

# Computer Science through Concurrent Enrollment: Barriers and Supports to Broadening Participation

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**Abstract**— CS Principles (AP-CSP) is giving more girls and under-represented students access to CS education, but CSP has not reached all students. Concurrent enrollment (CE), in which students take CE courses in their high school for college credit, is offered in places and to students who may not have access to Advanced Placement. The CS-through-CE project, an NSF-sponsored Research Practice Partnership, aims to broaden participation in computing by piloting and studying CE implementations of Mobile CSP, an effective CSP curriculum that has now been adapted as a college course. Initial research has identified barriers and supports to implementing Mobile CSP as CE in two contexts (rural, low-SES and urban, diverse, low-SES). This poster will present factors that support or impede implementation of CS-through-CE at the external level (e.g., policy, systems, context), the post-secondary CE program level (e.g., instructor qualifications, student eligibility, school outreach), and school/classroom level (e.g., teacher availability, student recruitment, administrator support). We aim to gather feedback on these results, as well as engage with others with experience with or interest in offering CS-through-CE.

**Keywords**—Broadening participation, Computer Science Principles, High school-to-College pathways, Education, Computer science education, Educational programs, Pre-college programs, Mobile applications

## I. INTRODUCTION

“Broadening Participation and Building Pathways in Computer Science through Concurrent Enrollment” (CS-through-CE) is a three-year project (Oct. 2018 – Sept. 2021) designed to study implementation and outcomes of concurrent enrollment (CE) programs as a vehicle for broadening high-school-to-college pathways in computer science (CS). Funded by the National Science Foundation as a Research Practice Partnership, the project involves CE programs at Capital Community College (CCC) in Hartford, CT and Southwest Minnesota State University (SMSU) and partner schools in each state. Mobile Computer Science Principles (Mobile CSP) is a College-Board–endorsed curriculum aligned with the Advanced Placement (AP) CSP framework. CS-through-CE is adapting Mobile CSP curriculum, assessments, tools, and teacher professional development in order to pilot a CE version of Mobile CSP in two states, training and supporting up to 40 teachers and classrooms over two academic years.

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## II. TWO MODELS OF ADVANCED COURSES

Advanced Placement courses are a popular way for high schools to provide rigorous college-level coursework to students in many regions. Bringing CSP to schools through AP as a breadth-first introduction to CS that enrolls more diverse students than AP CS A has proven to be a smart strategy. [1] However, not all schools offer AP CSP and not all students choose to take AP courses. Concurrent enrollment—a form of dual enrollment in which high school teachers are credentialed to teach college-credit bearing courses on-site during the school day—offers an alternative to AP as well as to dual enrollment programs where students leave their school to take courses on a college campus.

Both AP and CE are national models for college credit in high school, but they differ in important ways. AP requires a single high-stakes exam and project (usually done in May), whereas in CE courses, grades are based on students’ yearlong work. Students finish an AP exam with a score, but with no guarantee that any given college will accept that score as credit for an elective, required, general education or major course. CE students earn college credit on a transcript from the partner college, which in many cases may transfer to other colleges [2]. AP teachers have “. . . no formal requirements or mandatory professional development . . .” [3], while CE teachers must meet the requirements of the post-secondary institution to teach college-credit courses.

The U.S. Department of Education found dual enrollment to have “positive effects on students’ degree attainment (college), college access and enrollment, credit accumulation, completing high school, and general academic achievement (high school),” perhaps more so than AP courses [4]. The reach of dual enrollment is broad, extending across rural, suburban, and urban areas in all 50 states, but few high schools offer computer science via CE.

## III. RESEARCH DESIGN

This RPP’s shared problem of practice is how to implement CS as a CE offering in a way that broadens participation in computing at the transition from high school to college. Initial research questions jointly developed by researchers and practitioners address this shared problem of practice. Guiding Question: Is Concurrent Enrollment an effective model for broadening participation in computing?

- RQ1: What are the supports and barriers to implementing and sustaining Computer Science Principles (Mobile CSP) as a CE course?
- RQ2: Does a CE implementation of Computer Science Principles broaden participation in computing?

As part of an overall mixed-methods design, the initial research on barriers and supports used qualitative methods to gather and analyze interview data from stakeholders as well as documents. Case studies will be developed to understand the two contexts and issues and opportunities in each. The second question will be addressed using quantitative data on school populations and course enrollments to see to what degree CS-through-CE classrooms mirror the demographics of their schools. The ongoing research agenda will develop through an iterative process of research and implementation in practice with the RPP.

#### IV. PRELIMINARY FINDINGS

Data were gathered through semi-structured interviews with stakeholders identified through purposive sampling, including college CS faculty, CE program leaders, state higher education and K12 officers, teachers, and school administrators and counselors. Fifteen interviews with participants in both states resulted in approximately 18 hours of data. Researchers used an iterative process of thematic analysis along with a context framework. This poster will present findings about barriers and supports to implementing CS-through-CE at three levels: (1) external context (state-level policy, systems, and context); (2) CE program (e.g., instructor qualifications, student eligibility, school outreach); and (3) school/classroom (e.g., teacher availability, student recruitment, administrator support).

#### V. CONCLUSION

Broadening participation in computing requires not just innovations in tools, curriculum, pedagogy, and professional development. Research is needed to understand the educational systems and policies and their impacts on computing education access, diversity, and inclusion. Concurrent enrollment shows promise as a mechanism to bring equity-focused CS courses to more students. The barriers and supports identified so far by the CS-through-CE project point to policies and practices that might better promote inclusion. In future years, the project plans to create guides or models to support other CE programs to add CS courses to their offerings. Ongoing research will continue to inform how the project addresses the problem of practice: how to implement CS as a CE offering in a way that broadens participation in computing at the transition from high school to college.

#### REFERENCES

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