Chapter 13
The Design, Implementation, and Evaluation of a Graduate Course to Prepare Teachers and School Librarians to Lead K–12 Computational Thinking

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ABSTRACT

The importance of applying computational thinking—the problem-solving approach used in the domain of computer science—to solve significant problems is increasingly recognized in K-12 schools as a fundamental skill all students need to develop. The current study presents the design, implementation, and evaluation of a graduate course 20 teachers and school librarians completed in spring 2019. The purpose of the course was to expand learners' understandings of the value and nature of computational thinking, to explore barriers to access faced by students in underrepresented groups, and to reflect on how to facilitate K-12 students' understandings of computational thinking outside of dedicated computing courses. Using a model for systematic instructional planning and evaluation, this chapter reports qualitative thematic analyses of learners' performances and reflections. The chapter concludes with planned revisions for the course and implications for similar efforts within in-service teacher education programs.

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INTRODUCTION

This chapter presents the design, implementation, and evaluation of the online graduate course *Leading Computational Thinking in K-12 Learning* (Leading CT). The chapter opens with background literature related to the need for advancing computational thinking (CT) in K-12 schools and related challenges and policies at national and state levels. It also addresses the role of instructional technology programs that teach K-12 educators. The chapter then moves to the design of the course Leading CT, followed by its implementation and evaluation. The discussion focuses on design implications to guide course modifications for the next iteration of Leading CT.

BACKGROUND

Need for Computational Thinking K-12

In her 2006 essay, Jeannette Wing argued for the inclusion of computational thinking (CT) among the essential literacies taught in K-12 contexts, alongside reading and mathematics. Since then, several definitions of CT have been proposed (Barr & Stephenson, 2011; Grover & Pea, 2013). In this chapter, we use the 2011 definition created by a collaboration between the International Society for Technology in Education (ISTE) and the Computer Science Teachers Association (CSTA), which describes CT as a problem-solving process applied towards a range of challenges. The CT problem-solving process is supported by computers and other tools, and it may include algorithmic design to support automation; data organization and analysis; and data representation through abstraction (ISTE, CSTA, 2011). In this chapter, CT is considered fundamental to the domain of computer science (CS), a subject some students experience in high school through coursework that is usually elective.

The rationale behind the K-12 CS education reform movement—which includes learning CT and CS—is based on several key arguments: CT represents fundamental knowledge and skill needed to participate in our technology-enhanced society (Margolis et al., 2008); there are numerous jobs in computing and related fields projected in the future (Bureau of Labor Statistics, 2018); to learn CT is to learn important competencies that can be applied across domains (ISTE, 2016); and CT knowledge is necessary to solve today's grand challenges (Code.org, CSTA, & ECEP, 2019; National Science Foundation, n.d.). Furthermore, parents want their children to learn CS (Google & Gallup, 2015), an important indicator of its value in the realm of public opinion.

In 2016, ISTE updated its Standards for Students that describe what every K-12 student should know and be able to do with technology. In this update, it added "computational thinker" as one of the seven roles K-12 students should be able to assume. Students that are computational thinkers "[develop] and [employ] strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions" (ISTE, 2016). Sub-elements of this standard include defining problems; thinking algorithmically; collecting, analyzing, and representing data; developing models to understand complexity; and creating and testing automated solutions (ISTE, 2016). The ISTE standards have been widely adopted by state boards of education, including in the state of Georgia, the context for the Leading CT course. The ISTE standards update has implications for pre-service and in-service teacher educators: across all subjects that candidates will teach in K-12 contexts, teacher education