

## Chapter 9

# Enhancing Preservice Teachers' Confidence and Efficacy in Computer Science

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### ABSTRACT

*The growing demand for digital literacy, computer science (CS), and computational thinking (CT) has taken traction in U.S. schools. The emphasis on teaching these skills in the classroom demands teachers who are prepared to teach such content and skills. However, there has been limited research on preservice teacher self-efficacy for teaching CS to elementary-aged students even though a body of research related to teacher efficacy has supported positive changes in student learning. The purpose of the mixed-method research was to examine over 30 preservice teachers' self-efficacy in teaching CS lessons to elementary-aged students. Findings included improved efficacy, confidence, and positive perceptions about teaching CS from pre-to post-test surveys, focus-group interviews, and written reflections. Three prominent topics emerged from qualitative data and consisted of: (1) lack of familiarity of concepts caused nervousness; (2) peer and content support to ease implementation; (3) developing enthusiasm of the content through multiple exposures.*

### INTRODUCTION

The growing demand for digital literacy and computational thinking (CT) has taken traction in U.S. schools. An emphasis in computer science (CS) education within STEM fields prioritized into programs with increased funding from foundations, non-profits, and the federal government. A call for CS education to meet employers' demand is shifting attitudes and perspectives for the teaching and learning of CS in U.S. schools. But despite the increased demand, prevalent issues can impede growth and momentum. Such issues include the lack of teacher preparation in K-12, insufficient CS courses in teacher training programs, time constraints, applicability and suitability of a CS curriculum for certain age groups to learn CS, and buy-in from stakeholders on the importance of teaching CS.

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Perhaps from these issues, teacher qualifications and expertise to teach CS rise to the level of urgency. In order for CS education to become part of the K-12 curriculum, a critical need to prepare teachers to integrate this content with CT into teaching practices and activities (Lye & Koh, 2014) prevails. Recent efforts have focused largely on existing teachers by providing enhanced professional development activities and trainings to expose them to embedding CT into existing courses (Yadav et al., 2014). While there is momentum and considerable focus on inservice teachers, limited research is available on preservice teacher preparation in regard to CS teaching and learning. Given the shift in preparing teachers to teach CS, appropriate development of preservice teachers' knowledge and skills is essential in building CS capacity in K-12. But before building preservice programs, its expectations, or coursework requirements, it is critical to understand how preservice teacher self-efficacy plays a role in influencing one's ability for teaching related content.

## **THEORETICAL FRAMEWORK**

Quality instruction for learning any content revolves around teachers' knowledge of the content, their confidence levels, and preparation experiences. This research was driven by the conceptual understanding of teachers' self-efficacy including content with CS/STEM and preservice teachers' preparation of related content in coursework including field-based experiences.

### **Understanding Teachers' Self-Efficacy**

Self-efficacy is the belief of one's ability to teach students content which is related to teachers' confidence in understanding the content and the pedagogical methods used in meaningful ways. Rooted in Bandura's (1977) social cognitive theory, perceived self-efficacy includes four sources of efficacy expectations which are: mastery experiences (performance accomplishments); physiological and emotional states (emotional arousal); vicarious experiences; and social persuasion. Mastery experiences and social persuasion are powerful sources of efficacy that can raise beliefs. Opportunities for practice with peer encouragement and feedback influenced teachers' competence and their abilities to promote student learning (Parkinson, 2008; Woolfolk Hoy, 2000). Thus, the factors that motivate teachers' efficacy included a sense of internal or external locus of control, knowledge of the content area, maturation in the field, and the perceived ability or inability to improve student learning. Given the work around self-efficacy and the teaching of new CS concepts in this study, promoting efficacious behaviors for preservice teachers is essential as they make instructional decisions related to CS/STEM for diverse learners to achieve desired curricular outcomes.

As Bandura's theory (1997) along with Woolfolk Hoy & Spero's (2005) research has suggested, it is important to create preservice mastery experiences that provide new teachers with opportunities to work alongside others within a community of practice model. Contextual learning platforms are warranted that pull from the "situative perspective"—a framework that draws on ideas of situated cognition, distributed cognition, and communities of practice across the individual, others, and tools (Putnam & Borko, 2000). Situated cognition is a view of knowledge that suggests the relationship between what is known is tied to its specific context (situation). Situative theorists extended that these physical and social contexts become integral parts of the learning, taking into account the interactive systems that include the participants themselves, their interactions with others, and the materials and representational systems

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