Chapter 4
Artificial Intelligence and Educational Robotics in Maker Education

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ABSTRACT

In maker education, students are actively engaged in the educational process through experiential learning and become co-designers and co-creators of their own learning. The chapter examines the role of artificial intelligence and educational robotics in maker education. Based on the results, this combination can increase student technical and soft skills, improve their learning motivation and engagement, and enhance their creativity, higher-order thinking skills, and critical thinking. It supports personalized learning, self-regulated learning, and collaborative learning, increase student interest in and positive attitude toward science, and assist teachers to actively interact with their students and focus on their needs and performance. Through personalized feedback and meaningful hands-on experiences and project-based learning activities, students acquire a deeper understanding of the concepts taught. Integrating educational robotics and artificial intelligence into maker edu-

DOI: 10.4018/979-8-3693-9806-7.ch004

cation can enrich and transform teaching and learning activities and support both students and teachers.

INTRODUCTION

Students' learning needs and requirements have drastically changed with students pursuing to be more actively involved in the educational process (Anastasiadis et al., 2018). Additionally, students seek for more personalized learning experiences (Zhang et al., 2020) and for opportunities to participate in experiential learning and acquire hands-on experiences by applying their knowledge to real-world settings (Kolb, 2014). Recent reports have also highlighted the need to cultivate students' soft skills and digital competences (Pelletier et al., 2021).

As information and communication technology (ICT) rapidly advances and is being more widely used in educational settings, it is important to integrate ICT in teaching and learning activities (Papert, 1984). Additionally, artificial intelligence is increasingly being used to support the educational process due to the benefits it can yield (Chen et al., 2020; Vergara et al., 2024). Robotics also have potential to enrich and support and improve the educational process (Benitti, 2012; Papert, 1993). Simultaneously, project-based learning (Kokotsaki et al., 2016), problem-based learning (Wood, 2003), and collaborative learning (Smith & MacGregor, 1992) are gaining ground. In this context, maker education is being more widely adopted as an effective approach to actively engage students in hands-on learning activities while enabling them to play an active role in shaping their own learning (Dougherty, 2012). Although these technologies and approaches are mostly used in Science, Technology, Engineering and Mathematics (STEM) subjects due to the benefits that can yield, they have already started being implemented in different contexts and subjects. Despite their potential to help successfully meet students' educational needs, little is known regarding how artificial intelligence and educational robotics can affect maker education.

Consequently, the main aim of this chapter is to examine the role of artificial intelligence and educational robotics in the context of maker education and how they can impact teaching and learning. This chapter goes over the maker education approach and how it influences teaching and learning. It explores the use of artificial intelligence in education and examines educational robotics. Furthermore, it discusses how artificial intelligence and educational robotics can be used in the context of maker education to enrich the educational process. Finally, it presents the conclusions that arose and provides suggestions for future research directions.