

Chapter 5

English Learners (EL) and Computer Science (CS) Learning: Equity Issues

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ABSTRACT

The national call to increase student participation in CS is widely adopted, but there is limited research that examines English learners (EL) on the agenda for K-12 CS education. This chapter contributes to the literature by analyzing the landscape of EL in computer science and highlighting the linguistic challenges that EL students experience in CS. By understanding significant themes that emerge from these challenges, we conclude with recommendations on how to support EL and future research and strategies for creating a more equitable playing field in CS education for English learners.

INTRODUCTION

The increasing presence of CS education in schools has gained traction in recent years. More states are offering CS teacher certification; likewise, schools are offering their students CS courses and programs in-school and after-school. CS, as a discipline, has been marketed as high demand and a lucrative career path for students. Entry into a career in CS is limited by the access students have to CS knowledge, resources, and experiences to build expertise. The opportunity for English Learners (EL) to gain access and benefit from CS is examined further in this chapter as we explore the utility of curriculum and teaching as the factors that impact EL participation in schools.

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English Learners (EL) and Computer Science (CS) Learning

Initiatives such as Computer Science for All (CS4A) and organizations like Code.org., Black Girls Code, Girls Who Code, have come to the forefront in raising awareness of the benefits of a CS literate citizenry and the importance of producing, not only consuming technology. More importantly, these initiatives seek to leverage access for women and girls, Black, Latinx, and individuals with disabilities who have been, and still are, historically marginalized from computer science-related fields.

While access to CS may have increased for some, not all students have benefitted from the CS bandwagon. Wang and Moghadam (2017) report that Black and Latinx high schoolers are underrepresented in CS from high school to career. In 2015, of the AP Computer Science A test-takers, 3.9% were Black, and 9.2% were Hispanic. At the university level, only 11.4% of CS degrees were awarded to Blacks and 8.5% awarded to Hispanic students in 2012 (Ericson, 2016; Wang and Moghadam).

Despite the well-intentioned initiatives that emerge from CS4A initiatives, barriers persist for English Learners (EL). Achievement for English learners (EL) in particular has fallen behind native English-speakers writ large despite a growing EL population (National Academies of Sciences, Engineering, and Medicine, 2018). In 2015 there were nearly 5 million or 9.5% EL in U.S. public schools, an increase from 8.1% in 2000. Among the EL population, the primary home language is predominantly Spanish (77%); other primary languages include Arabic, Chinese, and Vietnamese (U.S. Department of Education, 2015). Census data indicate a wide range of languages spoken in U.S. households that vary based on geographic location, though most EL resides in metropolitan areas, are U.S. born, many of whom are early learners in grades K-5 (U.S. Department of Education, 2015). Although the number of ELs in schools is increasing, the paucity of research on English learners in computer science is troubling. Without research and academic literature to understand the specific challenges that ELs experience in CS classrooms, we cannot identify ways to develop useful computer science materials and adequately support EL students (Armeti, 2018), thus further limiting EL entry into CS careers.

Context of CS Education

To contextualize the complex landscape of CS education for English learners, we first examine the reality of schooling. Many EL students are placed in mainstream classrooms, where CS instruction is monolingual. English-only instruction in CS classroom is not surprising; English is the official language of many international open-source software communities and coding style guidelines (Igawa et al., 2017, Python, 2017.) Moreover, CS teachers lead classes with varying degrees of expertise in content knowledge and experience in the field of CS, and EL vary in their English proficiency and ability to read instructional materials, technical communication, and read and write code. Thus, in the CS classroom, an EL is learning English and programming simultaneously (Guo, 2017).

Prior to high school, CS is not part of a compulsory curriculum, nor is it a high stakes-testing subject like math or English, as such, teachers may not provide focused instructional time to support students who are struggling with CS content. In K-8 schools, CS instruction is commonly perceived as an extracurricular class, offered in rotation with other low-stakes subjects. Students are not expected to comprehend the entirety of the CS content, instead gain a basic understanding of fundamental content and skills in CS. Students who fall behind may not receive the assistance they need to comprehend the subject thoroughly due to the structure and length of the class. In core subjects, student outcomes are consequential, as such students may be pulled out in small groups or receive individualized attention and guided instruction. The perception of CS content as “less than” the content of tested subject areas highlights contradiction in the lack of prioritization of CS in schools despite the national call to increase CS education.

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