Chapter 71
Computational Thinking and Multifaceted Skills: A Qualitative Study in Primary Schools

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ABSTRACT

Computational thinking allows us to solve complex problem in a certain way, which has been taught in traditional computer science program in university. With the advanced digital computing technology, new visual programming tools have been developed to allow children at early age to explore the concept and practices of computational thinking, which could develop their multifaceted skills. In this study, it aims to report an exploratory study of two pioneer primary schools in Hong Kong on introducing computational thinking through coding. This study uses qualitative approach with classroom observations, field notes and group interviews (n = 14). We also develop a child-centered interview protocol to find out the perception of children in learning how to code. The results show that children are generally engaging in computational thinking activities and believe that this learning context can develop their multifaceted skills such as problem solving skills and creativity.

INTRODUCTION

In the current software-driven society, with the awareness of the importance of digital literary skills, several initiatives worldwide have revisited the importance of computer programming (or coding) and the impact on integrating computational thinking with coding in K-12 curriculum, particularly in primary

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or elementary schools (Wong et al., 2015; Barr and Stephenson, 2011). Wing (2006) revisited the ideas of computational thinking from Papert (1980), which suggests the unique methods of reformulating complicated problems into one we can solve more effectively through the concepts such as decomposition, abstraction, pattern recognition and algorithms. It explains how computational thinking as a thinking skill becomes an innovative way for solving not only programming but also real world problems. Computational thinking is applicable to helping people to think abstractly and pulling a problem apart into smaller pieces in different context for everyone, not only for computer scientist, which may have a longer-term impact on children's learning (Wing, 2006; Lye and Koh, 2014; Wong et al., 2015).

Since 1998, the Education Bureau (EDB) in Hong Kong has conducted four consultation seminars to seek opinions from stakeholders on how to formulate strategies to take advantage of information technology in education. To respond to global economic demand for computing skills, the EDB has suggested that the curricula of junior and senior secondary schools be expanded to include training that would equip students with programming-related capabilities similar to other countries, e.g. computational thinking, and logical analyzing (EDB, 2015). Recently, a large-scale quantitative questionnaire has been done to survey 42 primary school and secondary school in Hong Kong, which shows the trend in the local schools to promote coding education with positive perception on teaching and learning (Wong et al., 2015). However, the current educational context in Hong Kong as well as other countries requires more in-depth research concerning computational thinking to understand the impact of implementation in school curriculum through the perception of children and their perceived impact on the development of their multifaceted skills such as problem solving skill, creativity and critical thinking.

One of the approaches to understand this situation is to conduct an exploratory study to understand the perception of children in computational thinking and impact on development of multifaceted skills. To the best of our knowledge, however, there are limited studies related to the elementary students' perception. In this study, it aims to:

1. Investigate the impact of computational thinking on children's perception in primary education;
2. Examine the possibility of wide implementation as an education policy under the Hong Kong;
3. Identify the student's perception about their self-development with multifaceted skills, such as creativity and problem solving.

Literature Review

Definition of Computational Thinking

As of today, the definition of computational thinking has been developed from different perspectives, and no universal agreement of how it should be unified into one explanation (Lee, 2011; Barr and Stephenson, 2011; Brennan and Resnick, 2012; Grover and Pea, 2013). The term computational thinking, made popular by Wing (2006) but originated from Papert (1980), can be defined and referred to the International Society of Technology in Education (ISTE) and the Computer Science Teachers Association (CSTA), who collaborated with other experts and teachers to suggest an operational definition of computation thinking for K-12 education as follows:

Computational thinking (CT) is a problem-solving process that includes (but is not limited to) the following characteristics: Formulating problems in a way that enables us to use a computer and other