Chapter 6

Apps to Promote Computational Thinking Concepts and Coding Skills in Children of Preschool and Pre–Primary School Age

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ABSTRACT

A decade ago, Computational Thinking (CT) and coding were typically considered part of the secondary education programs, as the focus was on programming and algorithm development. The early childhood classroom was not exactly the area expected to find students-developed coding skills. But as has been the case lately, CT and coding have been characterized as fundamental skills of the 21st century, not only for computer scientists but for all citizens. Yet, through the application of developmentally appropriate technologies, the development of coding skills is increasingly possible, and the result may be the advancement of CT fluency or at least familiarity in young age children. Given the enormous success of smart mobile devices and accompanying mobile apps the rationale for this chapter is to investigate if there are apps that provide the children of preschool and pre-primary school age with opportunities to cultivate their foundational coding and CT skills.

INTRODUCTION

Until recently, Information and Communications Technology (ICT) acceptance and adoption focused primarily on the effectiveness of ICT as an educational tool, to be understood through the development of information literacies. Areas such as Computer Science (CS) or Computational Thinking (CT) were typically isolated into post-secondary education curriculum or below, with a focus on program development (Falkner, 2015). However, CS is quickly redefining what it means to be a literate citizen of the 21st century (Harel, 2016). The need to include CS in every school curriculum has arisen, with the belief

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that young people should have the opportunity to develop their CT and coding skills, to be creators, not just consumers of technology (Falkner, 2015). The CT has been implemented (in school curricula) in several western countries, as well as related concepts like logical thinking, problem-solving, abstraction, etc. (Minchillo, Vellozo, Borin & Borin, 2018).

And there is a reason for that. Researchers worldwide call for the need that CS and CT must become a new imperative for the western societies, societies that call for a bit of innovation, entrepreneurship, teamwork, and creative thinking. In the 19th century, the ‘3 Rs’ - reading, writing, and arithmetic – were declared as the foundational skills of modern Western education. For Generation Z, also called Post Millennials (Moschella & Basso, 2018) the ‘3 Rs’ aren’t going to be nearly enough to succeed in the 21st century economy. Since the last two decades, in the current literature of the ‘5th C’ of 21st-century skills, critical thinking, creativity, collaboration, communication and Computational Thinking have witnessed a growing interest as an essential component of the school curriculum as core skills that must be taught to all students (Grover, 2018). Wing (2006) said that CT is regarded as an essential skill that was ignited by the rise and widespread of computers, just as that the traditional ‘3 Rs’ of reading, writing, and arithmetic serve as the basic skills students need to succeed by the advent of printing (Chen et al., 2017). CT can help get young people to engage with powerful ideas, to unleash their own creativity and express themselves in new and interesting ways, as well as to understand the rapidly changing world around them (Yu & Roque, 2019). It has been pointed out by many scholars that there exists the relationship between understanding and practice of coding and the development of higher order thinking skills including problem-solving, critical-thinking and collaboration competencies (Kaldor, 2017).

To explain what CT is, and what is its relationship to programming (or coding), Grover (2018) defines CT as the thinking skills that are employed in understanding a problem and formulating a solution before coding. CT is not the same as programming, but rather a mix of skills, programmer uses in order to solve different types of problems. Coding is more than simply a technical matter of codes and protocols; Coding is the literacy of the 21st century (Bers, 2018). Coding is an excellent, fun, and useful context for developing CT skills (Pila, 2019). This is especially true in early childhood when opportunities are especially promising to cultivate an interest in computing as well as for the development of social, emotional, physical and cognitive skills (Yu & Roque, 2019). In fact, in many countries across the world, digital game-based learning applications, designed to support the more effective development of coding and CT skills in children aged 4 to 7 years old, have begun to appear.

Since 2012, the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center for Early Learning and Children’s Media at Saint Vincent College—had already recognized the use of technology for high-quality instruction as a gap in the education system affecting teachers across grade levels and published a joint position statement on technology and interactive media as early childhood educational tools. In this statement they increased early childhood educators’ awareness of this gap in their practice as they clearly state that educators who are innovating in the use of digital media in learning that can significantly enrich the learning experience in almost any knowledge area, particularly when their use of technology and media is child-centered, play-oriented, hands-on, relationship-building, and aligned with curriculum goals (NAEYC & the Fred Rogers Center, 2012). Furthermore, Bers (2018) confirms previous research that has shown that children as young as four years old can adequately understand, program their own robot to perform specific objectives while also building their CT and higher-order skills.

Consequently, using programming to teach CT is common in postgraduate and continuing education (Minchillo et al., 2018). New curricula around the globe, points to the need to improve for digital literacy,
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