Community college students (CCs) can play a critical role in meeting the national need for a more diverse and technically trained workforce but the vast majority of federal funding on STEM education, training and research focuses on bachelor’s or graduate level STEM education (Olson & Labov, 2012). There are over 13 million students enrolled in CCs nationwide; they represent greater racial/ethnic diversity and are more likely to be from lower socioeconomic groups than students in 4-year colleges and universities -- 57% are female, 43% are non-white, and 42% are the first generation to attend college (American Association of Community Colleges, 2013). Community college students are also older than the traditional 4-year university student that is the focus of most STEM education research: 60% are age 22 or older and over 80% are employed at least part time (American Association of Community Colleges, 2013). Increasing numbers of CC students come from low-income families (Carnevale & Strohl, 2010) and many start their education at a CC for reasons that include financial savings, staying closer to family, lack of academic preparation, and a desire for smaller classes (Rivera, 2010). Other reasons for enrollment include personal interest and learning job skills, as well as obtaining a degree or certificate or transferring to a 4-year university (Provasnik & Planty, 2008). However, research on the development of STEM-related interest and choice in this population lags far behind research on students in 4-year institutions.

This white paper focuses on the need for research on community college students in all areas of Information and Communications Technologies (ICT). This term is widely used internationally and “encompasses all rapidly emerging, evolving and converging Computer, Software, Networking, Telecommunications, Internet, Programming, Information Systems and Digital Media Technologies” (MPICT, 2012). In California alone, in the 2010-2011 school year over 560,000 students were enrolled in community colleges in ICT-related credit courses (MPICT, 2012). These students are an incredible resource—what Rothwell (2013) calls the “second STEM economy,” which includes skilled technicians that are a key part of the innovation process—they implement new ideas and advise researchers on the practical aspects of technological development. However, in the most technical ICT fields like computer science, only 58% pass the courses for credit, and less than 1% complete either an Associates degree or a certificate (MPICT, 2012). The low completion rates show the need for further research on factors related to outcomes such as course completion, program retention, degree/certificate attainment, and transfer to a 4-year institution in computer science.

While the large numbers of technically trained and diverse students at CCs make them a key asset for workforce development, there is very little research to guide the development of policies or programs to increase the number that earn CS certificates or degrees. To date, most research on broadening participation in technical fields has been done with university students and may not be relevant to students at CCs, who come with different demographic profiles, preparation, and motivations.

The few existing studies of CC students are also not adequate to inform strategies for recruiting or retaining underrepresented students in computer science. Research-based efforts to increase the persistence and success of CC students are rare, and the quality ones focus on students in remedial courses not computer science programs (Costello, 2012; Scrivener & Coghlan, 2011). A review of the literature suggests that research on the retention and degree attainment of CC students in computer science is limited in several ways. First, most research on CS students at CCs is descriptive—it summarizes the demographics of field of study and
retention/degree attainment—rather than identifying the factors that influence retention and success (Wang, 2013). Second, most studies combine CS with STEM education fields in which women are represented, rather than focusing on programs where women are underrepresented. Third, the handful of studies of CC students in CS courses is limited by several issues: they usually include small samples; have a single point of data collection; and focus on a narrow set of factors (e.g., individual or institutional). These studies miss the opportunity to understand other potential influences such as relational or cultural, ignoring prior research that shows the importance of relationships in the educational pathways of women and Latino/a students, as well as older students with family responsibilities.

Without further research, CS education programs and initiatives at CCs will continue to rely on tools and research done with a completely different population. Based on the current state of the research combined with the growing priority placed on CS, there is a clear need for additional research that can inform strategies to broaden participation in computing at community colleges, and increase retention and CS degree attainment. This new wave of research must build on existing knowledge about the barriers and supports to recruiting and retaining underrepresented groups in CS.

The National Alliance for Partnerships in Equity Education Foundation has identified three categories of research-based “root causes” of the lack of non-traditional career preparation (NAPE, 2009)—individual, relational, and institutional. Individual factors include the demographic and psychological factors associated with students’ decisions to enroll in and persist in CS classes. These include academic preparation, attitudes toward CS, and motivation, such as the extent to which they feel confident, or value or place importance on CS. Relational factors include perceptions of support or encouragement from family members, peers, mentors, and faculty, as well as limiting stereotypes or expectations. Institutional factors include the course content and pedagogy, as well as the size of the college, the proportion of students from underrepresented groups, and the availability of counseling, affordable childcare and financial assistance. While prior research suggests that some of these factors relate to the educational and career decisions of CC students, and some relate to choice of major for students at 4-year universities, there is very little research on CS pathways into and through community colleges. One recent study found gender differences in the relative influence of each of these factors, but the data were limited to California and the sample was too small to allow for comparison across racial/ethnic groups (Denner, Werner, & O’Connor, in press).

In summary, community colleges offer a critical resource for efforts to increase diversity in computer science. Students who enroll in CS classes at these colleges, for whatever reason, are the “low hanging fruit” for CS recruitment efforts in that they have already expressed an interest in CS by taking a class. The future of CS education depends, in part, on our understanding of how to increase their rates of retention and success. The following list of research questions is designed to launch a national effort to fill this gap.

**Research Questions**

1. What is the relative importance of individual, relational, and institutional factors in students’ decisions to enroll in CS classes at community colleges?
2. What is the relative importance of individual, relational, and institutional factors in students’ decisions to persist and complete CS classes and degrees at community colleges?
3. How does the relative importance of these factors for enrollment (and persistence) vary across key demographic factors, like gender, race/ethnicity, and age?
4. What are community colleges already doing to recruit and retain underrepresented groups in CS, and what evidence is there of effective practices?
5. What are the barriers to and opportunities for implementing institutional and relational level changes that can increase the enrollment and retention of underrepresented groups in CS?
6. What are the barriers to and opportunities for aligning pre-college preparation with community college course requirements?

References


