

Aligning Creativity in Science Education with the UAE's National Innovation Initiatives

This article investigates the alignment between creativity in science education and the United Arab Emirates' national innovation agenda. It contends that cultivating creative thinking is critical for empowering students to address complex, real-world issues effectively. The piece underscores the central influence of teachers, highlighting the impact of innovative teaching approaches and inquiry-driven learning on fostering creativity. A key question raised is whether the UAE's impressive science achievement levels genuinely translate into innovation, noting a noticeable gap in assessing creativity within classroom environments. The article advocates for embedding creativity more thoroughly within the curriculum, establishing robust frameworks and assessment tools, and enhancing support for pioneering ideas. These measures aim to better equip students with the skills necessary to actively contribute to the nation's innovation landscape.

Othman Abu Khurma

**Pedagogy, Technology and Teacher Education
Division**

Education Frontiers 2024 | Volume 1 | Issue 2



A considerable amount of research indicates that learning progression is significantly aided by inventiveness. In this context, learners with high divergent thinking scores are better at generating authentic ideas and solutions for challenging problems and issues. They can initiate original ways of addressing scientific problems that reflect novel perspectives and lead to discoveries that traditional methods would fail to achieve. Furthermore, according to the literature, creative students frequently tolerate ambiguity and show readiness to take intellectual risks. This tolerance for uncertainty underscores how important it is for teachers to apply flexible teaching practices, allocating substantial time to design and implement activities that involve exploring ambiguity and solving problems, a concept sometimes called "pedagogical creativity," as discussed in many research articles.

Moreover, the literature suggests that various aspects teachers manage in classrooms influence creativity, such as constructive feedback, engagement, and learning climate. This emphasizes the significant role of teachers in promoting and fostering creative learning, as their enthusiasm is associated with students' creative learning, enabling them to solve problems creatively.

The literature confirms, including empirical research, the pivotal role that teachers play in promoting creative learning among students using innovative teaching strategies. Additionally, the importance of teachers' epistemological beliefs, which have been empirically proven to influence students' creativity, cannot be overstated. Their teaching practices, which are also influenced by their beliefs, do not merely serve to inspire students to be creative or identify talented students (a responsibility traditionally attributed to teachers). Instead, compelling and structured teaching practices constitute an organized effort that clearly appears in every step of the teaching process and provide a reliable methodology for fostering creativity.

To elaborate, teaching starts with designing learning activities based on critical thinking, addressing ambiguities, and developing and discovering hypotheses. This effort also continues during instruction through continuous motivation, assigning collaborative tasks, providing feedback, encouraging risk-taking, and allocating time for laboratory work using inquiry-based learning of science. In this approach, students test their hypotheses and design experiments to collect and interpret data, which leads to the generation of new knowledge and ideas that resolve ambiguities and unproven hypotheses.

Science learners need creativity in their educational journeys to develop the fundamental understanding required to address real-life challenges. Therefore, every learner should use creativity to generate authentic solutions. In fact, daily life situations that present challenges and problems urge individuals to think creatively or sometimes to creatively customize a traditional solution to solve their unique challenges. What makes creative thinking important is the ability to utilize this skill in various contexts. While research literature identifies creativity as a capability for solving problems, it also involves innovative behaviors, where students focus on identifying issues, engaging in unconventional thinking, some research calls it divergent thinking, and seeking solutions. Consequently, creative thinking is required to create innovative solutions to a wide range of everyday problems.

Additionally, research indicates that creativity plays a complementary role in several contexts where the scientific method is applied. Instead of only collecting data and acquiring knowledge, students who employ creativity when learning science can apply it effectively and generate new validated assumptions or emerging ideas, allowing scientific knowledge to serve as the foundation for creating authentic solutions. Thus, one of the main goals of learning science is to develop the creative thinking abilities they will need at every level of their education and in daily life.

Educational research, including empirical and meta-analysis studies, has focused on understanding the association between students' capacity and potential for creativity and their science achievement. The multifaceted character of creativity has always been highlighted by theoretical frameworks like the Torrance Model of Creativity, which encompasses fluency, adaptability, originality, and elaboration. According to this framework, these cognitive processes are crucial for facilitating deep comprehension and problem-solving abilities in science education and invention.

Furthermore, many factors have been identified as influencing both creativity potential and science achievement among students. These include individual characteristics (e.g., intrinsic motivation, openness to experience, willingness to take risks), instructional strategies (e.g., inquiry-based learning, problem-based learning), and environmental factors (e.g., classroom climate, teacher support). However, empirical studies involving various interventions have provided mixed findings regarding the relationship between creativity potential and science achievement. Some research suggests a positive correlation, indicating that students with higher creativity scores tend to perform better in science subjects.

Understanding this complex interplay between creativity potential, which refers to the capacity students may exhibit, and science achievement has profound implications for teaching and pedagogical practice. This ability translates to approaching scientific questions from fresh perspectives, a critical component in the inquiry process, potentially leading to the creation or validation of new knowledge. Therefore, the key to revealing the potential for creativity is closely linked to inquiry-based teaching practices, as many empirical and theoretical research studies recommend. Through inquiry-based learning activities, educators can enhance student engagement and lead to a deeper understanding of scientific concepts.

Moreover, much research suggests a significant and evident link between creativity and science achievement. Given this, factors such as the educational stage, the type and nature of the achievement test, and GPA may impact this relationship. Some mediators and moderators, such as motivation, may act as crucial factors influencing these variables. This raises important questions: Do we have any studies in the UAE that have examined the ability of science achievement to predict creativity? Have we conducted any research on students' creative achievement in science classrooms in the UAE? If not, how can we assume that high science achievers will be or are innovative? (Perhaps they are or could be, but no evidence is available.)

If this has not been considered, then why is science achievement the ultimate goal for most stakeholders (students, parents, teachers, etc.)? The United Arab Emirates' National Innovation System (NIS) boasts impressive initiatives: the Mohammed Bin Rashid Innovation Fund, Sandoq Al Watan, Khalifa Fund for Small and Medium Businesses, National Space and Nuclear Energy Programs, Reading Initiatives, Competitions and Accelerators, and more. These programs undeniably cultivate a vibrant innovation ecosystem. However, a key question emerges: Are these creativity-based initiatives sufficiently connected to school students' science achievement?

While these programs encourage creative problem-solving and entrepreneurship, a strong foundation in scientific principles is crucial for fostering true scientific creativity across industries. For instance, for an entrepreneur in renewable energy, their ability to develop innovative solutions relies heavily on their understanding of physics and engineering. Therefore, although the UAE prioritizes science as a core subject, ensuring a strong emphasis on scientific knowledge within these innovation initiatives could further empower future generations to translate their creative ideas into impactful scientific

advancements.

This alignment between science education and innovation programs would solidify the UAE's position as a global leader in fostering scientific creativity, driving economic diversification, and sustainable development. Furthermore, we must address questions such as: "To what extent do science educators (including lab technicians) have a clear definition of creativity that is mapped to students' ages, levels, and abilities? And do they have explicit assessments of creativity in science classrooms and labs?"

Therefore, one of the prominent challenges limiting the fostering of creativity in science classrooms may be the lack of explicit teaching of creativity, innovation, and entrepreneurship skills as part of the curriculum. Consequently, these skills are not assessed against clear criteria that could be utilized to enhance creativity nationwide. Additionally, essential steps include developing legal and regulatory frameworks that explicitly address creativity in schools, eliminating language barriers by creating digital Arabic content to develop creativity and innovation skills for both teachers and students, and establishing federal monitoring and evaluation systems of creativity and innovation across the emirates to ensure sustainability.

Finally, there is a need for increased grants to support high-risk, innovative, and creative ideas across different levels of students in the UAE educational system. Future research should focus on developing practical frameworks for integrating creativity into science classrooms, investing in skills and concepts such as curiosity, risk-taking, imagination, and inquiry. This includes designing lesson plans that stimulate curiosity, encourage experimentation, and foster innovative thinking by incorporating hands-on activities, collaborative projects, technology (e.g., artificial intelligence), and real-life problems that national grantors can propose and ask innovators to solve creatively.