

Accepted Manuscript

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PII: S2212-8689(17)30023-5
DOI: <https://doi.org/10.1016/j.ijcci.2018.06.005>
Reference: IJCCI 108

To appear in: *International Journal of Child-Computer Interaction*

Received date: 2 February 2017
Revised date: 18 August 2017
Accepted date: 30 June 2018



Please cite this article as: C. Chalmers, Robotics and computational thinking in primary school, *International Journal of Child-Computer Interaction* (2018), <https://doi.org/10.1016/j.ijcci.2018.06.005>

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International Journal of Child-Computer Interaction
Special Issue on Computational Thinking and Coding in Childhood

Robotics and computational thinking in primary school

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Abstract

This paper reports on a research study that examined how Australian primary school teachers integrated robotics and coding in their classrooms and the perceived impact this had on students' computational thinking skills. The study involved four primary school teachers, (Years 1-6) from four schools, introducing LEGO® WeDo® 2.0 robotics kits in their classrooms. The data collected from questionnaires, journal entries, and semi-structured interviews were analysed using computational thinking and teaching frameworks. The results demonstrate that exploring with and using the robot kits, and activities, helped the teachers build their confidence and knowledge to introduce young students to computational thinking. The study identified that teacher professional development (PD) needs to focus explicitly on how to teach developmentally appropriate robotics-based STEM activities that further promote computational concepts, practices, and perspectives.

Keywords: Robots, Computational thinking, Coding, WeDo 2.0

1. Introduction

Researchers have identified the benefits of robotics with all levels of education [1,2]. Benefits reported include: developing students' problem solving and computational thinking skills and the hands-on application of programming and Science, Technology, Engineering, and Mathematics (STEM) concepts [3,4,5,6,7]. By building and programming robots teachers can introduce concepts from engineering, technology, and computer programming [8, 9]. The application of STEM concepts with robotics has the potential to improve students' mathematics and science understandings [6, 10,11,12], can help capture their interest, and build aspirations for future STEM studies [13, 14]. However, the potential for building STEM understandings with robotics can be missed by teachers who fail to focus on developmentally appropriate STEM ideas [15]. Teachers also need to expose students to robotics in developmentally appropriate ways [8]. It has been shown that developmentally appropriate robotics activities can engage students as young as four and five years old in learning programming concepts and skills commonly used in computer science [8, 16].

Computational thinking encompasses key computer science skills and practices that can be applied to a variety of problem solving tasks [17]. The need to incorporate computational thinking in classrooms was first discussed by Papert [18], he argued that computers had the potential to help students become active learners; developing procedural thinking through the process of programming. Computational thinking involves solving problems, designing systems, and understanding human behaviour by employing analysis, abstraction, sequencing, negotiation, and consensus building techniques [20, 21]. Wing [19] argued with advances in technology computational thinking skills, traditionally used in computer science, should benefit students in all subjects and need to be introduced from the early years of schooling. The skills are fundamental for all students to understand in order to participate in the technological world in which we live [19].

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