen.
5. These responses indicate that this Interactive Virtual Reality Walkthrough Tour app can help convey information about this historic building.
6. The design of 3D models on these virtual reality applications helps them to see the structure of the building clearly

Conclusion

There are studies on tourist attractions in Malacca in which a unique types of tourist attractions in the state of Malacca in the section, namely education through tourism as well as architecture as an attraction and the role of travel agencies in attracting tourists to the historic city.

What is convincing at this juncture is that there is a way for humans through experience to better understand history. When they are in that place, they can feel how things are for themselves. The narrative, the self-assembled narrative, and the participatory narrative are dictated by three sections of the human mind. These three different ways of thought have specific aspects of knowledge acceptance.

The decision-making variables impact the willingness of a tourist to select their destination. In addition, participation in tourism in the Industrial Revolution 4.0 is also discussed. There are many governmental calls in this region to improve the tourism sector of the country, including the digitalization of tourism.

The Historical House of Stadthuys in Malacca has been addressed in this study. It will include the use of devices for VR technology applications. The targeting of the audience for this product was addressed to draw visitors more quickly. This product also produced for use by travel agencies. Also, family tourists searching for their family vacation spot are those who will use this product.

Several guidelines have been found by analysts for quality enhancement. The researchers also asked for opinions from users who used this VR application through questions in the questionnaire report, apart from the assessment of users through the questions in the survey. Researcher often get input from lecturers who see examples of this VR application. This opinion is sought with a view to further developing the product in order to better attain the objective.

To boost this application, the recommendation is to incorporate some other types of media, such as video, to attract users. This is because when they just read the text, users can quickly get bored. If any new media such as video descriptions of the location or the museum are introduced, users would be more easily typed and amused and glad to receive data. This can stop them from getting bored while receiving data.

In addition, fix and pick all colour choices to make it look more authentic, and also make high poly count artifacts. As suggested by users, in this VR, more natural colours are used on 3-dimensional objects. That for each of these 3-dimensional artifacts, the improvement requires a high-polygon count. In order to handle high graphics, researchers need better system support to incorporate these upgrades, such as computers that have better specifications.

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THE IMPACT OF OPEN DISTANCE LEARNING (ODL) ON GERMAN A-LEVEL PREPARATORY PROGRAM IN GERMAN-MALAYSIAN INSTITUTE

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Abstract

The evolution of education has never been a linear change. The dynamic transition from conventional learning to blended learning would take at least half of a century. The world seems moving rapidly due to the innovation in education technologies where students are more active in the class and the term student-centred learning is suited to the 21st-century learners. When the pandemic Covid-19 started, the adaptation from face-to-face learning to online learning has happened rapidly. It is because 21st-century learners are exposed to educational technologies such as electronic media, apps, software and mobile gadget since they were young. Though the style of learning during the pandemic accelerated, yet the GMI students have proved that online learning is more prevalent than before and just as effective as face-to-face learning. To be specific, A-Level students in GMI experienced both online and face-to-face learning from July 2019 until November 2020. The results were gathered from Cambridge Assessment International Education and show that 96% of the students graduated with excellent achievements.

Introduction

The impact of COVID-19 on education around the globe has transformed the teaching and learning style tremendously. Educators and the learners are mainly, enforced to adapt to the new style of teaching and learning that they never thought of previously. When Malaysia Government announced Movement Control Order (MCO) for two weeks on the 16th of March 2020, from the 18th of March until the 1st of April 2020, no one knows that the MCO will be extended for months. Due to the extension, 109 students of the German A-Level Preparatory Program were on their Semester 2 preparing to take Cambridge Assessment International Education (CAIE) AS Levels Exam scheduled on May until June 2020. These GAPP students were the first batch to undergo an Open Distance Learning (ODL) since 1992, where the A-Level program was introduced. A unique data from German A-Level Preparatory Program (GAPP) students batch 2019, acquiring an ODL and face-to-face learning show that 104 students are eligible to fly to Germany after they sit CAIE AS and A Level Exam in October and November 2020. By the percentage, more than 95% of the students have achieved an excellent result in CAIE A-Level and are eligible to fly. The percentage of students eligible to fly who have undergone ODL and face-to-face learning methods is even higher compared to the 2017 and 2018 CAIE AS and A-Level results. We found that the students had no significant association with the decline in students' performance in the pandemic period.

Literature Review

Previously, online learning is one of the learning methods can be used in the classroom. Called it flipped classroom, blended learning or hybrid learning, there is an 'online' element used in those methods. When pandemics started, most higher institutions transform traditional learning into fully online learning. Some of the universities have studied the impact of online learning that has been executed immediately. One of the higher institutions in Spain conducted a study on emergency remote teaching. It was done by the School of Telecommunication Engineering in Madrid, Spain (Santiago et al., 2020). The case study shows an increase in students' academic performance in online delivery mode. The shift to distance learning created a strategic model called Discover, Learn, Practice, Collaborate and Assess (DLPCA) in Chemistry courses at the University of Santo Thomas, Manila, Philipines (Lorico DS. Lapitan Jr. et al., 2021). This strategic model came out with a manageable and effective alternative that can be executed in online learning. The transformation of learning style because of COVID-19 has accelerated distance learning by about five years if we are not changed our education model completely. Additional online learning tools might help with practical subjects. The successes and challenges of teaching chemistry online in China were highlighted by Huang (2020). His team has conducted a survey on 56 teachers and 432 students in two universities in China after online teaching for chemistry experiments has been proposed. As chemistry experiments pose the biggest challenge to online instruction, they moved from the lab to computer-based and worked in a virtual chemistry lab. The students and teachers were satisfied with the supporting software as online platforms grow rapidly in China. There are more virtual tools emerging for education such as augmented reality (AR) and virtual reality (VR). Nur Idawati et al., 2021 from UiTM did research on AR for Electrical Engineering Faculty's students. The development of AR for microprocessor courses have received a great response and it has the potential to increase engagement between students and educators.

Methodology

Organizational structure and overview of the program

This study focuses on the transformation implemented in the foundation programme known as the German A-Level Preparatory Programme (GAPP) in GMI, Bangi. GMI is a technical higher institution that offers a diploma in Engineering Technology besides GAPP. This section presents an overview of GAPP that has been conducted in GMI. Furthermore, the timeline of events highlights the decisions made by the Deputy Managing Director of GMI during the pandemic. It also provides further insight on the readiness of the Technical Training Officer (TTO) and GMI students in implementing emergency online learning after the movement control order is announced.

GAPP was established at the GMI in 2001 to prepare the qualified SPM leavers and their equivalent to further their study in the fields of engineering at the University of Applied Sciences which requires A-Levels, TesfDAF and Vorpraktikum qualifications for enrolment. The students will undertake a 22-month preparatory programme at GMI, and also a 6-month intensive German Language training at various language centres in Germany before they are accepted for enrolment at the University of Applied Sciences (UAS). Subjects that they are taken include physics, chemistry, mathematics and the German language. The students require to sit for two exams from CAIE which are Advance Subsidiary (AS) Level in May/June and A-Level in October/November. The total semesters that they are taking before A-Level are 3 semesters and it is about 16 months. The majority of the students are taking engineering courses in Germany, hence the three science subjects are essential to sit in GMI before pursuing a graduate degree in Germany.

During the online learning, digital supporting tools for education are provided by the Information Communication Technology (ICT) section of GMI which offers a Learning Management System such as GMI Virtuelle Lernumgebung (GMI VLU); Moodle interface – which was already used before the COVID-19 pandemic. Other relevant online platforms available for all students and TTO include GoogleMeet, Google Classroom, Zoom, Webex and other free online platforms. The TTOs were given the privilege to choose the most convenient platform for their online learning. Nevertheless, practical online tools are essential and might help students and TTO in delivering successfully according to the program learning outcome. Many higher institutions nowadays are considering augmented reality (AR) and virtual reality (VR) for education.

Timeline of events

To get the whole picture of the implementation of emergency online learning during the pandemic, it is necessary to explain the timeline of the GAPP 2019 batch shown in figure 1. In the second semester, programmes started in the early week of January. By that time, no reported cases of COVID-19 in Malaysia (Ain Umaira Md Shah et al., 2020). When the COVID-19 pandemic arrived in Malaysia on January 25, 2020, after less than 48 hours of the first case reported in Singapore, most schools, colleges and institutions have yet to have any action plan to conduct an emergency online learning. The transition from face-to-face to emergency online learning started when the Malaysian government announced Movement Control Order on March 18, 2020. Ministry of Higher Education (MOHE) suspended all face-to-face education activities immediately due to the announcement made by the federal government. On March 20, 2020, online teaching and learning is immediately begun 100%. A survey was carried out to observe the readiness of online learning for students and TTOs, after a month of implementing online learning. October and November 2020, the GAPP students are sitting for their external exam set by CAIE and the results were released in January 2021. In this analysis, the GAPP batch 2017 and 2018 students' results where 100% experienced face-to-face learning, are compared with the GAPP 2019 students. The analysis is shown in the result and discussion below.

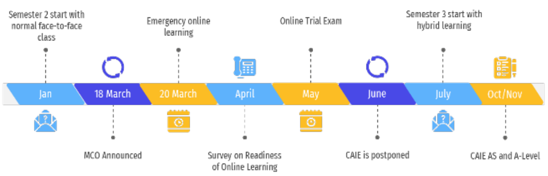

Figure 8 Timeline of GAPP students batch 2019 in semester 2 and semester 3

Results and Discussion

In this section, the analysis of the students' results for batch 2017, 2018 and 2019 are discussed. The analysis was done right after the results were released in January 2021. Three main subjects are analysed based on their grade. The excellent percentage shown in Figure 2 below is based on the students who got 80% and above for the respective subject. Out of 109 students of GAPP 2019, 56%, 68% and 61% scored A for chemistry, physics and mathematics respectively.

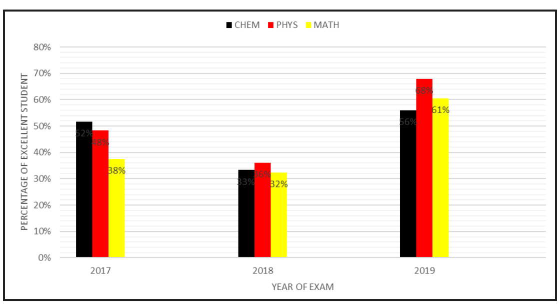

Figure 9 Percentage of excellent students for three consecutive years

The conventional learning method that was experienced by GAPP batch 2017 and 2018, indicates that the percentage of students who achieved grade A is lower than students who are experiencing face-to-face and online learning. When online learning is embedded together in the teaching method, the analysis reveals less significant differences across the three batches.

According to eligibility to further study in a language centre in Germany, the cut-off point is set for sponsored students and self-sponsored students. Out of 109 GAPP students of the 2019's batch, 96% of the total students are eligible to fly to Germany. Whereas GAPP 2017 and GAPP 2018 batch, there were 77% and 72% respectively met the cut-off point.

On the other note, practical for sciences subject were inadequate to cater lab skills on the students. Teaching and learning can be conducted online, but practical skills are also important in ensuring students understand theoretical concepts.

Conclusion

Our findings make us assured that hybrid learning could be implemented for a future student in GMI. With 10 months of face-to-face and 6 months of online learning, GAPP batch 2019 students prove that percentage of excellent students is higher than GAPP batch 2018 and 2017. The percentage of students who were able to further their studies in Germany was higher than in the previous year. Nevertheless, hybrid learning needs a strategic learning model before executing. Not all courses are suitable for hybrid learning. The learners' satisfaction is a key factor in evaluating hybrid learning (Xiao et al., 2020). A hybrid learning space was developed for the finance course student at Shanghai Open University and from the feedback, it shows that to have an experience satisfying learning, students need not have certain competencies but cognitive engagement competence, which is correlated with learners' cognitive ability to figure out the right mix of learning options. However, a strategic model for hybrid learning should be imposed and training on teaching tools could also be done in making sure that online teaching is delivered efficiently. Furthermore, the platform listed in the massive open online course (MOOC) might help TTO and students as additional tools in online teaching and learning.

Acknowledgement

We would like to thank the administration of the German A-Level Preparatory Program, German Malaysian Institute, Malaysia, for their analysis and contributions in providing the results from CAIE.

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STUDENTS ACCEPTANCE AND SATISFACTION OF TEACHING AND LEARNING TOOLS IN GOOGLE CLASSROOM DURING COVID-19 PANDEMIC

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Introduction

The ongoing Covid-19 pandemic has made a huge change in the way we work and learn. In Malaysia, since March 2020, the lockdown has forced everyone to work from home and use the available technology to continue performing daily tasks. Due to this situation, governments all over the world have come up with Standard Operating Procedures (SOPs) which include the need to self-quarantine, self-isolation and social distancing (Anderson et al., 2020). This drastic change has also affected the education system. The usual physical face-to-face classes had to be conducted virtually via a Learning Management System (LMS) platform. LMS is an online platform that provides a place for instructors to upload classroom materials, activities and assignments easily at one location and to be shared with students. Many popular LMS platforms are available such as Google Classroom, Moodle, Blackboard Learn, Brightspace, etc. With the ongoing Covid-19 pandemic in Malaysia, many institutions have fully turned to using online-based learning platforms such as Google Classroom (GC). GC has many advantages such as providing a user account to access the learning contents securely without any geographical and time limitation as well as providing cloud storage for its users to store their materials online which saves their computer storage space and creates a paperless learning environment (Sudarsana et al. 2019).

This paper describes the students' acceptance and satisfaction of using the Google collaboration tools specifically Google Forms, Meet and Docs to support their online learning through GC. Educators use Google Forms to assess the students either as a pre-test at the beginning of a lesson or as a post-test at the end of the lesson. It is useful as it can be autocorrected by Google Forms itself thus giving immediate feedback to both educators and students (Nguyen et al., 2018). Google Meet allows educators to create virtual meeting sessions with students. Virtual meetings provide many advantages which make learning more efficient, practical and most important of all, safe (Pratama et al., 2020). Studies have shown that using Google Meet increases students' motivation to learn (Putra, 2021). Due to the user-friendly interface, it creates a positive perception and results in an increased number of users (Purwanto & Tannady, 2020). Educators often use Google Docs as a method to share information, submit homework and assignments and provide feedback (Oxnewad, 2012). It is also being used by students when group work is assigned to them (Zhou, Simpson, & Domizi, 2012). Limited studies are engaging Malaysian students with regards to Google Classroom as Learning Management System (Kassim, 2021).

Objectives of this study,

1. To determine students' acceptance towards the implementation of teaching and learning tools in Google Classroom.

2. To explore students' satisfaction in using Google Classroom incorporating teaching and learning tools.

Literature Review

In order to deliver knowledge efficiently, instructors might integrate some online tools in their teaching and learning activities and one of the famous tools is Google Classroom. To examine the students' acceptance of the learning tools, most of the studies were carried out using Technology Acceptance Model (TAM). Shaharanee et al. (2016) explored the perceived usefulness, communications and interaction, and effectiveness of using Google Classroom among the students. Overall, the study showed positive responses and satisfaction with it. Recently, there were few studies on students' acceptance in using specific tools in Google Classroom. Based on the study done by Al-Maroof et al. (2021), the findings revealed that Google Meet could enhance the perceived usability and students intended to accept this technology as it is convenient, useful and easy to use. Rahman (2020) and Purwanto & Tannady (2020) explored perceived ease of use and intention to use Google Meet in teaching calculus subjects. The result showed positive acceptance as Google Meet has a simple yet user-friendly interface. Few studies also have been carried out on the acceptance of specific tools such as Google Docs and Google Form and the students showed good responses (Khalil, 2018 & Madrona et al., 2021). However, Solihah & Guritno (2017) found that some factors might affect the perception of using the tools such as internet connection, time and test format when the instructors conducted online tests through Google Form.

Incorporating teaching and learning tools in Google Classroom (GC) has been adopted significantly in a virtual classroom during the pandemic. It is important to explore the satisfaction level of students in adopting GC and its applications as a learning management system. The level of satisfaction of an individual could be determined when the needs of the individual could be fulfilled (Dewi et al., 2021). Research on the application of GC and Moodle among university students in Indonesia found that the respondents showed a significant level of satisfaction towards the use of both GC and Moodle as learning management systems (Wiradharma, 2020). A recent study by a group of researchers which examined the usability and satisfaction of higher education students in Indonesia concluded that the respondents showed a high level of satisfaction towards the implementation of GC as their e-learning platform. It was further explained that the students asserted the attractiveness of GC such as easy to use, easy to learn and interesting features of GC made the respondents satisfied with its use as an e-learning platform (Alim et al., 2021). Most of the previous research focused on the satisfaction of GC in general. With regards to the incorporation of teaching and learning tools in GC, prior study in determining students' level of motivation in utilizing Google Applications such as Google Drive, Google Forms, Google Sheets and Google Slides revealed that students were satisfied with the usage of Google Applications even though satisfaction was the least significant motivational element (Amiruddin, et al., 2020).

Methodology

This study used a survey research design to determine students' acceptance and satisfaction of teaching and learning tools in Google Classroom during Covid-19 pandemic period. There are three Google apps that have been included in this study, which are Google Docs, Google Form and Google Meet respectively. The survey consisted of five sections. Section 1 is about demographic details. The distribution of items under each section (2-5) is as shown in Table 1.

Table 1 Distribution of questionnaire items

Component	Number of Items	Sample Item
Perceived Ease of Use	12	I am able to submit my course assessments easily using Google Forms.
Perceived Usefulness	9	Google Docs allows me to have real-time collaboration with others.
Satisfaction	3	I am satisfied with my overall experience with Google teaching and learning tools.
Intention to Use	3	I would continue to use Google teaching and learning tools for other non-academic discussions or any other activities.

Our research's sample involved a total of 89 students who enrolled on their studies at various faculties in Multimedia University Malaysia. A convenient sampling technique was applied. In our study, means scores were used to compare which of the choices were chosen by students, data were analysed to obtain descriptive statistics.

Results and Discussion

Table 2 showed the demographic profile of the respondents in this study.

Table 2 Demographic information

Item	Values	Percentage
Age	Less than 20 years old	46.10%
	20 – 24	52.80%
	25 – 30	1.10%
	31 – 40	0.00%
	Above 40 years old	0.00%
Gender	Male	49.40%
	Female	50.60%
Faculty	FIST	50.60%
	FOB	49.40%
Devices used for online class	Laptop/ Desktop	49.40%
	Laptop/Desktop/ Smartphone/Tablet	7.90%
	Laptop/Desktop/Tablet	1.10%
	Laptop/Desktop/ Smartphone	41.60%

Overall students' acceptance and satisfaction of using the teaching and learning tools in Google Classroom during Covid-19 pandemic is the focus of this research. There are a total of 27 items concerning the opinions and perceptions which were grouped under 4 main components:

Perceived ease of use, perceived usefulness, intention to use and satisfaction towards Google's teaching and learning tools. The findings obtained from the analysis are given in Table 3. The result showed that the component "perceived ease of use" had the highest mean score (4.11) and the component "intention to use" had the lowest mean score (3.94). Overall, all components obtained a moderately high degree of agreement (Agree) as in the range of 3.40 – 4.19.

Table 3 Mean and standard deviation of each component

Component	Mean	Standard Deviation	Degree of Agreement
Perceived Ease of Use	4.11	0.85	Agree
Perceived usefulness	3.97	0.87	Agree
Satisfaction	3.96	0.90	Agree
Intention to use	3.94	0.93	Agree

The findings of this study revealed that students showed a high level of acceptance with the implementation of teaching and learning tools in Google Classroom during virtual learning. Most of the students agreed on the convenience and the usefulness brought by Google Classroom tools such as Google Meet, Google Docs and Google Forms. According to Rahman (2020), the students preferred Google Meet over other video conference platforms due to its simple interface. Another study shows that the use of Google Docs as an online collaborative tool is also highly accepted where the students mentioned they are able to edit and share in the same workspace together with the feedback feature (Khalil, 2018).

This study also revealed that the majority of the students showed a significant level of satisfaction in using GC incorporating teaching and learning tools such as Google Forms, Google Meet and Google Docs. It was supported by Shaharanee, et al. (2016) that Malaysian university students were satisfied with the features and tools of Google Classroom for data mining courses. Another study which explored the motivation level of Google Applications' usage also found that part-time students showed a significant level of satisfaction with the usage of Google Applications such as Google Forms in teaching and learning activities (Amiruddin et al., 2020).

Conclusion

The Covid-19 global pandemic has indirectly opened new avenues on how information technology is being used to deliver teaching and learning materials. This study has shown that online classes, discussions and assessment submissions can be efficiently managed and conducted with the help of available digital platforms such as Google Classroom. This study has revealed that Google Classroom and its accompanying tools have been proven effective and beneficial in the current education situation. It may pave the way to create a change in the future education paradigm which gives another avenue where teaching and learning can be conducted and not only applied when there is a state of emergency or disaster.

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AN EVALUATION OF TECHNOLOGY-ENHANCED EDUCATION VIA IR 4.0: USING AUGMENTED VIRTUAL REALITY IN TECHNICAL COURSES

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Introduction

Prior to the Covid-19 pandemic, Universiti Kuala Lumpur (UniKL) has developed the UniKL IR 4.0 Education Framework which aims to produce holistic and balanced graduates who meet the demands of the industry, in line with the Malaysia Education Blueprint 2015-2025 (Higher Education). This is by incorporating the 9 IR 4.0 Technology Pillars into the curriculum and implementing 21st century teaching and learning (T&L) that is learner-centred (UniKL IR 4.0 Education Framework, 2018). Augmented reality (AR) is one of the 9 IR 4.0 technology pillars, and a study has suggested that using AR and virtual reality (VR) as one of the T&L delivery is as effective as face-to-face, especially because learners are able to repeat the task/experience and explore things that are not possible in real-life situations (Sapkaroski, Mundy & Dimmock, 2020; Kukulska-Hulme et al, 2021). The use of AR and VR can also engage learners by making the experience exciting and memorable (Kukulska-Hulme et al, 2021).

The Covid-19 pandemic then forced educational institutions to find alternative ways to deliver T&L to ensure that learners are still provided with a positive and meaningful learning experience (Wyres & Taylor, 2020; Halili et al., 2021). Face-to-face T&L were no longer applicable and online learning quickly became a requirement and the choice of platform for all educational institutions globally (Zhu & Liu, 2020; UNESCO, 2020). One of the challenges of online learning for higher learning institutions such as UniKL that focuses on technical training is that the majority of the hands-on and practical part of the courses were not able to be conducted as before. Hence, a pilot study was conducted to see the effectiveness of incorporating augmented virtual reality (AVR) into technical courses via the EON-XR application to replace practical or hands-on sessions, as well as its feasibility to be used even during post-Covid-19 pandemic.

Method of the EON-XR Pilot Study

The EON-XR pilot study was conducted in four phases; preparation, execution, checkpoint, and wrapping-up. In the first phase, preparation, four UniKL institutes nominated their programmes to participate in the pilot study. The lecturers were given several trainings on how to use the EON-XR application, as well as applied pedagogy training to assist the lecturers in creating their AVR lessons via the app. Towards the end of the pilot study, four courses from four programmes managed to complete the pilot study and conducted AVR lessons via the app. This is a total of 8 lecturers and 114 students.

The second phase was the execution, whereby the lecturers conducted lessons using the app and support were provided remotely by the EON-XR team. The checkpoint phase was to check whether the lecturers encountered any issues and how to trouble-shoot them. The final phase, wrapping-up, is done by conducting a survey for both lecturers and students who participated in the pilot study and a final meeting to discuss on their experience. The purpose of the survey was to get feedback on their experience using the app in terms of suitability, familiarity, features, and other technical or non-technical matters.

EON-XR Pilot Study: Results and Discussion

There were 114 students and 8 lecturers who participated in this pilot study and two different surveys were carried out for the academic staff and students respectively via Microsoft Forms. The overall participation of the survey was 75% (lecturers) and 39% (students). The purpose of the surveys was to get feedback on their experience using the app in their T&L in terms of suitability, familiarity, features, and other technical/non-technical issues. For lecturers, the survey consisted of 21 questions divided between five categories; General information, Device & Internet Access Information, EON-XR Functionality & Features, 3D Modelling, and EON-XR Implementation. As for students, the survey consisted of 18 questions divided between four categories; General information, Device & Internet Access Information, EON-XR Functionality & Features, and EON-XR Implementation.

One of the criteria that must be assessed on the participants is their familiarity with such platform while conducting online T&L. It is important to gauge their adaptability rate with using AVR as part of T&L delivery. As shown in Figure 1, it was found that the participants were not familiar with AVR prior to this pilot study. As such, it presented a good opportunity to test their acceptance to this new T&L approach during this pilot study.

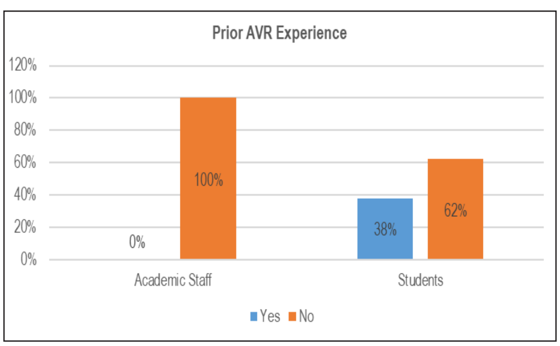

Figure 1 AVR Experience

Table 1 and Table 2 are related to the EON-XR Functionality and Features; the rating made by the lecturers and students respectively.

Table 1 Functionality and features (Students)

Functionality & Features	Rating Scale				Total
	1	2	3	4	
Visually well-designed	0	4	26	15	45
User-friendly	1	8	23	13	45
Seamless navigation	1	9	27	8	45
Satisfactory loading time	6	14	19	6	45
Meet lesson objectives	2	7	28	8	45
Feedback provided is helpful	1	7	28	9	45
Enhances understanding	2	5	28	10	45

Table 2 Functionality and features (Lecturers)

Functionality & Features	Rating scale				Total
	1	2	3	4	
Visually well-designed	0	0	4	2	6
User-friendly	0	2	4	0	6
Seamless navigation	0	2	3	1	6
Satisfactory Loading time	0	4	2	0	6
Meet lesson objectives	2	1	2	1	6

From Table 1 and Table 2, it can be inferred that most lecturers are quite critical with minimal accord agreement on EON-XR functionality and features and the students find that they are quite comfortable with EON-XR.

The lectures voiced out several issues when confronted with challenges while using the EON-XR platform. Table 3 lists down these issues. However, the most dominant one revolves on the insufficient assets provided to them when preparing the lessons using EON-XR.

Table 3 Challenges on using EON-XR

No	Challenges	No. of Lecturers
1.	Unstable/unavailability of internet	1
2.	Insufficient assets	6
3.	Lack of knowledge	2
4.	Not suitable for my course	1
5.	Incompatible technical requirements	3
6.	Others	1

For question on the lecturers' knowledge and experience in 3D modelling, the feedback is shown in Figure 2 It is understandable that many technical courses may involve 3D models in the teaching materials even some lecturers' familiarity with 3D modeling is still low. However, they have indicated interest to gain some level of expertise in 3D modeling.

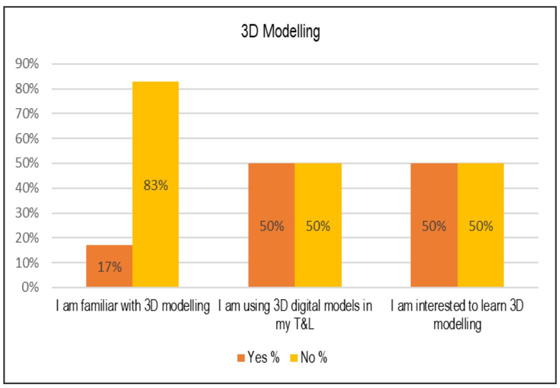

Figure 2 Need for 3D Modelling

Two different questions were asked to indicate the lecturers' opinion on implementing the EON-XR platform across UniKL institutes (Figure 3) and as part of tools in T&L process (Figure 4). Figure 3 shows favorably in agreement for implementation across UniKL institutions and Figure 4 shows somehow indecisive trend whether it can be included as one of their tools in T&L. The main reasons contribute to the indecisiveness are,

1. Only several early topics can be covered in their courses.
2. More appropriate models/assets must be provided coupled with more time and trainings to be familiar with the platform.

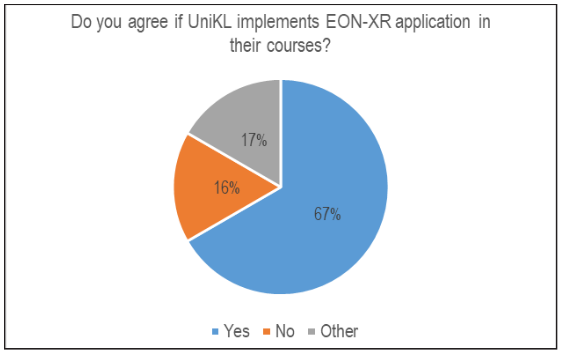

Figure 3 Implement EON-XR in courses (Lecturers)

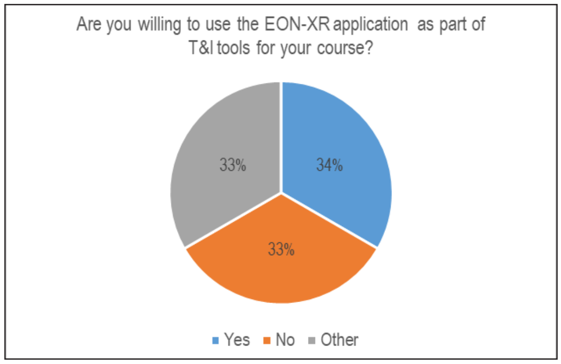

Figure 4 Implement EON-XR as T&L tool

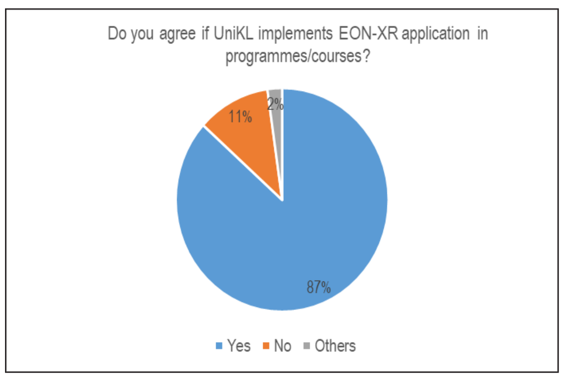

Figure 5 Implement EON-XR in courses (Students)

The students expressed an overwhelming response towards implementing the EON-XR platform. About 87% which is a majority of the students agreed for implementing this application for all students, as shown in Figure 5. It is a quite remarkable testament by the students who were involved in this pilot study. 6 of them did not agree where one reason given is for UniKL to provide all the technical and computing facilities to use the application.

Table 4 Responses from students

Category	Responses
Training/Demo/ Guidance	1. Lesson on how to use it 2. Unikl should do a workshop to all of students on how to use EON-XR very well. 3. briefing carefully and need to use to lecturer first 4. More understand features to use. 5. Make a tutorial on how to use the application wisely. 6. Give 1-2 quizzes weekly to enhance skill of using the application 7. Tutorial 8. Insert more information on how to use the programme and add more knowledge and information for each topic 9. Give a brief knowledge about the application first to student before used 10. more time needed to guide student 11. Do more exercise 12. Giving talk about how to use this application more to the students
Device compatibility	1. EON-XR hard to use because some of student's laptop or phone can't download it... And my suggestion I hope this app will be in lab computer (at campus) already to students using it without problem when want to start the learning in class...
Features & Functions	1. Improve on students to login and download EON-XR, 2. Add more materials, upgrade UI 3. Actually I can't access to sign in that application 4. User friendly 5. make it more smooth 6. make the app looks pleasing to look at 7. no need to have many step to log in and access the apps 8. The navigation of the apps must be made simpler and easier for learners to navigate and access the topic that they are searching for 9. Faster the loading 10. More user friendly 11. More user friendly 12. Ensure all students can sign up into the EON-XR (mostly students who are using ios cannot sign up/log in into this app) 13. Hope the opening is more faster 14. More things that can be explore

cont... **Table 4**

Category	Responses
Internet Connection	1. Make the internet speed up 2. Use more stable internet connection
Teaching content	1. make a lot of interesting academic video 2. More topics/subjects can be added.
Others	1. No idea 2. i think it is great enough 3. no comment 4. No comment 5. It's easy to understand 6. It is okay 7. Nothing 8. Perfect 9. No comment 10. improves the efficiency of skills transfer 11. Nothing. 12. n/a 13. Nothing 14. There is no improvement, actually, it is already the best to every student and lecturer.

Nevertheless, more improvements must be made in order to increase the effectiveness of EON-XR application for more successful implementation of this platform. The students' feedback is recorded in verbatim as listed in Table 4. The suggested improvements have been divided into six categories as detailed in the table. The highest feedback is on the application's features and functions with various concerns being highlighted (31%), and the next highest feedback is on training/demo/guidance on how to use the application (27%).

Conclusion

Based on the EON-XR pilot study, it can be concluded that using AVR as one of the methods in T&L is beneficial especially because learners have the advantage to repeat the task/experience until they master the knowledge and skills required of the lesson. However, to ensure that the use of AVR as the future T&L platform is a success, factors such as the infrastructure and support must be made highly available. It is one of the main concerns voiced out by the participants in this pilot study. The other factors are the much needed training as well as the needs for the app to be much more user-friendly.

To sum up, a comprehensive awareness program with demonstration must be held for lecturers and students alike to ensure that everyone has equal basic knowledge on the platform itself to help the T&L process to go smoothly. On another note, there must also be an AVR expert group that acts as the epicenter on extending knowledge for other academicians and students. The members of this expert group shall be the reference point for any technicalities pertaining to the AVR-based T&L activities. Subsequently, the expertise of this group can be offered for the public to extend this valuable experience on conducting T&L using AVR technology.

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TEACHER'S PERSPECTIVES ON THE CHALLENGES OF TEACHING AND LEARNING SCIENCE SUBJECTS USING INTERNET OF THINGS AS A TEACHING TOOL AID IN MALAYSIA

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Introduction

Internet of Things (IoT) ecosystem consists of interconnected devices equipped with sensors and communication hardware to generate, exchange, consume data from their environments with minimal human interventions (Kurelović et al., 2018). Mobile technologies, virtual reality, augmented reality are the technologies that are commonly adopted in teaching and learning. With the COVID-19 pandemic situation, the use of technologies has been there is approximately 470 million educational mobile application downloads in the first quarter of 2020 (Clement, 2020). Virtual reality and augmented reality applications enhances student's engagement by transforming the way educational content is being delivered. It can be said that different technologies serve different purpose. The use of Internet of Things (IoT) as a tool in teaching, and learning seems to be unclear. IoT, a technology that is in line with IR4.0, is not yet common in education particularly in teaching and learning (Digiteum, 2020). Thus, the objective of this study is to identify the perceived issues and challenges that primary school science teachers are facing in using IoT devices as a teaching tool.

Literature Review

The demand for labor related to knowledge and skills in STEM has increased however, the interest in science related subjects continues to deteriorate. According to Academy of Science, the number of students pursuing education in science stream in secondary school decreased from 44% in 2011 to 21% in 2014. These statistics are alarming since it is far away from Higher Education Planning Committee's set target to achieve Science 60: Art 40 by 2020 (Ramli et al., 2017).

Students feel that STEM discipline subjects are complicated, dull and tedious. Kennedy et al., (2018) reported a study conducted by Pew Research Center which suggested that students do not pursue a STEM-related degree because of the difficulty of the subjects. Student's perception on STEM subjects is theoretical and difficult is a major reason why student lose interest, feel disengaged and demotivated in Malaysia. Other factors include the subjects are not useful in their careers and the subjects are too boring. In addition, the laboratory activities are usually like a recipe book that are highly arranged to teach students to design, execute and analyze data.

Teachers' attitude towards STEM is positive (Chia & Maat, 2018) but there are still barriers and challenges that needs to be addressed. Maruthai (2019) conducted a review on the barriers and challenges of STEM education in Malaysia. The author's findings indicate that the barriers of STEM education in Malaysia are Lack of subject contents knowledge, shortage of STEM teaching skills among teachers, non-option teachers, lack of motivation and guidance and lack of time. The authors have outlined several suggestions. One of the suggestions is to make the subject more contextual and based on everyday life. There is an opportunity for teachers to use technologies such as IoT, augmented reality, drones, and others to make their teaching more interesting but teachers are still lack of ICT skills and the trainings on ICT are still inadequate (Mahmud et al., 2018).

Internet of Things (IoT) refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not ordinarily considered to be computers, allowing these devices to generate, exchange, consume data with minimal human interventions (Kurelović et al., 2018). IoT is just not a standalone technology, but it is a combination of various hardware and software technologies. There are three IoT component that enables seamless connections which are hardware, middle ware, software (Aldowah et al., 2017). IoT in education can be classified into two categories The first category is about providing courses to teach essential knowledge on computer science and the second category is about using IoT as a platform to enhance academic infrastructure of a subject (Gul et al., 2017). Using IoT as the platform to enhance teaching and learning involves the use of sensors to capture data that can be used in teaching and learning. In the classroom, sensors can be used to capture data as parameters. These data can be used as part of a science experiments, tutorials, or assessment. This can only materialize with an IoT platform that capture, store and access collected data.

Virtual reality and augmented reality applications are common teaching aid tool. Furthermore, it is used to enhance the content of a particular topic. This study focuses on IoT as teaching aid tool for science subjects in primary school. The use of IoT as a tool in teaching, and learning seems to be unclear. IoT, a technology that is in line with IR4.0, is not yet common in education particularly in teaching and learning (Digiteum, 2020).

Methodology

A survey was developed to get data on teacher's perceived challenges in using IoT. This study This study adopts a quantitative approach. A survey was distributed to teachers to get feedback on their perception on the benefits and challenges in using IoT as teaching aid tool in class. The survey was distributed through social media platform and chat applications. The data was analyzed using descriptive statistics approach.

Results and Discussion

A total of 18 teachers responded to the survey. Figure 1 shows the teacher's current approach in teaching science in their schools.

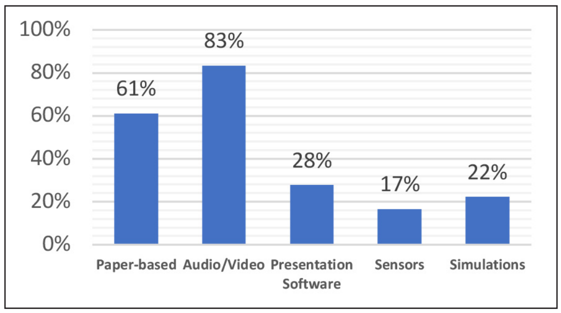

Figure 1 Teaching aid tool used by science teacher

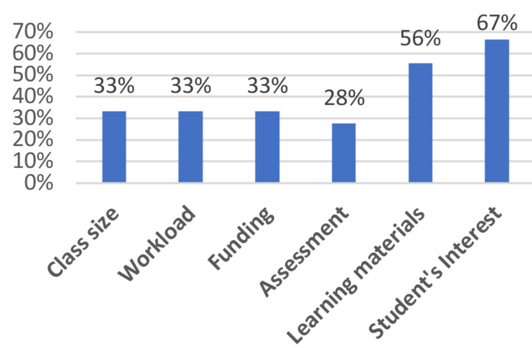

Figure 2 Challenges faced by science teacher

Science teachers used a combinations of teaching aid tool in their teaching. From Figure 1, using audio and video visuals are the most widely used teaching aid tool. Teachers could get tons of references on YouTube and other video sharing sites. Using paper-based materials such as textbooks comes second with 61%. Using computer-based technologies are still lacking with a percentage of below 30%. Figure 2 shows the challenges of the science teachers in teaching. Teachers are allowed to choose more than one option for this question on challenges.

About 67% of the teachers find it difficult to attract student's interest in science. This could be a few factors, but one plausible factor could be related to online learning as teachers find it difficult to demonstrate experiments. Large class size, teacher's workload and funding seems to be not much of a challenge for the teachers as only 33% of the teachers cited these three challenges. In terms of perceived benefits, 89% of the teachers agree on the use of IoT in teaching science in primary schools. About 11% is neutral which indicates several issues of challenges such as training, infrastructure, funding, and others that need to be addressed before it could be IoT can be adopted in the classroom as a teaching aid tool.

Conclusion

This study attempts to understand the teacher's perspective on the use of IoT as a teaching tool for science subjects. While the teachers are willing to explore and adopt IoT, teachers still believe in the use of models, interactive diagrams and videos in their teaching. This makes sense because not all topics in the Science subject would require the use of IoT. For example, the topics on human body or the solar system could best be taught using augmented reality. While it is possible, the use of IoT sensors might not be a suitable tool. Overall, the teachers believed that the use of IoT as a teaching aid tool could help the students to understand science concepts better and improves the students' performance and interest towards science.

Acknowledgement

This research was funded by through International Collaborative Research Fund (015ME0-211) with Universiti Teknologi PETRONAS and Universiti Ahmad Dahalan, Indonesia.

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