"ENGAGING YOUNG MINDS IN TECHNOLOGICAL INNOVATION WITH THE TEACHING OF ROBOTICS TO GRADE 10 STE STUDENTS"

by:
Ryan T. Ambrocio
Teacher I, Luakan National High School

In education, robotics is rapidly emerging as an essential element, particularly in STE (Science, Technology and Engineering) program. Grade 10 STE students studying robotics develop practical problem-solving skills, enhance their critical thinking, and gain direct experience with advanced technologies. This article explores the importance, methods, challenges, and effective strategies for instructing robots at this level.

Students learning robotics refine their creativity, increase their computational thinking, and become career ready for emerging technology-based industries. Eguchi (2017) asserts that the teaching of robotics to students develops their skills at building, crafting, and figuring out problems within systems — all of which is vital in current times where information technology reigns supreme.

Additionally, robotics connects theory to practice. Studies by Alimisis (2015) show that students working with robots perform better in physics and mathematics because they apply abstract ideas in real-life situations.

Effective robotics pedagogy encompasses a variety of essential methodologies aimed at augmenting student comprehension and participation. Project-Based Learning (PBL) promotes collaborative efforts and problem-solving competencies by enabling students to work collectively on pragmatic endeavors such as autonomous vehicles or robotic manipulators. The provision of Hands-On Experience utilizing robotics kits, including but not limited to LEGO Mindstorms, Raspberry Pi, or Arduino, facilitates a

vibrant and experiential educational atmosphere (Papert, 1980). The acquisition of Programming Languages such as Python, Scratch, or C++ equips students with the ability to develop automation capabilities while simultaneously enhancing their logical reasoning and problem-solving proficiencies (Wing, 2006). A Multidisciplinary Approach that effectively amalgamates robotics with disciplines such as physics, mathematics, and the humanities not only expands students' intellectual horizons but also nurtures innovation, critical analysis, and creativity across a multitude of academic fields (Mikropoulos & Bellou, 2013). The inclusion of gamification in robotics competitions such as the Technobot Expo and Robotics Exhibition significantly boosts student motivation engagement and enthusiasm leading to a vibrant and dynamic learning environment (Zawieska and Duffy 2015). The inclusion of these strategies significantly enhances the effectiveness vibrancy and value of robotics education.

Despite the numerous advantages of robotics education there are several significant challenges that teachers need to overcome. Insufficient funding for required equipment and supplies is a major hindrance. Most institutions, especially those with low budgets, often struggle to obtain the robotics kits and technology needed to provide an entirely virtual learning environment. An inadequate teacher is another prominent problem. Special integration of engineering programming and pedagogy knowledge is required in order to instruct robotics. Sadly, not many teachers have the expertise required to teach robotics well which complicates it for most. Schools to acquire or hire teachers who are competent in both the subject matter and designing stimulating learning environments. Additionally, robotics kits and equipment can become outdated or require maintenance which isn't always within budget so schools typically struggle with equipment maintenance and upgrading. Teachers may also not receive sufficient training and professional development to handle the demands of teaching robotics, including having the ability to solve technical issues and having a welcoming classroom for diverse student needs.

Regardless, schools can develop innovative ways to address this challenge. Schools may partner with organizations in the community or request funding from local grants, for example, a university or technology company for access to resources and expertise. There are effective teaching strategies that contribute to robotics teaching and learning. Providing professional learning experiences for teachers builds the required skills for efficient robotics teaching. Schools can also provide easier access to robotics through low-cost kits and open-source platforms to allow students and teachers opportunities for robotics education, for example, Arduino for a class project. Collaborative robotics projects provide peer-to-peer learning opportunities and communicate skills, which is critical. Moreover, allowing students to use their own design, project, and purpose allows creativity and growth in their technological fluency. These strategies support learning in robotics education that is more participative, equitable and successful.

In summary, teaching Grade 10 STE students robots is not merely building a technical skill, but building also the creativity and innovation, and problem-solving skills for successful living in a technology-based world. Teacher best practices, barriers, and effective pedagogy design of learning activities that are interactive will provide students an educational opportunity for 21st Century.

As a Grade 10 STE teacher, it is important to not only facilitate students' explorations into robotics but also inspire creativity, critical thinking, and problem-solving skills. As teachers, we are entrusted with a duty to give students immersive, hands-on learning experiences, use effective and engaging evidence-based teaching strategies, and motivate students to participate in robotics competitions. We foster all these experiences in an environment that encourages collaboration, innovation, and joy. We empower students to consider their learning as the basis for applying their learning in the world and create readiness for the future's challenges and opportunities.

References:

Alimisis, D. (2015). Shaping the future of learning through educational robotics: Integrating robotics in education and education in robotics. Proceedings of the 9th Workshop on Robotics in Education (WRE 2015).

Eguchi, A. (2017). Robotics as an educational tool for transformative learning. Proceedings of the 24th International Conference on Computers in Education (ICCE 2017), 27-31.

Mikropoulos, T. A., & Bellou, I. (2013). Educational robotics as learning tools. Education and Information Technologies, 18(1), 23-37.

Papert, S. (1980). Mindstorms: Children, computers, and powerful ideas. Basic Books. p. 45.

Wing, J. M. (2006). Computational thinking. Communications of the ACM, 49(3), 33-35.

Zawieska, K., & Duffy, B. R. (2015). The role of social robotics in STEM education. Robotics and Autonomous Systems, 75(1), 61-67.