Using Computational Thinking to Learn Creative Writing and Performance Arts: summer experiences of story creation projects

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ABSTRACT

In our modern society, technology has profoundly reshaped various aspects of our lives, influencing the way we work, communicate, and interact. This raises a fundamental question: Is the current K-12 education system adequately preparing students for success in this technology-driven era, where innovation and problem-solving skills are essential? A recent study investigated this inquiry. The goal was to integrate Computational Thinking (CT) into the domains of Creative Writing and Creative Media and measure its impacts. This poster describes the design and refinement of summer camp experiences in which predominantly Hispanic female students participated in hands-on CT-based learning to create their own creative stories and films. Educational outcomes were evident through increased student engagement, enhanced collaboration, and improved problem-solving skills, underscoring the intervention's advantages. Furthermore, the researchers gained transforming insights, recognizing the versatility of CT across domains. Camp participants experienced a shift in perspective, with a greater interest in vocations and domains connected to computing. We share lessons learned from these summer camps in the hopes that they will inform other researchers and practitioners who are interested in designing and deploying similar experiences. In summary, the study outlines a trajectory where students and educators skillfully navigate the complexities of contemporary paradigms.

ACM Reference Format:
Ruth Torres Castillo, Tomas Valdez, Enrico Pontelli, Horacio Gonzalez, Erick Nevarez, and Raena Cota. 2024. Using Computational Thinking to Learn Creative Writing and Performance Arts: summer experiences of story creation projects. In *Proceedings of the 55th ACM Technical Symposium on Computer Science Education V. 2 (SIGCSE 2024), March 20–23, 2024, Portland, OR, USA.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3626253.3635619

SIGCSE 2024, March 20–23, 2024, Portland, OR, USA

ACM ISBN 979-8-4007-0424-6/24/03.
https://doi.org/10.1145/3626253.3635619

1 INTRODUCTION AND BACKGROUND

Computational thinking (CT) promotes a methodical approach to addressing challenges and encourages individuals to formulate solutions in comprehensible terms, suitable for execution by either a computer or another person [11]. In the context of our intricate digital landscape, the principles of CT equip individuals to effectively engage with a wide spectrum of challenges [5, 7]. DEPICT (Discover Computational Thinking through Creative Writing) joins the family of interventions that explore the use of non-computing techniques to expose students to CT [4, 6, 10]. The novelty of DEPICT lies in two aspects. First, DEPICT builds on an area that has not been deeply exploited in the past, i.e., the combination of creative writing (CW) and the production of movies/plays. The appeal of this area comes from its popularity among students, especially women, and Hispanics, and the high level of self-efficacy demonstrated by students in the corresponding courses. The second novelty comes from using this creative domain as a target for the infusion of CT - i.e., we use CT as a methodology to teach the creative domain, contending that relevant concepts of CT are already present in the domain, and they simply need to be extrapolated. This paper presents the conception and execution of two DEPICT summer camps. These initiatives collectively engaged high school students, immersing them in hands-on learning experiences deeply rooted in CT. To accommodate the constraints of page limitations, we use this document to share a summary of findings, we provide additional information and insights on our poster presentation.

2 OVERVIEW OF DEPICT SUMMER CAMPS

During the summers of 2022 and 2023, we hosted two two-week camps where 20 local HS students (14 females, 5 males, and one non-binary) participated in an experience centered around Performance and Creative Writing (PCW), with a project-focused emphasis. Throughout the camps, we delved into the worlds of CS, CT, CW, Creative Media (CM), and animation content, using tools like Merge Cubes[3], Specdrums[8], Rocketbooks, and Finch Robots[9]. We introduced new software such as PhotoPea and Capcut. Other web browser applications that were also introduced were CoSpaces[2], Studio Binder[1], and Teachable Machine from Google. During these summer intensives, students learned how to bring CS, CT, CM, and PCW together, developing skills to create remarkable projects. During the 2023 DEPICT summer camp, a "Mystery" concept was

applied to each exercise which aided in collaboration between CS, CM, and PCW. Students applied combinations of traditional and digital techniques to solve riddles, generate whodunit stories, and create imagery intended to deceive their audience and leave them in suspense. Students enjoyed projects with varied combinations of visual and auditory applications, such as a movie poster with voiceover narration and mystery stories coded and presented using Co-Spaces and Merge Cubes. At the camps' finale, students showcased their projects to their families through a Photopea poster design for their Story-Movie, alongside a video, or a Script from Studio Binder.

2.1 Camps collection of data

Retrospective Surveys: DEPICT employed retrospective online surveys to assess the impact and extent of exposure to CT concepts during the duration of the summer camp. Each set of items was asked twice at the end of the program, with one set of questions focusing on how a participant felt "before the program" and another set emphasizing how they feel "after the program".

Pre and post-performative interviews: On the first and last days of the DEPICT camps, each camper was asked specific questions aloud by staff working at the camp. Each interview was audio recorded. Students were asked to describe awareness of CT terms, define the term, and complete tasks that related to loops, decomposition, and abstraction [4].

Camper's Projects: Each camper worked on individual projects: during week 1, campers were introduced to all the technology and CT concepts and during week 2, they worked to create a final project. We encouraged campers to brainstorm personally and socially relevant projects for their final presentation.

2.2 Camps Outcomes

DEPICT summer camps participants experienced modest, positive gains in belonging/identity in STEM, and future plans with computing/technology across items; their retrospective survey scores saw less change in their perceived value of computing and CT. DEPICT summer camp students experienced modest, positive gains in conceptual understanding of CT according to assessment scores from performative interviews. Youth-focused approaches used in DEPICT supported interest, and engagement in the program. Practice and play were vital for student computing identity development and easing uncertainty that students could participate in computing.

3 LESSONS LEARNED

Benefit from parallelism: The parallels between CT and the creative process are apparent, while the differing perspectives appeal to varied learning styles. Every activity used by DEPICT summer camps provided the opportunity to discover how CT was embedded in the host discipline content.

Use a common theme: Applying a common theme in activities assists in collaboration between different disciplines. Using the "Mystery" team for the summer camp helped students build the relationship between CT and CM content.

Learn by experimenting: Experimentation is beneficial upon the initial introduction of CT concepts to those outside of CS. During the 2023 DEPICT Summer Camp, for example, Algorithmic Thinking was used to introduce concepts of character design when Pattern Recognition proved to be a more appropriate CT concept in hindsight.

Use interdisciplinary experts: Combining the expertise of interdisciplinary areas was beneficial to the development of the curriculum. Each of the participants in the design of activities had something to add to each lesson plan. HS teachers added their content knowledge, CS fellows helped by mentoring the activities, and the implementation team helped overview the general process.

Merge CT with pedagogical approaches: CT concepts can enhance previously applied pedagogical approaches in creative classrooms by providing structure and a scientific, methodological approach. We predict that in-service teachers can apply the strategies used during summer camps to foster their future lessons.

4 CONTRIBUTIONS AND FUTURE WORK

By infusing CT principles into CW and film production, DEPICT manages to bridge disciplines, enhancing problem-solving skills, engagement, and collaboration among participants. The outcomes of this project demonstrate that CT has the potential to transcend its conventional boundaries, proving itself as a powerful tool in navigating modern challenges. DEPICT's innovative approach of merging CT with CW offers a distinctive path to engage underrepresented groups, contributing to broader efforts aimed at bridging gaps in computing education and fostering inclusivity. Building upon the benefits of DEPICT, future work could explore the scalability of this approach across diverse educational settings and disciplines. Further research can delve into refining and expanding the curriculum, encompassing a broader range of creative domains and computational concepts. Long-term studies could track the sustained impact of CT exposure on students' academic trajectories, career choices, and problem-solving abilities.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant #2137581.

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