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Facilitating Creative Processes while Learning to Code and Design Virtual Reality Environments

By
Monique Woodward
Drexel University
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Supervising Professor:
Dr. Aroutis Foster

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Monique Woodward
Drexel University

Abstract

People of color are increasingly marginalized in STEM fields, especially in computing. Furthermore, teachers in formal classroom environments face challenges pertaining to explicitly teaching students 21st century skills, such as critical thinking and problem solving. To combat these issues, Easley Space Camp offered students an opportunity to design their own virtual reality environment, during the last hour of each day for three days. The curriculum developed for "STEAM Hour" intentionally facilitated students' creative processes, which are critical thinking and problem solving skills. Findings indicate how students' creative processes and interest in code and design increased. The significance of this case suggests that curriculums that are purposefully designed to facilitate creative processes can improve students' 21st century skills while simultaneously engaging them in STEM areas.

Aim

This study sought to engage students in authentic computing activities while facilitating their creative processes.

Problem

The number of careers involving computing is anticipated to increase and pay higher wages than other fields in STEM (Morales-Chicas et al., 2019). Despite this anticipated growth, people of color continue to be underrepresented in computer science occupations (Çakır et al., 2017; Scott et al., 2016). Compared to their White counterparts, underrepresented minoritized groups are less inclined to major in computer science (Scott et al., 2015). Furthermore, students that attend lower socioeconomic schools have limited access to quality computer science courses (Scott et al., 2015). To further exacerbate this issue, these students have limited access to formal and informal opportunities and resources in which they can develop their computational skills (Pinkard et al., 2017). To address this digital divide, Easley Space Camp was awarded a grant from the Philadelphia Promise Neighborhood. The camp design included three tracks – astro-engineering, astrobiology, and astrophysics – in which the students developed a project specific to their track. In a one-week summer program, students were provided the opportunity to learn how to develop their own virtual reality (VR) environment during a lesson called "STEAM Hour." As such, the following research question will be addressed in this paper: To what extent does learning to develop virtual reality environments in a summer camp facilitate creative processes in middle school students?

Research Study Design

To assess the students' creative processes (critical thinking and problem solving skills), the CASEE (collect, analyze, synthesize, evaluate, and employ) framework was utilized. As individuals formulate multiple solutions to a problem, they collect information related to the

topic of interest. Specifically, analyze, synthesize, and evaluate are mentioned in Beaumont's (2010) explanation of critical thinking. Collect refers to gathering information pertaining to the participants' project. Analyze is the process of generating and assessing ideas, which eventually leads to focusing on the most appropriate and feasible idea. Individuals synthesize ideas when they combine knowledge from "Collect" and "Analyze" to complete a current task. Evaluate refers to providing and receiving feedback from peers and making adjustment based on the given feedback. Lastly, employ is the ability to use "collect, analyze, synthesize, and evaluate" in a useful project and articulate how and what they did. CASEE is a dynamic process, which means individuals can generally implement these elements in any order to accomplish their goal. CASEE provides a way to formally assess students' creative processes as they engage in developing a VR learning environment. The students were explicitly taught these skills, and data points where collected when the students showed instances of any aspect of CASEE.

To address this research question, this project used a case study design for sampling and analysis as described by Stake (1995). Easley Space Camp was implemented as part of a six-week summer camp program for students in the neighboring area. Data collection included student journals, artifacts, interviews, and researcher observation notes. Lastly, an observation protocol was specifically designed to assess students' instances of CASEE.

Zorah and Tianna (pseudonyms) were selected through purposive sampling, and they are sisters that attended the camp along with their brother. These two students were selected based on the final design of the VR environment, the codes they implemented, and on their experience creating the environment. Tianna and Zorah were chosen because of their interest in design and coding their virtual reality environments developed over the course of the week.

Findings

Zorah exhibited creative processes through engaging in the activities underlined in the CASEE framework. While she was tasked to create a VR environment, she demonstrated critical thinking and problem solving skills during STEAM Hour. For example, she sought out models to that fit her environment's aesthetics, and iteratively tested her design. Creative processes were integrated in the lesson plan, through CASEE, as students were tasked to create a VR environment that was set in outer space.

Tianna demonstrated creative processes during STEAM Hour as she iteratively tested her design, sought out feedback from instructors, and transferred old knowledge into creating the environment. Since creative processes were designed in the lesson plan, Tianna was not overwhelmed with the task to demonstrate these skills. She was given the freedom to design her own environment, and when problems, relevant to her environment, emerged, she sought ways to solve them.

Zorah and Tianna both displayed instances of creative processes by way of CASEE as they developed and implemented their VR environments. Despite initially showing a lack of interest, they discovered ways to make their environment personal to themselves. The instructor encouraged students to personalize their environments and to add anything they wanted. The only limited was that it had to be set in space. Tianna's characters were Black and represented her friends. Tianna and Zorah were provided the opportunity to develop an environment without

constraints. They included their friends and used their imaginations to create a world they sought fit.

Implications

This project has implications for educators and researchers as it demonstrates the usefulness of designing curricula that is informed by culturally responsive computing while targeting creative processes. STEAM Hour was designed to engage students in career exploration in computer related fields, such as computer science and design. Although this study was implemented in a summer camp, this can be further extended as an after school program. Such program would provide students with the opportunity to develop their skills and to retain interests in computing. Despite the multitude of programs designed to engage underrepresented students in STEM, there remains a challenge to retain Black students specifically in these fields (Morton & Parsons, 2017). To mitigate this issue, the summer programs should be extended to after school programs because a week-long summer program is not sufficient enough to retain and facilitate students' interests.

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Author Biography

Monique 'Moe' Woodard is a second year PhD student in the School of Education. She earned her bachelors' from Wilkes University, completing a dual major in Integrative Media and Theatre. She earned her Masters in Digital Media, and continues to integrate her digital media background in her research. She also has several years of experience working at summer outdoor and indoor camps, serving as a director. Her research focuses on facilitating creative processes in Black girls as they learn to design and code virtual reality environments.

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