

Computer Science Principles Curricula: On-the-Ground, Adoptable, Adaptable, Approaches to Teaching

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1. Summary

Previous sessions and presentations at SIGCSE have explained to the community many details about the development, piloting, and exam format of the NSF/College Board Computer Science Principles (CSP) [1-3] project --- a project that is intended and designed to be a rigorous, engaging, and broadly appealing Advanced Placement (AP) course taught in high schools, for which students can earn placement and/or credit for a college course. We are now less than two years from the launch of the course as an official Advanced Placement course in 2016-2017. Hundreds of high schools have offered courses designed around the CSP Framework, but these courses differ in many respects – from choice of programming language, to the degree of emphasis on the Internet, to varying focuses on modeling/simulation, and more.

As schools move to adopt the CSP framework, develop courses, and deliver them, teachers and administrators look to national models for curricula that can be adopted and adapted to suit local needs. In this session, we highlight both NSF-funded

projects and private/non-profit-funded projects that have developed, piloted, and made available CSP curricula designed around the same framework [4]. These curricula share the same framework, but differ in important ways. We present a matrix, hosted on the CS10K Community of Practice, that highlights the similarities and differences between the approaches represented here. In the session, each curriculum project will be represented by a very short (five-minute) flash talk describing the curriculum. Brief synopses or elevator pitches of the curricula aimed separately at teachers and administrators will also be included in the session as written documents. The matrix and associated documents will be available online and as resources accessible during the session. There will be ample time to engage the audience in questions about the approaches.

2. Overview of Approaches (Owen Astrachan)

We provide a brief overview of the CS Principles project: its design, implementation, and direction. We expect general familiarity with the project but include this overview to ensure that those in the audience are aware of recent changes regarding the scope and format of the exam.

Owen Astrachan is the PI of the CS Principles project. He works to help the community of educators working on this and related projects achieve their goals. He helps to coordinate CSP initiatives for the CS10K Community of Practice.

2.1 Project Engage (Calvin Lin/Bradley Beth)

Project Engage is a dual-enrollment program in which high school students have the opportunity to earn computer science credit at the University of Texas at Austin. The accompanying project-based curriculum, *Thriving in Our Digital World*, is aligned with both the *Computer Science: Principles* framework and the Texas College and Career Readiness Standards. The curriculum and instructional supports are freely available online, for adoption by teachers outside of the Project Engage Community.

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2.2 Project Lead the Way (PLTW, Bennett Brown)

Project Lead The Way (PLTW) is a non-profit organization providing K-12 curriculum, professional development, and assessment to over 6,000 U.S. schools in three pathways: engineering, biomedical sciences, and computer science. The computer science pathway includes Computer Science and Software Engineering (CSE), a CS Principles course that is being implemented in more than 200 schools. PLTW courses use a problem-based learning approach. With PLTW professional development occurring at over 50 universities, this implementation of CS Principles is immediately scalable.

2.3 CISS Ohio (Nigamanth Sridhar)

The ComPASS project, developed by a team led by Beth Simon at UC San Diego, is being adopted in Ohio as part of the CISS project. The project uses a hybrid professional development model combining online delivery with face-to-face delivery, and a network model to provide academic year support by way of the Ohio STEM Learning Network. Through this network, the project has reach throughout the state of Ohio.

2.4 Mobile CSP (Ralph Morelli)

The Mobile CSP project engages teachers and schools in Connecticut and more broadly through the development of App Inventor and a CS4HS-funded MOOC for teachers delivered in the summer of 2014. This project includes several pilot schools from the College Board CSP pilot program.

2.5 CS4Alabama (Jeff Gray)

The CS4Alabama project uses a master teacher model and has delivered an online-accessible curriculum using a CS4HS-funded MOOC. The curriculum has been developed through the master teacher model. Several teachers in this project are part of the College Board CS pilot program.

2.6 CS Matters in Maryland (Marie desJardins)

The “CS Matters in Maryland” CS10K-funded project also uses a master teacher model and is piloting a CSP curriculum across Maryland, using resources that are connected to both the College Board CS Principles pilot program and to Code.org.

2.7 Beauty and Joy of Computing (Daniel D. Garcia)

The Beauty and Joy of Computing (BJC) project has been part of the College Board pilot project since that project began. BJC is a programming-heavy curriculum by CSP standards, covering the powerful ideas of recursion and higher-order functions using Snap!, a free, HTML5/Javascript-based reimplement of Scratch adding first class procedures and first class lists.

Readings are taken from current events and from [5]. Hundreds of teachers have participated in BJC professional development. Four 5-week “MOOClets” are under development and will launch in the Fall 2015-Spring 2016 school year as a Small, Private, Online Course (SPOC) as well. During 2015-19 we are partnering with Education Development Center (EDC), a nonprofit curriculum developer, to package all these materials into a teacher-friendly form (with a teachers’ manual, scope and sequence, etc.) and to bring this curriculum to 100 New York City public high schools.

3. Intended Audience

This special session is designed for all educators interested in broadening participation in computer science teaching, particularly in high school; however, the lessons of the projects here also extend beyond high school to post-secondary institutions. The varied approaches to a Computer Science Principles curricula have been developed using best practices in educational research, in established pedagogical approaches designed to change how students learn, and in providing professional development opportunities for teachers. The partnerships represented in this special session continue a community-driven collaboration to support adoption by many different groups rapidly and at scale.

4. References

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