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How to Teach Computer Science/Computational Thinking: Collaborative Online CS/CT professional Development

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Abstract: This design paper proposes an online computer science/computational thinking (CS/CT) professional development (PD) outline that utilizes collaboration tools and a community channel. Teachers actively participate in conversations and discussions using the collaboration tools that enable us to understand teachers' perceptions of the work ahead and design subsequent workshop sessions. Using community channels, teachers can share ideas and pose questions to the group. We discuss how online PD can affect the development of teachers' understanding of CT/CS.

Introduction

Recent years have shown growing enthusiasm and awareness of the need for K-12 computer science (CS) education opportunities and, in particular, a need to engage students in CS ideas and practices to help understand how computing is changing our world (Blikstein & Moghadam, 2019). Computational thinking (CT) has been suggested as a path to addressing this need, particularly in younger grades, and is recognized as a crucial skill set that every student should learn and develop (Wing, 2006). Despite the progress that has been made in bringing CS/CT education to students across the United States, there is still a great deal of work to be done, particularly in the elementary grades (Code.org et al., 2020). Moreover, there is relatively little research on how to train elementary school teachers to teach computing (Rich et al., 2017). Researchers propose that even though not all innovations are successful, by engaging teachers in fruitful professional development, necessary changes in education can be achieved (Guskey, 1986). Providing support to practicing teachers in integrating CS/CT into their subject areas and curricula is critical for promoting CS for All (Barr & Stephenson, 2011; Yadav et al., 2017). Also, many researchers have suggested ways for teachers to leverage computational thinking in supporting their curricular and pedagogical needs within disciplinary content areas (Barr & Stephenson, 2011; Weintrop et al., 2016; Yadav, Hong & Stephenson, 2016). Therefore, we decided to create a workshop for K-5 teachers to help them understand how CS/CT could be integrated with other subject areas.

Online CS/CT professional development using collaboration tools and community channel

Given current constraints related to COVID-19 precautions, our PD will be conducted virtually. A series of one- to two-hour PD sessions will be scheduled strategically across the school year. This will help to ensure that teachers have an opportunity to apply what they have learned, reflect, and return to the professional development environment to discuss experiences, successes, and challenges, develop plans for future implementation, and continue their computer science learning.

The professional development experience will focus on integrating computer science into one or more disciplines (e.g., math, social studies). The goal is for the workshop to be broad enough to support a variety of implementation preferences, but also contain enough specificity to give participants a solid foundation from which they can implement their computer science integration strategy. Each session consists of collaborative, active learning activities using an interactive platform (e.g., Padlet, Google jamboard, and Nearpod), which gives equal opportunity to all participants in terms of engagement. We will also work to develop a strong community of practice by creating a Slack channel where participants can share ideas and pose questions to the group. Workshop facilitators will monitor the Slack discussion and provide resources and guidance where appropriate. However, the Slack community is intended to be a sustainable strategy to foster ongoing support and collaboration between participants. Lastly, after each session, participants will be asked to complete a survey. The results of the survey will help the workshop facilitators understand participant perceptions of the work ahead and design subsequent workshop sessions in a manner that addresses participant concerns and needs.

Teachers need and desire specific examples of how CS/CT can be included in their lesson planning and instruction. Therefore, experiences are needed that can help K-5 educators understand how CS and CT are relevant to their existing classroom practices and instructional goals. By creating our CS/CT professional development for K-5 teachers, we hope to address the specific needs outlined above. Through this workshop, teachers will be able to:

- Describe CS/CT and its importance in K-5 education
- Understand how CS/CT can be integrated into other content areas/disciplines
- Locate high-quality resources that support K-5 CS/CT instruction
- Identify optimal opportunities for CS/CT integration into the existing curriculum

Conclusion

Most online professional development, especially in the CS/CT subject area, is lecture-based and asynchronous, not enabling interaction with peers and instructors. However, to support elementary teachers in embedding CS/CT education in their existing curriculum, it is important to understand their perception and attitude of CS/CT in the learning process and support (Rich et al., 2019). Collaborative online CS/CT PD will demonstrate a promising design case that can help teachers extend their understanding of CT/CS and enhance teachers' self-efficacy to be more prepared and have more confidence to teach CT/CS through continuous interaction among teacher participants and between teacher participants and the facilitator(s). In the poster session, we will explain of design the online PD session with examples of activities.

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