The 2017 AERA theme is Knowledge to Action: Achieving the Promise of Equal Educational Opportunity. How does your scholarship align with the 2017 AERA meeting theme?

AERA President and Program Chairs’ call for proposals for the 2017 AERA Conference (Gadsden, Arzubiaga, Davis, 2016) included a number of challenging questions focusing on equity and opportunity, including:

- How do we conceptualize educational opportunity, who is studied and who is not, and what are the implications for research, policy, and praxis of such conceptualizations?

- What steps might research help craft across educational, social, and public policies at all levels of government and in philanthropy—and what partnerships are needed—to reimagine equity.

These questions have been at the heart of our work for the last six years (Lynch, 2015), as we studied inclusive STEM high schools (ISHSs). The goal of ISHSs is to develop new sources of STEM talent among underrepresented minority students and to provide them with the inspiration and competencies to succeed in school and in STEM jobs, college majors, and careers (Lynch, 2015; Means, Confrey, House, & Bhanot, 2008; NRC, 2011). These schools, relatively new to the U.S. education scene, are schools of choice that admit students primarily on the basis of interest in STEM. Students represent a broad range of abilities, but choose to study in high schools with a STEM-focused curriculum. They take more STEM courses provided in greater depth and breadth than typically required by states or school districts. Tracking is minimal and all students are held to similar high goals.

Our study, Opportunity Structures for Preparation and Inspiration (OSPri), included eight ISHSs spread out in seven states (see study website, https://ospri.research.gwu.edu/). The criteria of inclusion in the study were school records of success in preparing students for college STEM, and schools whose students’ backgrounds were socio-economically, racially, and ethnically diverse.

In addition to STEM-focused curricula, students participated in a range of practical, real-world experiences in STEM fields to prepare for college and for life, to create positive STEM identities, and to build “STEM social capital” (Peters-Burton, Lynch, Behrend & Means, 2014).
For example, we recently returned from a second site visit to an ISHS located on an 80 acre working farm in Chicago. Students, selected by lottery, take a traditional, college preparatory core of classes in science and mathematics. Simultaneously, they pursue one of six career technical education pathways in agriculture including, animal science, plant science, food science, economics of agriculture, and biotechnology, or agricultural mechanics. About a third of this school’s graduates—many of whom are African American—intend to major in agriculture and are sought by university schools of agriculture. Some of these graduates major in agriculture in college, but others reported that they intended to go to medical school; aimed for MBAs; or, wanted to become STEM teachers.

Given your work on inclusive STEM-focused high schools and on enhancing effective leadership in such schools, what do you see to be some important contributions of these works to the field of educational change?

One challenge to our study is how to account for the successes of the exemplar ISHSs. Were they successful because they included factors that might be best attributed to the school setting high expectations for all, to the school using data for decision making, or to the school establishing communities of practice? Or were these schools successful due to factors that were unique to their STEM focus, such as highly qualified STEM teachers, integrated STEM learning opportunities, and ubiquitous use of technology? We learned, nearly by accident, that seven of the eight principals of the ISHSs in this study did not have degrees or backgrounds in STEM, but rather in the humanities or social sciences. This begs the question: How did these principals create and lead high-performing STEM high schools with noteworthy successes with students from groups underrepresented in STEM fields?

We began the study on inclusive STEM-focused high schools with strong orientation toward STEM curriculum and instruction and in how people learn STEM (NRC, 2001; 2005; Peters-Burton, et al., 2014). As time went on, we found that explanations from cognitive science and national mathematics and science education reform documents alone were insufficient to explain how the ISHSs worked. We therefore turned to the school reform/change literature (c.f., Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010; Hargreaves, Boyle, & Harris, 2014; Mehta, Schwartz, & Hess, 2012.; Merseth, 2009; Rutledge, Cohen-Vogel, Osborne-Lampkin, & Roberts, 2015). In fact, one of the doctoral students who worked with our study for four years, Mike Ford, will defend his dissertation on school-level leadership in ISHSs in February of 2017; that dissertation should be of great interest (Ford, work in progress).

For example, Ford (in progress) found the success of the ISHSs lies in these schools’ organization and in their leadership structures which included both the principal and teachers.

First, because of their unique missions as inclusive STEM schools and as educational experiments, leaders needed a measure of autonomy from the central office of the school district and the state in order to innovate. At the same time, they needed to have the blessing and support of these same educational agencies. They accomplished this by involving planning committees and advisory boards that included important stakeholders in local business, industry, and NGO science centers, as well as actors from key agencies at the state and district level with oversight of curricular issues. This provided ISHSs with legitimacy and made them more community-oriented than many traditional high schools. Grants from philanthropies such as the Gates Foundation were often used to kick-start ISHSs.

Second, in order to create strong STEM schools, the leaders of ISHSs embraced distributed leadership (J. Spillane, 2006) that involved STEM teachers who developed courses that were coherent with the school’s goals and integrated with one another, and oftentimes, with the humanities classes. Some STEM
teachers were career changers who could connect their STEM communities with the curriculum to create experiences that engaged students and other teachers.

Third, the school leaders nurtured teacher professional learning communities within the ISHS (N. Spillane, 2015; N. Spillane, Lynch & Ford, 2015), creating a dynamic for innovation and change. Employing STEM design principles requires understanding that risk and failure are a necessary part of the design process, if followed by evaluation and re-design. This spirit pervaded ISHSs whose leadership teams included the principal and teachers, and sometimes, students. ISHS principals provided schedules that allowed, and sometimes required, teachers to work together in professional learning communities that emerged organically from a close reading of the school mission. Technology platforms for teaching and instruction provided the glue that allowed innovations that would otherwise be impossible.

Given your focus on boosting equity in STEM opportunities for all students, what would be some major lessons we can learn from educational changes in your local context and from those taking place in the global context?

To set the context, these ISHSs should not be directly compared with traditional comprehensive high schools because they vary in intent and structure. These schools’ student populations likely reflect these differences even though they may appear demographically similar. In ISHSs, students (or their parents/guardians) choose to attend a college preparatory STEM-focused high school, acknowledging that learning experiences would be different from those in traditional high schools in the types of challenges required and resources available. Second, ISHSs tend to be small, ranging from 300-650 students. Third, they attract teachers who wish to work in innovative education environments focused on an inclusive STEM mission for a diverse student population. Fourth, they have a more narrow STEM focus compared with comprehensive high schools. Finally, students in ISHSs are often challenged to perform as (young) adults inside of school and outside in STEM settings in the community and beyond, something that is not often required in comprehensive high schools.

It is clear now that there are at least two ways to view ISHSs. The first is through the eyes of the adults who have created these innovative schools and who work in them. Another lens is seeing ISHSs through the eyes of the students who attend them, allowing a view of ISHSs as opportunity structures that create new pathways to college and career and expand students’ STEM social capital.

Lessons for educational change include how to situate a new school geographically so that students from families of limited means can get to it. If racial/ethnic integration and equal access to high quality STEM is a goal (c.f., Orfield & Frankenberg, 2013), then a lesson to be learned is how ISHSs in this study engineered lottery systems for admissions that result in diverse student school populations. In some ISHSs, admissions slots are set aside for students from high poverty urban school districts; in others, slots are reserved for students who are first generation in their families to attend college. Outreach for 8th grade students and their families help ensure that the 9th grade class is diverse.

ISHSs also provide extensive student supports so that new students would not be overwhelmed by a rigorous STEM curricula that require mastery of concepts. Supports include tutoring, bridge programs, advisories, and social networks. This allows students to progress through high school and build a sense of competence and agency, and identify as “a STEM type of student.”

Finally, because of shortages of STEM professionals and teachers, ISHSs are apt to tap STEM resources in their communities and beyond to create learning environments that are stimulating for students and that encourage them...
to learn STEM in real world contexts. This approach has the positive side effects of being an excellent means of professional development for teachers and increasing the STEM capacity of the school.

Reflecting back to educational systems in the U.S. and globally, it appears that schools, school districts, and nations/states that deliberately create educational environments that nurture innovation and seek equitable opportunities to learn hold the most promise for education improvement. Bringing the community into school and getting students out into the community for learning experiences linked to the curriculum, be it for STEM, or a social justice initiative or an arts focus, could enliven all aspects of the education process.

Young people (students) are the focus of educational change for improvement. From your perspective, what are the key needs of young people at this time and what might the field of educational change prioritize in order to meet these needs?

Consider this account: Samantha, a Latina student in Chicago, commutes an hour by bus each day to her ISHS from her neighborhood, which she describes as “pretty rough”. Because her parents do not want her to socialize in a neighborhood that they consider unsafe, Sam spends a great deal of her discretionary time at her school, involved in her chosen animal science pathway. As a junior, she has created a business plan and wrote a successful proposal for a small grant ($300) to purchase a young female goat that is kept in the school’s barn. Over the next 18 months, she would breed the goat and sell the kids, keeping any profit. Because she is good taking care of large animals, she was offered an afterschool job to care for the livestock at school. She is doing what she loves in a place that her family views as safe and good for her future. Sam is also gaining valuable experience for her chosen career as a veterinarian. She has had opportunities to travel around the U.S. for various agriculture-related events and competitions and has also visited potential colleges to attend after graduation from high school. Sam’s ISHS is helping her meet a number of needs: social, emotional and experiential, as well as academic.

Sam’s ISHS is only one example of an inclusive STEM high school. Other ISHSs focus on engineering or medical/health careers, use project-based learning to foster integrated STEM knowledge and skills, or involve students in college-level STEM through early college experiences. It is important to note that all of the schools in the OSPri study had much in common as alternative schools that are designed to challenge students and create opportunity structures in STEM that might not otherwise be available to them. Crucially, these ISHSs provide STEM opportunity to learn by requiring all students to take a college preparatory STEM sequence in science and mathematics, which is perhaps the single biggest predictor of success in STEM in college (Wang, 2013). ISHSs also build opportunity structures for students through a wide range of related educational experiences that occur outside of the normal school day, week or year. These experiences can help scaffold student success in college and beyond, preparing students socially (by providing opportunities for interactions with like-minded peers and adults who share similar interests); emotionally (by providing challenging, yet confidence-building, activities); and, experientially (by developing 21st century skills for college and for STEM careers.)

In building a logic model to explain findings in our study on ISHSs, we divided students’ developmental benchmarks for STEM schools into three sections, What Students Know, What Students Can Do, and Who Students Become (Lynch, et al., 2015). We identified conditions that schools can provide to ensure STEM support:

- **Content and Practice**: Strong STEM-focused curriculum and instruction that generate opportunities to create, collaborate,
communicate, and think critically. Students readily adopt technologies that expand how they approach learning or how they express their ideas and use them to organize their work with others;

- **Continuity and Meaning**: Providing continual STEM experiences outside of school that provide opportunities for learning through real-world activities and real-world problems. This connects content knowledge to real-life needs in communities and engages students as they learn to work with adults;

- **Efficacy Mindset**: Setting up ongoing opportunities to be successful in tasks and experiences, as well as opportunities to fail without thinking of themselves as failures. They should be able to access supports when they need help, but this should be viewed as normal rather than remedial; and,

- **STEM Social Capital**: Developing college savvy or the means to navigate the college admissions and financial-aid processes. Some ISHS students come from low-income families or are first-generation college goers. The ISHSs in our study provided increasingly focused college preparation experiences from 9th grade through graduation. Students and families understood what to expect at college and made plans that fit their goals and finances.

*What do you think are the most important issues in educational change today? What excites you about the educational change field today?*

The good news is that the educational change research community seems to come to some consensus about the attributes and character of effective and equitable schooling overall, as seen in the reform and change literature, and which we have reified in our study of ISHSs. Moreover, in the U.S., there has been a willingness to experiment with new types of schools in some municipalities and states. In some places, there is a well-developed process to evaluate and regulate charter schools. In others, whole school systems have initiated data-based school improvement agendas where learning communities are their central focus and where students’ lived experiences count (Bryk, 2015). New technologies are expanding student opportunity to learn, and it is heartening to see students liberated from a single classroom or teaching style, develop agency to learn online and from peer support groups, or engage in programs outside of regular school. Community colleges are going to play an important role in education change for many U.S. students.

Rather than seeing school as a set of Carnegie units for graduation, some policymakers, educators, and communities are beginning to see the potential for creating schools that build entire opportunity structures (incorporating school, higher education, and work.) They work closely with students, families, and communities to provide experiences that broaden students’ sense of possibility and give them the agency to find pathways that include higher education, careers, and hopeful futures (Hargreaves, et al., 2014). Equity is of increasing concern not only to educators and families, but also to government, business and industry, resulting in some renewed unification of purpose, and openness to change.

However, I worry most about the immediate effects of the last U.S. presidential election and the politicization of school change. For example, “school choice” could easily become a polarizing issue down party lines if it is associated only with dog-eat-dog, free market capitalism, or the intent to dismantle the public school system and destroy a public good. I would prefer to see school choice employed carefully to create more racially/ethnically and socioeconomically integrated schools (c.f., Orfield & Frankenberger, 2013) and to develop new kinds of schools and innovative learning environments that expand students’ opportunity structures. This would require a system where researchers are involved in school
change or where innovations at the school level are carefully studied and evaluated. Thus, stories of successful schools could be shared, as they were in this study of ISHS's. As new schools or school change at the district level are better understood, the chances for improving how students learn in schools may increase. Such schools should reflect the diversity of students in our society, as well as provide 21st century needs and skills.

References


Lynch, S.J. (2015, July 14). Science for all: A new breed of schools is closing achievement gaps among students and may hold the key to a revitalized 21st-century workforce. Scientific American, 301(2). This article is from the In-Depth Report Building the 21st-Century Learner. See: http://www.scientificamerican.com/article/science-for-all/


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