Chapter 8
Developing Robots, Self-Esteem, and Self-Perception for Elementary Students Through Educational Robotics

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ABSTRACT

In this chapter, the impact of an educational robotics curriculum to enhance students' self-esteem and self-perception was examined. The intervention employed various activities and educational robotics packages based on the educational robotics curriculum developed by Frederick University Robotics Academy. Forty-one students, 6-13 years old, participated in a summer school program of 8 weeks. The study statistically examined the relationship between the robotics and the development of the aforementioned skills. The results revealed the positive impact and great potential of integrating robotics as a cognitive-learning tool to enhance self-esteem and self-perception of students. Specifically, the intervention minimized gender differences in self-esteem and revealed positive inference in both self-esteem and self-perception, with the last one to have also statistical significant differences. Finally, it revealed positive influences in regards to leaning, friendship, happiness, perception and acceptance of themselves, and expression of their beliefs and opinions.

INTRODUCTION

Research has shown that robotics integration in education promotes the development of student higher-order thinking skills such as application, synthesis, evaluation, problem solving, decision making, and scientific investigation (Eteokleous, 2015; Resnick, Berg, & Eisenberg, 2000; Williams, Ma, & Prejean, 2010). Using robots for educational purposes allows the development skills related to STEAM fields, as well as 21st century and transversal skills (i.e. creativity, critical thinking, innovation) (Alimisis, 2013; Eteokleous, Nisiforou, & Christodoulou, 2019; Khanlari, 2013). Additionally, educational robotics allows

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the development of different personal abilities (Chen & Chang, 2008; Miller, Nourbakhsh & Siegwart, 2008). Jung and Won (2018) systematically and thematically reviewed the literature regarding the use of educational robotics kits, suggesting positive outcomes for teaching concepts related to the STEM areas. Along the same lines, Anwar, Bascou, Menekse, and Kardgar (2019), highlighted robotics potential as a learning and teaching tool, its impact on supporting students that do not show interest in STEM areas and its contribution in developing mental relationships to engineering, physics, and mechanistic concepts. On the other hand, Benitti (2012) after systematic review of recently published scientific articles on the use of robotics in schools, suggests that not always educational robotics act as a parameter that promote and enhances learning and cognitive skills. Specifically, there are studies that identified situations were no improvement in learning was achieved. Along the same lines, several, other studies concluded that no significant gains were revealed from robotics interventions (Barker & Ansorge, 2007; Hussain, Lindh, & Shukur, 2006; Lindh & Holgersson, 2007).

Literature mainly focuses on the direct impact of robotics in learning and the development of specific skills. Limited research has been conducted in investigating the relationship of educational robotics and other skills, i.e. personal abilities (Chen & Chang, 2008; Miller, Nourbakhsh & Siegwart, 2008), self-concept beliefs and self-regulatory skills (Agatolio, Pluchino, Orso, Menegatti, & Gamberin, 2018; Eteokleous & Kolani, 2018; Master, Cheryan, Moscatelli, and Meltzoff, 2017; Schunk & Ertmer, 1999). It seems that more research studies are needed to examine the impact of robotics to the development of new skills in students (Jung & Won, 2018), since there are also studies suggesting that self-concept skills are related to learning, motivation and student achievement. (Bandura, 1993; Master, Cheryan, Moscatelli, and Meltzoff, 2017; Schunk & Ertmer, 1999).

The development of skills characterized as "other", "new" or more specifically "self-concept" skills seemed to be essential due to the changes in the global competition and collaboration, the focus on service economy, and the information growth. The workforce needs, job tasks and type of work have changed, and consequently the required skills are constantly differentiating. It is increasingly important that students; as the future citizens of the Information Society are equipped with various cognitive, social, soft, and life skills in order to survive in today's globalized, rapidly changing, highly demanding interconnected world and succeed in their career aspirations. Additionally, the challenge emerges in response to how best to cultivate students' skills. Technology plays a crucial role in assimilation of these skills. Emerging technologies such as robotics provide challenges and opportunities to the learners to develop numerous skills. What is the context and the tools through which these skills can be developed? How technology can contribute to the development of students' self-concept and self-belief skills that are considered important characteristics for the Information Society? The Educational Robotics Curriculum developed by the Robotics Academy aims to embrace all the above under its innovative umbrella.

MAIN FOCUS OF THE CHAPTER

Based on the aforementioned, the current study suggests the investigation and assessment of educational robotics impact on parameters firmly related to learning, such as self-concept beliefs (self-esteem, self-perception, social adequacy) and other (life) skills as well as skills beyond STEM areas (mathematical, engineering and programming). Consequently, the study examined the application of a pioneer educational robotics curriculum and how it affects the development of self-esteem and self-perception skills for elementary school students. Specifically, it investigates the role of integrating robotics as a cognitive-