

Chapter 19

Computational Thinking in Educational Digital Games: An Assessment Tool Proposal

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ABSTRACT

In our age, computational thinking is a required skill for the 21st century that guides individuals' systematic behavior towards resolving the problems they face. Today, it could be argued that one of the tools that could be used with the students to achieve this skill is the educational digital games. Literature review revealed no measurement tools that scrutinize the readiness levels of educational digital games for the students to achieve computational thinking skills. Thus, the present study aimed to develop a checklist to determine the competency of educational digital games in promoting the achievement of computational thinking skills determined by ISTE and CSTA (2011) by the students. It was considered that the developed measurement tool would facilitate the assessment of educational digital games for achievement of computational thinking skills and guide the designers. At the end of the study, recommendations for future research and applications are presented.

INTRODUCTION

Information and communication technologies (ICT) are becoming indispensable tools in every aspect of our lives each passing day. As a result of opportunities presented by these technologies, distances are closing in, unknown are becoming known and inaccessible are being rendered as accessible by all. Thus,

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it is obvious that effective use of ICT facilitate access to information and present great opportunities to save time and labor. Today, several daily tasks could be performed with a few clicks on our computers, thanks to the ICT in a very short period of time. Most of us wake up by the alarm on our smart phones in the morning, plan our duties using an electronic daily schedule, order the products we need using the computer and select the freest route using our navigator during the daily commute. On the other hand, these utilities that sound great in words necessitate the adaptation of individuals to an ongoing change in addition to facilitating their lives. In other words, while the facilities that these ICT provide a more productive management of our lives, alter the qualifications that a modern individual should possess as well. These qualities that today's individuals should achieve are called 21st century life and thinking skills.

Today, 21st century life skills are the skills that individuals should possess to continue their lives in harmony with the society they live in within the context of the change that is experienced in every aspect of life. Among these skills, individual productivity, ethical behavior, accountability, ability to communicate, ability to adapt, leadership, individual responsibility, management of individual skills and social responsibilities could be listed (Partnership for 21st Century Skills, 2006). 21st century life skills are considered guiding qualities to achieve a modern society structure. On the other hand, continuous development and progress of modern society brought the idea that this is only possible through self-improvement of the members of the society. Thus, the focus was concentrated on the qualities that individuals should possess to achieve 21st century learning and thinking skills. In other words, it is considered significant for all individuals in the society to achieve these skills as the 21st century thinking and learning skills were determined by assessment of 21st century life skills based on learning. These thinking and learning skills include skills such as critical thinking and problem solving, active communication, creativity and innovation, collaborative working, contextual learning, information and media literacy skills (Partnership for 21st Century Skills, 2006). 21st century thinking and learning skills are indicative qualities in preventing the individuals to lag behind the times and thus, in sustainability of the learning society. Thus, it is necessary for all individuals to achieve 21st century life skills and 21st century thinking and learning skills at early ages. In this context, it is imperative for mass education processes to be structured accordingly and to be updated based on modern requirements.

In our age, parallel to the change observed in every realm, increasing complexity of social habits and resulting issues cause the transformation of active thinking and decision making processes. In the context of this transformation, a strong learning infrastructure is inevitable. Thus, "computational thinking (CT)" skill was added to new skill set that is being attempted to be integrated in learning-teaching processes frequently and rapidly during the recent years.

Computational Thinking

Although CT draws attention as a novelty concept today, CT specifications date back to the first half of 1900's. Computer scientist Jon von Neumann introduced the CT concept in 1940 and defined it based on algorithmic thinking (Denning, 2009). CT concept evaluated as only algorithmic thinking until the end of 1950's addressed as cognitive processes required to formulate problems. These specifications focused on the idea that computers should not be considered as an auxiliary tool, but a tool that could result in different cognitive mentalities by overtaking supporting roles in scientific processes. Nobel laureate in physics, Ken Wilson came up with the idea that simulation tools and computation could be utilized in scientific processes towards the mid-1970's and explained phase modulations in substances with the computational models he designed (Wilson, 1989). Towards mid 1980's, Wilson proposed

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