Chapter 7
Teacher Preparation in Computer Science Pre-Service and Inservice Programs

Wykeshia W. Glass
North Carolina Central University, USA

Desiree G. Hickman
Sam Houston State University, USA

Calvin M. Reaves
North Carolina Central University, USA

ABSTRACT

In order to create an effective 21st century classroom that engages and meets the needs of students, teachers must be knowledgeable of what motivates students to learn and how technology plays a critical role in his/her instruction. Due to the limited exposure of computer science education in the mainstream P-16 curriculum, only a small portion of students from public schools go on to careers in technology. The purpose of this chapter was to examine how teacher preparation programs and districts can better prepare pre-service and inservice teachers with experiences and professional development opportunities to equip them with the tools to effectively and efficiently teach in P-16 classroom settings. As a result, not only school districts but colleges of education must begin to develop and plan for the uses of computer related technologies for its educators.

INTRODUCTION

There has been a growing interest as well as an important discussion on how to broaden participation in computing and integrate computer science education into K-12 classrooms in the United States (e.g. Franklin, 2015; National Research Council, 2011; Resnick et al., 2009). Computer science education at K-12 level is not only critical for its potential to provide a pathway to a good array of careers, but also

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important for students to gain 21st century skills like critical thinking, problem analysis, and design of solutions (Grover & Pea, 2013). Recent efforts to breach the chasm between computer science and the mainstream K-12 curriculum are generating publicity and increasing awareness (Code.Org, 2016). In the United States parents, teachers, and students are expressing a growing interest in computer science, as reflected in the numbers of students participating in the "Hour of Code" sponsored by Code.Org (Code.Org, 2016). The success of "Hour of Code" shines a bright light on the CS education reform landscape. According to Code.Org (2016), since its release in 2014, the K-8 courses from Code.Org have been used in more than 31,000 classrooms worldwide. Lesson materials available through Code.Org are designed to emphasize fundamental computer science skills outlined in the CSTA K12 Standards, such as computational thinking and algorithm development; community, global and ethical impacts; computer programming, pair programming, and computer engineering and communications (Code.Org, 2016). Despite the sustained effort to raise awareness through the "Hour of Code" computer science continues to occupy a marginal place in the K-12 curriculum in the United States (Code.Org, 2016).

Computer science is no longer seen as an option for student electives, but more so, as a basic skill for all P-16 education. As stated by President Obama in 2016, "Our economy is rapidly shifting, and both educators and business leaders are increasingly recognizing that computer science (CS) is a 'new basic' skill necessary for economic opportunity and social mobility" (The White House, 2016). In addition to being considered as a basic skill for students, leaders in the industry have increased their demand for current and future employees to possess computer science related skills. The Bureau of Labor Statistics has projected that from 2016 to 2026 there will be a 13 percent growth in computer and information technology systems, which is faster than average across all occupations (The White House, 2016). Based on this outlook, it is imperative that today's K-12 students are given the opportunity to build a foundation of computational science skills so they are better prepared for future opportunities (Grover & Pea, 2013; Lee, 2015; Pellegrino & Hilton, 2013; Wilson et al., 2010).

Many states are trying to increase computer science education opportunities for K-12 students. As of 2016, there were seven states that had adopted K-12 computer science standards, while eight additional states were in progress on standards (Stanton et al., 2017). As of October 2017, 10 states had K-12 computer science standards, and an additional 10 were working on developing standards (Patel, 2017). Furthermore, four states required all high schools to offer computer science (Texas, Arkansas, Virginia, West Virginia) (Stanton et al., 2017). Iowa, Arkansas, Nevada, Texas, and West Virginia require that computer science courses are offered and have adopted computer science standards (Code.org, 2017). Many other states, such as Colorado, are in the process of developing and adopting computer science standards and have hired state level computer science education support specialists (Code.org, 2017). The cities of Chicago and New York City require computer science credits for high school graduation (Code.org, 2017). Virginia has embedded computer science into content standards (Code.org, 2017). Since the 2018 State of Computer Science Education report was published, 33 states passed 57 new laws and regulations promoting computer science (Code.org, 2017). As we look forward to 2020, it is imperative to continue the bipartisan support and momentum we have seen for a subject that is critical to the success of all of our students (Code.org, 2017).

If districts across every state were to offer computer science courses, there would not be enough qualified teachers to meet this demand. There have been many initiatives and professional development offerings designed around educating middle school and high school computer science teachers (Menekse, 2015). However, most of the plans for preparing or certifying computer science teachers draw on existing teachers, often math or science, which are already high demand areas (Goode, 2007; Lang et al., 2013).