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The Big IDEA and the PD Pipeline

Former Computer Science Teachers Association executive director Mark R. Nelson discusses his work with the group to overcome core challenges to computer science education.

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CSTA: Computer Science Education, Equity, and the Future Workforce
<http://bit.ly/2hGMSlt>
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In 2015, when considering whether to apply for the position of executive director for the Computer Science Teachers Association (CSTA), I read the book *Stuck in the Shallow End* by Jane Margolis (<http://bit.ly/2zcEZpP>). Computer science (CS) remains one of the least diverse of the STEM disciplines, and Margolis' book opened with a compelling comparison between the racial divide in swimming and the divide we see today in CS. Understanding that teachers are critical to access, and how we teach can influence what field students might pursue, I saw that within CSTA there was opportunity to make a positive difference in the world.

Fast-forward to 2017, and thanks to Stephen Ibaraki, I had the opportunity to participate in the AI for Good Summit held in Geneva, Switzerland (<http://bit.ly/2h494Xi>). The Summit crystalized for me the scope, magnitude, and im-

portance of an organization like CSTA to change the world. The work of CSTA addresses core challenges for the future:

- How will we ensure all students are prepared to be citizens and workers in a different world than we knew in the past?

- How do we retrain adult workers, in this case education workers (teachers), to be ready for a rapidly changing world?

By working collaboratively, we *can* solve these challenges. Over the past two years, I saw the pathway to addressing these challenges within CSTA come together in a pair of initiatives: The Big IDEA and the PD Pipeline.

What Is the Big IDEA?

Building upon CSTA's historical interest in equity in CS, we began to change our language around equity. In 2015, our equity work focused mainly on a program with declining participation called "faces of computing," where students created videos to showcase some of the diversity within CS. In evaluating the program and looking at other successful initiatives, we recognized that focus on equity alone is insufficient to achieve equitable outcomes. Thus, we created the

Big IDEA as an umbrella for our current and future initiatives in this area.

IDEA stands for Inclusion, Diversity, Equity, and Access. While not the first group to utilize this acronym, the Big IDEA fit well within the needs of our community. By focusing almost exclusively in equity, we heard from many teachers that they did not feel included in the conversation because they identified themselves as "teachers of CS" rather than "CS teachers." That realization uncovered the diversity of perspectives that exist within our membership—which consists of nearly every teaching domain in K–12, and teachers who both come from and work with exceptionally diverse student populations. To achieve CS for All students, we realized the Big IDEA would be a more effective, holistic approach for focusing our efforts and building engagement in our community.

There is still much work to do. Take, for example, the challenges of accessibility in the context of disabilities. People with disabilities represent an estimated 15% of the world population. Designing for this group of learners can be challenging because disability is not a single construct. It can include physical challenges (related to areas such as vision, hearing, and mobility) as well as cognitive impairments (such as challenges related to reading, memory, and attention deficits).

Accessibility has implications for CS in education beyond the important category of children with disabilities. Accessibility challenges exist by race, gender, geography, community urbanization,

socioeconomic status, and many other dimensions. For example, in the U.S. there are entire states where not a single woman, African-American, or Latino takes the CS Advanced Placement (AP) exam each year. The Latino community, which represents 26% of K–12 students in the U.S., has been underserved by CS education largely due to access issues. We see similar challenges emerging for students in rural communities.

Limits to the Big IDEA, such as those highlighted here around access, become the basis for many forms of institutionalized inequity and can limit access to economic prosperity at multi-generational levels. As one speaker put it at the AI For Good Summit, the lack of diversity and inclusion in CS leads us to “solving mostly white male problems.” Over my two years at CSTA, I saw firsthand how teachers are critical for ensuring the Big IDEA becomes reality for children and society.

Organizations like CSTA have it within their mission and influence to make real change around the Big IDEA. Thanks to support and contributions from Google for Education, NCWIT, the Hispanic Heritage Foundation, and many volunteers, CSTA’s Big IDEA initiatives reached more than 3.5 million households over the past two years. In 2017, the Big IDEA in CS Education received a prestigious Silver Power of A Award recognizing CSTA and the contributions of both K–12 teachers and those who support them for “their extraordinary contributions and efforts to enrich lives, create a more competitive workforce, drive innovation, and make a better world.”

The PD Pipeline

In 2016, thanks to a grant from the Infosys Foundation USA, CSTA began development of the Professional Development (PD) Pipeline. The project emerged in response to a set of challenges from our members, which included:

- How do I know where to go to learn CS from quality providers?
- How do I track all of my PD and learning?
- How do I ensure all my PD contributes to certification or endorsement in my state?
- How do I connect with other teachers who took the same PD or came from the same background as me?
- How do I know what PD is the right

PD for me based on my current skill level and interests?

- How do chapters track and communicate PD taken or needed most by their members?

- How do I collect and share content and learning resources with other teachers like me?

Working with Degreed, last summer CSTA piloted an initial solution to these challenges via the PD Pipeline. The solution includes several elements. It begins with what will evolve into a developmental self-assessment to help teachers assess their knowledge of CS. That will be linked to developmental pathways to provide teachers with a roadmap to build their confidence and competence in teaching CS. We will provide digital badging and microcredentials to demonstrate teacher progress toward goals and outcomes. There is capacity to provide communities of practice and opportunities to share resources linked to a professional development (PD) experience, a developmental pathway, or other factors. The solution includes a digital portfolio, enabling a teacher to track all her PD in one place. Finally, nearly all these pieces link back to the K–12 CS Standards and Framework, or to a given state’s standards for CS, so a teacher can track progress against local requirements for licensure or endorsement.

The PD Pipeline recognizes that K–12 teachers of CS come from many different academic backgrounds and different exposure to CS. Our best estimate is that 1 in 9 teachers of CS have had a college-level course in CS, and fewer than 7% of our membership identify themselves as “CS teachers” first. Most are teachers of another subject who also teach CS. Thus, our 26,000 members include teachers of math, science, career and technical education, English, history, modern languages, art, music, physical education, special education, and many other domains.

We also learned that teachers came into CS with different areas of interest. We have teachers interested in robotics, cybersecurity, game design, artificial intelligence, data analytics, mobile applications, and many other domains of CS. We also recognized that some teachers want to become CS teachers, while others just want to integrate some CS in their classrooms.

The PD Pipeline is designed to provide a customized experience for an individual teacher with a goal to help her achieve the level of competence and confidence she desires or requires to be a successful teacher of CS in K–12. With technology changing quickly, and most CS teachers likely to come from the ranks of existing teachers, the PD Pipeline is an effort to address the question: How do we retrain the K–12 educational workforce (teachers) so they can prepare their students for the future?

As we look at the future displacement of jobs due to artificial intelligence, many individuals across a range of occupations and industries will need to be re-trained. The CSTA PD Pipeline initiative is one approach to solving such a large-scale workforce development problem.

Concluding Thoughts

The Big IDEA and the PD Pipeline are two examples of industry-changing initiatives under way at CSTA over the past two years. There is certainly much more that needs to be done in both these areas and others. As with any small non-profit, CSTA is dependent upon the support of organizations and individuals to fulfill its mission. While CSTA was founded by ACM more than a decade ago as part of its ongoing support to K–12 education, today more than ever, CSTA needs support from a broader range of stakeholders to successfully meet the challenges and needs of both the K–12 teacher community and the organizations and industries that depend on that community.

It was a distinct honor to serve as CSTA’s executive director for the past two years. By working collaboratively with many stakeholders, we made substantive progress on many fronts as we began the transition of CSTA from a “mom and pop” organization into a world-class professional association. Having accomplished many of the initial strategic goals set in 2015, it is now time for the next executive director to continue to build upon the transitional process that we began. I look forward to watching CSTA’s future success and encourage readers to support CSTA as the voice for K–12 teachers of CS. ■

Mark R. Nelson was executive director of the Computer Science Teachers Association from June 2015 through July 2017.

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