

Differentiated Instruction in Online Teacher Professional Development

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Abstract: The integration of computer science into K-12 learning environments requires that teachers be prepared to teach computer science. Due to the pandemic, we transitioned an in-person professional development (PD) for upper elementary teachers to an asynchronous online format. Using reflective interviews, we examine the affordances of this approach. We discuss how the online PD provided advantages for differentiation of instruction and teacher reflection.

Keywords: online, professional development, affordances, differentiated instruction

Introduction and background

Increasingly, meaningful participation in society requires knowledge of computer science and computational thinking (CS/CT). To prepare individuals to become educated citizens capable of computational participation (Kafai & Burke, 2014), governments throughout the world have poured unprecedented resources into computing education, professional organizations have developed K-12 standards for computing and technology usage, and educational systems have worked to integrate computing into K-12 curricula. Despite this push, the number of trained CS teachers remains insufficient to meet the new demand. Researchers in the computing education space have been concerned with how to prepare teachers to teach computing. One of the encouraging avenues to provide CS and CT training to teachers is asynchronous online professional development (PD) (Fishman et al., 2013).

Online PDs are able to provide similar learning as in-person workshops and have been supported by the U.S. Department of Education (2010). High-quality teacher PDs focus on strategies for teaching content and incorporate active learning opportunities for teachers to test and evaluate teaching strategies (Darling-Hammond et al., 2017). Online PDs afford unique opportunities to teachers, such as providing for differentiated instruction by allowing teachers to review new content as many times as necessary to grasp the key ideas or skipping over content that is already familiar. We address the following research question: What are the affordances of asynchronous online professional development for teachers engaged in learning introductory computer science at the elementary level?

Methods

The ESTITCH PD prepares grades 3-6 teachers to implement the ESTITCH curriculum in their classrooms. The ESTITCH curriculum leverages the affordances of making with electronic textiles materials and programmable electronic components that can be integrated into fabric and paper. This allows CS/CT to be integrated with social studies, language arts, and science standards. Originally, we designed the ESTITCH PD to be completed in person, but public health concerns related to the COVID-19 pandemic forced us to move our PD to an asynchronous online model. Teachers were provided with access to a Canvas course that walked them through key ideas in each of the integrated disciplines and provided guides for how to make each of the three ESTITCH projects: (1) a programmable paper circuit timeline, (2) an e-textile quilt square based on the patterns of freedom quilts that helped formerly enslaved peoples navigate their passage on the Underground Railroad safely, and (3) a programmable quilt square telling about a meaningful moment in one's life (see Figure 1). We also provided Zoom office hours with project research assistants for troubleshooting and debugging.

Twenty-seven elementary school teachers were recruited from throughout the state of Utah to participate in the online PD, two of whom were master teachers completing the PD for the second time. Of the 27 teachers who started the PD, 23 teachers completed the training. Teaching experience ranged from none to several years. Importantly, some districts in Utah have robust dual-language immersion programs and actively recruit speakers of those languages to come teach at an immersion school for a period of several years. These teachers teach half the day in their native language (e.g. Portuguese, Mandarin, Spanish) while another teacher teaches the other half of the day in English. Our participant population included Portuguese and Mandarin immersion program teachers.

In order to understand teachers' experiences with the ESTITCH asynchronous online PD, we conducted a post-survey that asked about teachers' online PD experiences. We also conducted exit interviews with each of the teachers. We focus on teachers' final reflective interviews about their PD experiences. We examined the interview transcripts using emergent thematic coding (Nowell et al., 2017). We were interested in the affordances of asynchronous online PD for teachers engaged in learning introductory computer science at the elementary level.

Findings

A central finding of our analyses was that teachers liked the built-in differentiation provided by an online asynchronous learning environment. It allowed them to utilize a variety of strategies to master the content and to troubleshoot and debug their own projects, including reviewing the material independently, connecting with other PD participants, and seeking help from the PD providers.

Time to practice and plan

Many of the teachers appreciated the built-in differentiation provided by an online asynchronous learning environment. Unlike in a traditional in-person PD setting, teachers were able to go back and review content until their understanding was sufficient to create a functional project or pause the modules and create a plan for their classroom in that moment. For instance, one teacher observed, “I went to, the lessons that I read through, and then, I would tell myself, maybe I missed something and I need to restart it again. I would follow through the instructions, and it always helped me figure it out in the end (Interview, 07/24/20).” The asynchronous online format allowed teachers to work through the materials at their own pace, to go back and review when their projects did not work, and to create things for their classrooms in real-time. Further, teachers appreciated being able to read other teachers’ discussion posts about things that didn’t work in their projects or experiences the master teachers had in their classrooms during the previous school year.

Creative collaboration

Prior to implementing the online PD, we envisioned the lack of opportunities for teachers to connect with one another as a major disadvantage, but teachers found creative ways to reach out to one another and collaborate. As one teacher said, “So we just kinda did it together like that through texting or Face-timing each other and working through it and troubleshooting and stuff like that” (Interview, 07/24/20). Often, we think online asynchronous PD will not offer the same opportunities to connect with one another and form meaningful PLC’s. While the teachers who worked together on projects typically already knew one another and worked together, the online asynchronous format supported rather than detracted from their ability to work together.

Discussion

When we transitioned from what had previously been a weeklong, face-to-face PD experience to an asynchronous online course, we were concerned that the experience we provided would be less optimal and present teachers with fewer opportunities for developing PLC’s. However, as Fishman and colleagues (2013) argued, the online PD was able to provide a similar, if not better, experience than the face-to-face PD. Teachers’ reflections highlighted aspects of an effective PD as outlined by Darling-Hammond and colleagues (2017). In particular, it is significant that the asynchronous nature of the online PD provided teachers with the opportunity to work at their own pace, review materials, and learn from their mistakes. In addition, while teachers’ abilities to connect with other teachers were more limited, those teachers most likely to form a PLC, such as a grade-level teaching team, leveraged existing connections to help each other with projects. And, when all else failed, teachers were supported by the PD facilitators for Zoom. Because of the asynchronous online nature of the PD, facilitators were able to provide more focused attention to the teachers struggling the most with technical aspects of the projects.

References

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