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CS as a Graduation Requirement: Catalyst for Systemic Change

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CCS CONCEPTS

• **Social and professional topics** → **K-12 education**; *Computational thinking*; *Model curricula*; *Student assessment*;

KEYWORDS

high school; graduation requirement; instructional coaching; systemic change; CSforAll; Exploring Computer Science; teacher professional development; Chicago Public Schools

1 SUMMARY

Since President Obama's announcement of the Computer Science for All Initiative in 2016, there has been a surge in the number of districts that are planning for or newly implementing computer science (CS) offerings at their schools. Chicago Public Schools (CPS) is the first large school district to have adopted Computer Science as a high school graduation requirement, taking this significant step along the path towards systemic change. The foundation was laid eight years ago when an informal alliance was formed between a CPS high school CS teacher, a CPS administrator, and three university computer scientists. With the addition of an education researcher, the alliance later formalized as a researcher-practitioner partnership: the Chicago Alliance for Equity in Computer Science, known as CAFÉCS. With CE21 funding from NSF (CNS-1138417), the alliance initiated work on the Taste of Computing project with a pilot cohort of 11 teachers. Through multiple public (CNS-1543217, CNS-1542971, DRL-1640215, CNS-1738691, CNS-1738776) and private grants since then, the alliance has developed 15 CPS peer facilitators who have provided professional development to over 200 CPS teachers. In the alliance's first 5 years, ECS has been taught in 40 CPS high schools to over 13,000 students. Of these students,

47% have been Hispanic, and 38% have been African American, both of which match the overall CPS demographics; 44% of the students have been female. Currently, ECS is being taught in 63 schools to over 11,000 students by over 150 teachers. The alliance has also contributed to the literature on the impact of the ECS course on students' attitudes towards computer science [3], students' choices about future CS coursework [4], and students' development of computational thinking practices [5]. Lessons learned in Chicago over the last eight years can inform this process in other school districts.

The panel will present discussion questions revolving around key factors for constructing a successful CS initiative. Following the ethos of ECS, participants will have the opportunity to share and to discuss their own district's progress with peers in small groups. These discussions will lead to a larger groups discussion focusing on best practices and lessons learned.

2 OBJECTIVE

The history of achieving the computer science graduation requirement contains important lessons for other school districts large and small. Beginning eight years ago with a small group of like-minded Chicago high school teachers, administrators, and university professors, our effort has evolved into a grassroots movement resulting in endorsement and support from the Chicago city government, expansion of CS into elementary as well as high schools, collaborations with industry partners, and connections to nationwide systemic change with Exploring Computer Science, Code.org and NSF-funded CSforAll.

The successful creation of a high school computer science requirement requires more than just inspiration and a group of willing teachers. Our evolution began in the classroom with students and teachers, and has expanded to include the larger academic and political community in Chicago. Along the way successes and failures have taught us lessons from which others can benefit. Key ingredients in our recipe for success have been:

(1) Growing at the pace of relational trust. It takes time to cultivate a geographical community of partners. It takes time to establish common vision among stakeholders, to find appropriate equity-based curriculum, for teachers to change their pedagogy, for principals to embrace the change, and for a school system to adopt a new course requirement.

(2) Implementing best-practices professional development for long-term growth, implementing an inquiry approach not only for the curriculum but for the PD experience itself.

(3) Transitioning ownership into the school system, and building institutional structure to sustain the effort: examples are CPS' adoption of ECS as the flagship high school CS curriculum, CPS' hire of a full-time ECS coach, and the expansion of the computer science-related district administrative staff toward levels enjoyed by traditional core subjects, building out the CS deptartments.

(4) Handling the failures that come with success. For instance once CS was required in CPS, it became more common at professional development sessions to have teachers attend only because they were required to be there rather than because they were otherwise personally invested in it.

The objective of the session is to share Chicago successes and failures with participants and provide an interactive forum for participants to brainstorm how to adapt elements of Chicago's success to their own local contexts.

3 OUTLINE

An initial brief history of CAFÉCS and the Chicago story will give overall context to the discussion (10 minutes). Special session question leaders and team members will include Brenda Wilkerson (CPS CSforAll champion), Don Yanek (CPS teacher, CSTA president, ECS coach), University partners (Lucia Dettori of DePaul, Ron Greenberg of Loyola, Dale Reed of UIC), Steven McGee (external evaluator and researcher), along with additional CPS staff and teachers (Andy Rasmussen, Troy Williams, Faythe Brannon).

Each of the implementation areas are given below, along with emphasis areas for each one. Session leaders will first summarize each question (1 min.) as a lead-in to brief small group discussion. Groups will be asked to consider how various solutions apply to their own local contexts (4 min.), and will take turns reporting out as part of the larger group discussion (5 min.). This process will be repeated for each question.

(1) **What are steps to building a good researcher/practitioner partnership involving teachers, university partners, and district leaders?** *Emphasis:* It is important to have a champion within the system, which in our case was Brenda Wilkerson.

(2) **How can a good pilot be leveraged for systemic change?** *Emphasis:* Initial seed funding and commitments from a highly motivated core group can provide a proof-of-concept pilot to be used to sway leadership.

(3) **For building institutional capacity what is the relative importance of curriculum, PD, coaching, and systemic endorsement? Which should come first?** *Emphasis:* While all these are important, start with the right curriculum, then adopt an effective PD model.

(4) **From teachers' perspectives, what are the most pressing needs in implementing CS across a school system?** *Emphasis:* Teachers need community support to get started, and coaching support to continue.

(5) **How would a CS graduation requirement fit into the existing curriculum?** *Emphasis:* Find the path of least resistance, with the requirement drafted in such a way that it works politically with the existing curriculum structure.

(6) **What are primary concerns from the school district administrator point of view?** *Emphasis:* Funding and political support go hand-in-hand.

(7) **What are the problems you might expect once the graduation requirement has been adopted?** *Emphasis:* It is not one-and-done. Real work continues after the graduation requirement. There are many schools that are not ready, more teachers will be needed to meet the demand, and frequent leadership turnover means we need to continue to convince administrators of the importance of CS.

4 EXPECTATIONS

Intended Audience: K–12 teachers and administrators, university professors, policy makers.

The session will cover the evolution of creating a high school graduation requirement. The audience will learn a pathway and strategies to investigate as well as critical people to engage in the mission. They will become aware of possible pitfalls and issues.

5 SUITABILITY FOR A SPECIAL SESSION

With the announcement of the CSforAll initiative, many states and municipalities are allocating budgets around the investigation of how to implement Computer Science education in K–12. The Chicago CAFÉCS is a mature implementation of CSforAll, having worked as a cohesive team on this unified vision for the last eight years, leading to Computer Science being adopted as a graduation requirement for all CPS high school students a year ago.

The session goal is to enable participants to consider what elements of Chicago's success can be replicated within their own local context. For this reason the session is designed to be interactive, capturing participant dialogue. We have learned from both our successes and failures and presenting these in this session coupled with small group discussions will help participants to consider what elements of the Chicago story might be appropriate to help bring about systemic change in their own contexts.

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