Game Changers: Evaluating Post-Secondary Students' Computational Thinking in a Video Game Building Class

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1. Introduction

First introduced by constructionist Seymour Papert [1], the term *Computational Thinking* (CT) was popularized by Jeannette Wing in 2006 as a new literacy encompassing specific critical thinking skills and dispositions used for problem solving in broad disciplines [2]. However, while CT is more readily adopted in science, technology, engineering and mathematics (STEM) education [3], other disciplines have been less inclined to explore the potential of CT for teaching and learning. In part, this resistance is due to the ambiguity of the definition of CT, as researchers have used variable meanings and elements to describe the concept. This research examines pre-service teachers' CT in a video game building class.

2. Literature Review

A popular definition of computational thinking is "thought processes involved in formulating problems and…solutions [that] are represented in a form…that can be effectively carried out by an information processing agent" [4]. Simultaneously, the International Society for Technology in Education (ISTE) [5] and the Computer Science Teachers' Association (CSTA) [6] defines computational thinking as "formulating problems in a way that enables…a computer and other tools to help solve them, automating solutions through…a series of [algorithmic] ordered steps… [and] generalizing…this problem solving process to a wide variety of problems". Other definitions of CT emphasize skills such as logical analyses, decomposition, abstraction, writing algorithms, recognizing patterns, debugging, tinkering, etc. Other significant CT attitudes and dispositions include perseverance, collaboration, or tolerance for ambiguity [7].

In an attempt to make CT more accessible to other disciplines, some researchers have attached extraneous concepts or skills to the definition, proliferating confusion or misconceptions. In education, computing science concepts and CT are generally introduced in piecemeal workshops or teacher conference days, rather than in a systematic, applicable approach that would enable educators to develop critical thinking skills and attitudes through CT [8], [9], [10]. As a result, those outside of computing science are rarely exposed to CT or carry certain preconceptions of what CT encompasses.

3. Methodology

This exploratory study will examine post-secondary students' common preconceptions and ideas about CT. Specifically, n = 30 students enrolled in a University cross-faculty course on Video Games in Education, will participate in the study. This project-based course aims to provide educators and pre-service teachers with the opportunity to gain hands-on, constructionist experience as video game designers and builders, not simply game consumers. In addition, educators are encouraged to critically evaluate video game use and integration in the education system, and to self-assess personal educational technology competencies, preconceptions of CT. Concomitantly, they will develop 21st century skills, such as creativity, collaboration, communication, problem-solving, and critical thinking as learners in the digital age. Students will sign consent forms and complete both a pre-survey and post-survey following guided CT exercises and game design projects using two visual programming tools, Scratch and Kodu. Results drawn from the pre-survey will be used to examine any prevalent themes. The pre-survey will also be employed to explore the correlations between the students' prior computing experiences, video game experiences, and educational background at the start of the course, on the openness and perceived applicability (attitudes) of CT in other disciplines and contexts. Then, following the completion of the final course project, the post-survey will be administered and responses will be compared with the pre-survey to assess any changes in the students' definition of CT.

4. Conclusion

The insights drawn from this study will advance the literature on general preconceptions of computational thinking and educational applications in a variety of disciplines and contexts. Thus, researchers can address the confusion surrounding CT skills and dispositions to make this approach more accessible to other disciplines. The findings will be particularly relevant for university students and will be employed to plan future studies focused on different student populations.

5. Acknowledgements

We would like to express our gratitude to the Faculty of Education (*Support for the Advancement of Scholarship Grant* # G018000473) and to the University of Alberta (*Roger S. Smith Undergraduate Research Award*) for their generous support.

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ISBN: 978-1-908320-76-6