Chapter 18
Developing Computational Thinking Using Lego Education WeDo at 4th Grade of Primary Education: A Case Study

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ABSTRACT

The research was carried out at the School Santísima Trinidad in the framework of robotics education and social science. The aims of the study were to determine participants' perceptions about the effectiveness of the experience to meet the learning objective, to construct and programme robotics models, and to help pupils to become familiar with computational concepts and practices. Based on these goals, it employed a case study method in which were involved a teacher and 52 students of the fourth grade of primary education. The instruments used to collect data were a questionnaire, a semantic differential, a semi-structured interview, and a monitoring guide. The findings suggested participants' positive perspective towards the project to achieve the objectives and contents of the unit; acquire the skills of critical thinking, creative thinking, problem solving; apply their knowledge to real-world problems; and become familiar with some mechanical movements and with a set of computational concepts.

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INTRODUCTION

The intent of this study is to contribute to the overall knowledge base about best practices in Robotics Education since, as Toh et al. (2016) state, comprehensive and detailed studies of what pupils learn through robotics education and how they actually engage with educational robots are still needed. Specifically, the present research focuses on the use of LEGO Education WeDo materials in Primary Education to analyse participants' perceptions about its effectiveness to meet the learning objective of social science, construct and programme robotics models, and help pupils to become familiar with computational concepts and practices.

In the current society, technology plays a relevant role and has transformed the way we live, communicate, work and train. The different opportunities that technologies afford have determined the way in which curricula are implemented and taught, and they have also provided the tools to carry out the teaching-learning process in an innovative new way (Lamoyi, 2012). As Butler-Kisber (2013) states, there is a movement in many countries to create curricula for STEM subjects (science, technology, engineering and mathematics) that allows learners to be prepared for the challenges of contemporary and future society, and its demands. This implies to train students in what it is called digital language (Hafner et al., 2015) and in all the necessary digital skills to be part of the current digital world and to come across really well in it. They should acquire the ability to put into practice the basics of programming as a way to solve problems, and computational thinking (CT) as working paradigm (Llorens, 2015). As Wings (2006) defines CT is "a fundamental skill for everyone, not just for computer scientists (…). Computational thinking involves solving problems, designing systems, and understanding human behaviour, by drawing on the concepts fundamental to computer science" (p.33). It is not just a synonym of the ability to programme a computer but it requires a thinking that is run in different levels of abstraction, and is independent of technological devices (Valverde et al., 2015). Many researchers have defined CT as a concept that includes abstract thinking, logical thinking, modelling thinking, and constructive thinking (Flores, 2011; Liu & Wang 2010) since it is a problem-solving process in which problems are formulated in a way that allows using computers and other technological tools to solve them through algorithmic thinking. Data are represented through abstractions and are organized and analysed in a logical way. Moreover, the possible solutions are analysed and implemented to know the most effective combination of steps and resources, and to generalize and transfer a specific problem solving process to other problems (ISTE 2011). As many studies highlight, CT cannot only to be applied in computer and information science but in other disciplines. It must be integrated into the basic curriculum (Bundy, 2007; Lee et al., 2011), accessible to everybody, and learnt early and often (Lu & Fletcher, 2009; Perkovic et al., 2010; Qualls & Sherrell, 2010).

BACKGROUND

In the current study, researchers refer to robotics education as the implementation of educational robotic models in the teaching-learning process. The paper describes how to introduce robotics education and computational thinking in primary education through the use of LEGO Education WeDo robotics set, a material designed by LEGO Group in collaboration with Massachusetts Institute of Technology (MIT). This material is a simple-to-use construction set composes of more than 150 elements that favour that pupils can learn the basics of programming. This set offers opportunities to students to construct and