

Chapter 3

Examining the Current Definitions of Computational Thinking

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ABSTRACT

Computational thinking involves understanding human behavior, designing systems and solving problems by applying the mental tools that reflect the computer science and basic concepts. Development of frameworks of computational thinking helps integrate computational thinking into education and daily life. It is important for students to start using the computational methods and tools as well as algorithmic problem solving in their educations from kindergarten level to university level. Importance of training on programming at early age was explained. In addition, the current situation of programming in education in the world was reviewed. Then curricula and projects in different countries were summarized. It is necessary to start studies at an early age to help individuals acquire these skills.

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INTRODUCTION

Information and communication technologies (ICT) have become an indispensable part of our daily lives, and they constantly change how we interact both in and out of the cyberspace. Adapting to such changes may not always happen automatically, especially at a national level. Nonetheless, in order to become and remain as active contributors to the global community, individuals and nations alike should improve their adaptive skills for the digital era. Otherwise, the social, economic, and developmental gaps are bound to widen. Hence, adapting to technological innovations is an important aspect of the contemporary society, and going beyond adaption by producing such technologies is a key to success in this environment (OECD, 2005). The changes in technology also reshape the workplace. Some professionals even claim that once today's digital children grow up, there will be brand new professions we do not know yet. To better prepare for this fast approaching future, individuals need to develop diverse sets of skills that enable them to function in the society. Among many 21st century skills found in the literature, computational thinking -an advance structure of problem solving- has gained precedence in the recent years.

Despite the growing interest in computational thinking skills, there is not a simple definition of the concept. Rather, the researchers often try to explain computational thinking by elaborating on what it encompasses. For instance, International Society for Technology in Education (ISTE) and Computer Science Teachers Association (CSTA) provided a functional definition of computational thinking that covers (International Society for Technology in Education [ISTE] & The Computer Science Teachers Association [CSTA], 2011);

Formulating problems in a way that enables us to use a computer and other tools to help solve them,

Logically organizing and analyzing data,

Representing data through abstractions such as models and simulations,

Automating solutions through algorithmic thinking (a series of ordered steps),

Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources,

Generalizing and transferring this problem solving process to a wide variety of problems. (p.1)

According to Wing (2006), computational thinking includes understanding human behavior, designing systems and solving problems. Hu (2011) also expresses computational thinking as a kind of problem solving while emphasizing computational tools, automation, data transformation, concretization or abstraction, and modelling. Riley and Hunt (2014) state that computational thinking resembles the way computer scientists think as they approach problems. Moreover, Selby and Woollard (2013) maintain that while there is a general consensus that problem solving is at the core of computational thinking, problem solving, by itself, is not sufficient to define the depth of the concept. Rather, computational thinking is an intense problem solving process that also covers abstraction, pattern recognition, algorithmic thinking, decomposition and reflective thinking. Michaelson (2015) maintains that before utilizing computers in any given problem solving scenario, one should define the problem in detail and think about solution paths in a broader sense. Computational thinking influences how an individual perceives problems. It

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