

Educational Robotics: A Review of the Impact on Students' Cognitive Development

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ABSTRACT

Purpose - This study explored the relationship of robotics activity with the development of conceptual understanding skills among secondary school students.

Method - Forty-four sixteen-year-old Form 4 (Year 10) students in a fully government-aided school who have access to functioning LEGO-Mindstorms sets during physics lessons participated in the research. This study analyses how students use thinking skills and science process skills to solve robotics challenges. The Force and Motion Conceptual Evaluation (FMCE) test was utilized to assess students' understanding of the concept of force and motion.

Findings - The descriptive statistics revealed significant gains in mean scores from the pretest to the posttest in the various cluster breakdowns. Cohen's *d* also shows a strong effect size, indicating that the activities are capable of promoting conceptual understanding.

Significance - The flexibility of the teaching instructions was able to provide opportunities for students to explore and learn through investigations, leading to an increase in cognitive skills, thus supporting the expansion of science, technology, engineering and mathematics (STEM) programs and enlarging the pipeline for the future of STEM, particularly in a high-tech world that has become increasingly complicated in the 21st century.

Keywords: Educational robotics, Force and motion, Thinking skills, Process skills, Science, Technology, Engineering and Mathematics (STEM)