

# The Global STEM Education Center



## Global STEM Education: Catching Up or Leading the Way?

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### Proceedings

#### Keynote – Pasi Sahlberg

*“Should we do more of what we’ve been doing, or should we do it in a different way? Is the problem that we are teaching too few classes in science, math, and technology to children, or should we change the way we teach these things? In Finland, we chose the latter. We have been reducing the time that children spend in these things, but changing the way we do them.”*

Sahlberg described the impact of three change forces on global STEM education. The need for STEM leads to a change in *quantity*: more focus on STEM subjects. New understandings about teaching and learning change the nature of STEM pedagogy, a change in *quality*: the best ways to teach STEM subjects. Finally, climate change and other ecological shifts increase the hope of STEM, a change in *relevance*. Sahlberg noted that in most of the European Union, climate change has been a driver for revisiting curriculum.

Do these changes mean doing more of the same things, or doing STEM in a different way? Sahlberg used the PISA exams to show why we need a different approach to STEM. He critiqued what he called the Global Education Reform Movement (or GERM)

and its emphasis on competition, standardization, and accountability. The countries which are most “infected” with GERM are not improving in PISA. He contrasted this approach with Finland, where there is only one external standardized examination, which includes no multiple choice questions. He noted that Finland’s equity and student achievement are both high (as opposed to the U.S. and even Massachusetts, where there is high achievement but low equity).

Over the last forty years, Sahlberg said, Finland’s enhanced performance in STEM subjects, as well as in literacy, has come through a focus on curriculum, teachers, and pedagogy. The U.S. culture of measurement disallows the trust that Finland has in its teachers. As well, Sahlberg says, there is a difference in how parents and the culture look at student achievement. “In Finland we ask whether children are happy with what they are learning. In the U.S., you are more interested in knowing the level of achievement. We never talk about performing at the grade level. We never use that term. In Finland, parents are more likely to ask if their children like to read. Does he like doing mathematics or not?” Sahlberg’s implication: how can we engage students more in liking STEM? That will lead to achievement – not necessarily the other way around.

### **Policy: International, Federal, State**

**Chris Dede** began by noting that, in the modern workplace, “Interpersonal and intrapersonal skills are more important than cognitive skills. The modern practice of STEM is not dysfunctional geniuses sitting in offices thinking deep thoughts. You’ve got to have those interpersonal and intrapersonal skills if you’re going to be effective in STEM in the

21<sup>st</sup> century.” So how do we inculcate these skills? How can students practice them throughout their education? Teachers find it very difficult to set up real-world learning situations, so one answer Dede proposes is immersive interfaces such as virtual worlds and augmented realities. The data these produce, along with social media-embedded learning communities, can also lead to a shift in how we evaluate student progress: “One of the most promising things for education is not abandoning assessment but abandoning drive-by summative assessments, instead doing embedded, unobtrusive, diagnostic assessment all the time. Forget about closing for inventory with the summative tests.”

Like Sahlberg, Dede also noted the importance of student motivation. “If we graduate kids who have very high scores in STEM subjects and hate doing it, we have lost. If you look at the erosion in college, in part that’s because of incredibly poor teaching in college, but in part that’s because of motivation.”

**David Driscoll** argued that policy is not a huge problem here in Massachusetts. Instead, he focused on national policy and school culture. “The testing has become ridiculous,” he said, but “I really want to talk about culture. I just came back from China and asked some middle school kids in China the same question I asked some middle school kids in India. What do you hope to do when you grow up? They said we hope to be successful in math and science. Same answer. We want to learn English and we want to learn math and science. If I asked a middle school kid in America what they want to do when they grow up, besides being in the movies or playing sports...We have a cultural problem in America.

Our kids are willing to spend hours every day on their favorite sport. But they’re not ready to do the hard work necessary to build the basic skills in science and mathematics.” It’s

not their fault, says Driscoll: “We just don’t hold our kids to high enough standards and expectations.”

**Paul Reville** focused on the distinction between achievement and equity: “The averages in Massachusetts conceal deep, persistent achievement gaps. The question is, what did we get wrong, or what did we miss? What do we need to add if we’re going to finish the quest for equity and excellence?” Reville proposed that we need to think about a system that, rather than giving every student the same thing, meets all children where they are and gives them what they need in order to be successful. “If that’s a longer year for some children, if that’s English-language instruction on top of everything else that we do, that’s what we need to do. We need to hold standards constant and allow the time in school to vary in accordance with the needs of the learner.” Reville called for braiding mental health, physical health, and social welfare systems with the education system to address issues that get in the way of children achieving at high levels. “We have to move beyond 6 hours a day, 180 days a year, to achieve the goal that twenty years ago we thought, naively, we could achieve through our current education system.” In STEM, he said, students need more hands-on, applied learning opportunities, where they are actually doing the work of scientists and technologists.

In the discussion, Isa K. Zimmerman, the moderator, began by noting a common theme that “we know what needs to be done, we know how to do it. We just don’t have the political will.” Dede argued for increased freedom and experimentation in school structures. “We haven’t talked about a policy that historically happened a century ago – when people looked at the urban industrial economy, and schools developed for one-room schoolhouses in a rural economy. We blew up that box. Maybe a century later

we're in the same position. We now have industrial-era schools that are somehow trying to prepare kids for a global, knowledge-based, innovation-centered civilization. We can't retrofit those any more than we could retrofit the one-room schoolhouse." Reville agreed: "We've done enough of trying to refine and improve the engine. The new work of all means all will require a new and stronger engine." Driscoll believes that this kind of big-picture work is limited by politics: "we're getting hammered by the shortsightedness of just the next election." Within education, the panelists agreed that we need an improved focus on teachers; as Dede said, "How do you get teachers passionate about continued learning, and given creative and powerful opportunities for continued learning?"

### **Global Education Programs in Massachusetts**

**Brenda Finn** described the founding of the Massachusetts International Academy, a post-secondary intensive English language school that also focuses on strengthening students' academic skills and understanding of American culture: "the values, mores, customs in the U.S. so the transition to university life will be much smoother." MAIA serves 360 students from China each year, who go on to higher education at the University of Massachusetts as well as other colleges from Wisconsin to New York. "Most of our students have indicated that they will pursue study in business or finance, math, science, computer technology, and engineering, and about half intend to stay in the US," she said. Finn noted that the way students learn in China is very different from the way students learn in the US: "We focus on creative and critical thinking skills, effective approaches to problem solving, collaboration, and teamwork. We also emphasize the

importance of active student participation and fostering confidence in the classroom.”

MAIA also offers opportunities for students to participate in American life and culture, including extracurricular activities and community service.

Finn called for broader changes in the American education system to reflect changing needs in society. “When math is flat on paper or flat on the board, it just does not mean much to most kids. Math and science learning should be more experiential.” She also called for better curriculum and focus on computer literacy; increased access to STEM for underrepresented populations, including girls; opportunities for teachers to travel to other countries; and authentic, ongoing, strong connections between the world of work and schools.

**Deborah Cunningham** of Primary Source supports teachers in globalizing the curriculum. Programs include professional development, study travel abroad, an online community, and curriculum. “In every subject, be it STEM or humanities, the rest of the world is infused throughout the K12 experience.” Primary Source’s vision is that students are familiar with the rest of the world, appreciative of their cultural contributions, and used to working together to solve problems we can’t solve within our own borders. “Compared to when we began,” she said, “there’s much more understanding and acceptance of these concerns within the teaching community, but not everyone knows where to begin.” Unfortunately, so much of what students know and hear about the world comes through mainstream media and is fairly stereotypical. If they graduate and get sent to work in another country, it is difficult to work collaboratively with cultures you haven’t spoken to, studied, and don’t really deeply understand.

Cunningham's most important message: "I see the STEM subjects and the humanities as very much united in creating kids who can solve problems and take an active role in their world. We have to pull together to solve any kind of problem I can envision." She used the example of vaccinations: you could develop the most wonderful vaccine, but if it's not accepted culturally, you are not actually saving lives. She sees the Common Core as a skills-based curriculum that provides many opportunities for interdisciplinary, global, and STEM education. But with its focus on literacy and math, she wants to make sure that the most exciting STEM does not get buried in afterschool programs. "I want to emphasize the importance of investing in Professional Development and find time to put STEM teachers and foreign language teachers and humanities teachers in rooms together to create exciting curricula. Until they're using each other's strengths and insights, this agenda will creep along at a slow pace."

**Larisa Schelkin** spoke from her own experience of the globalized STEM professional world. She described the complexities of transitioning from one culture and country to another, and of how much corporations train STEM professionals in diversity and inclusion. In her work with the Global STEM Education Center, she says, "we are modeling a real global teamwork environment in our school and out of school programs." Students have the unique experience working in a real global STEM team on real-world problems provided by corporations in a real global STEM team. The teachers not only teach the students but work with colleagues overseas: it is an experience in training global teams to work together.

## Participant Takeaways

Among the learning articulated by attendees at the symposium:

- We often make this whole enterprise into rocket science. Sometimes it is and sometimes it isn't. We need to look at some of the low-hanging, simple answers to the problem.
- The Common Core and STEM are supposed to be preparing kids for higher education and the workplace. What was really important today is to realize that those jobs of the future are global. How are we preparing the global part of it in our schools?
- The same educational transition that happened when we went from an agricultural-based economy to an industrial one needs to occur as we go from an industrial to an information-age economy.
- Think about policy not in mandating computer science, but in lowering the barriers (such as teacher certification) for it to happen at school.
- We need to see technology as broader than computers. In Finland, they have hands-on learning from first day they go to school. They have tracks where they go to school and keep doing hands-on learning. In America, hands-on learning has been denigrated, and yet we need people who can do real things in addition to virtual things.
- We talked about differentiated learning and personalization for students. What I felt was missing was a discussion about differentiation and personalization for adults in schools.

- Learning needs to be relevant to students for them to be interested.
- We need to take into account the students who are coming out of poverty and other difficult situations and put more resources there. We can expand STEM programs, but if motivation is crucial, we have students who don't believe in themselves.
- The professional development of teachers was a theme I heard regularly – from elementary school on up.

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