Photo: Deaf Kids Code

Set a Place at the STEM Table for Youth with Disabilities and their Families

Linda Kekelis, PhD

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> *Sometimes it is the people that no one imagines anything of who do the things no one can imagine.*
>
> Shireen Hafeez,
> Founder of Deaf Kids Code[1]

How can we make sure that kids who are deaf, visually impaired, or physically disabled have the chance to imagine and create a bright future with science, technology, engineering, and mathematics (STEM)? Youth with disabilities hold potential to be productive and creative adults, and yet they are less likely to go to college and less likely to live independently than their peers without disabilities. It's not because of their disability, but often because of the expectations and opportunities afforded to them.[2] STEM can provide the means to master skills and develop confidence and perseverance that make possible a fulfilling life.

STEM in Out-of-School Time: Missed Opportunities for Some

Afterschool and summer programs provide many positive impacts as a result of hands-on engagement in safe spaces with caring adults and supportive peers. They increase interest and confidence in STEM and introduce a wide range of career pathways.[3] For youth with disabilities these programs can be especially important. Rather than sitting on the sidelines as they sometimes do in their mainstreamed classrooms, youth with disabilities may experience more hands-on STEM and meet role models in afterschool and summer programs.[4] Role models can dispel stereotypes and shine a light on the possibilities and the accommodations that can transform an interest into a career possibility.

Unfortunately, there are few out-of-school-time STEM programs for youth with disabilities.[5] And, there are even fewer programs that support family engagement for these youth and their parents. What prevents youth with disabilities, particularly more significant disabilities, from participating in out-of-school-time programs? Barriers include separate classes and school placements, inadequate teacher preparation, lack of transportation, and limited parent involvement.[6] These challenges can be overcome with vision and policies for inclusion and resources. For example, afterschool and summer programs can be linked with the individualized education plan (IEP) for youth with disabilities.[7] Leadership of STEM programs can provide training and resources that support inclusion in their programs, and families can be empowered to advocate for these programs.

STEM Empowers at the California School for the Blind

I learned firsthand of the impact of STEM programs for youth who are disabled. As founder of Techbridge Girls, I helped design and support afterschool programs for girls in Oakland, CA. As I considered where to expand the program, I reflected on the power of hands-on experiences in empowering youth who are constrained by factors like gender, race, and class. What about ability? I had a research background in Special Education but was not aware of STEM programs for kids with disabilities. Why not bring Techbridge Girls to the California School for the Blind? The administration, staff, students, and parents were on board and excited to participate.

With projects that involved soldering irons, working with tiny screws, using power tools, and other activities that seemed reliant on vision, I confess that I wasn't certain how we would adapt our curriculum for students at the California School for the Blind. I soon learned that we didn't need to have the answers. We learned from and with the students and teachers.

We asked the students and teachers at the start what they wanted to do; we hadn't expected that their interests would be just like those of the kids and partners in our other programs. They wanted to do hands-on projects and go on field trips. Together, we made STEM accessible, introduced curriculum and role models that challenged stereotypes, and most importantly broadened the idea of what was possible for youth who were blind and visually impaired. Dissecting cow eyes and going on a Challenger Space Mission at Chabot Space & Science Center were two favorite experiences. With support from the Mitsubishi Electric America Foundation, we developed new projects and wrote curriculum, which is available in Explore it Afterschool! Technology and Science for Students with Visual Impairments.[8]

Photo Courtesy Chabot Space & Science Center

Making Connections to Careers

Career exploration was as important as engaging in STEM activities. I learned this lesson during an early visit when I posed the question, "What do you want to be when you grow up?" As we went around the circle, I was surprised by how many in the group didn't have an answer. I asked this question many times in many programs—at Techbridge Girls and other out-of-school-time programs across the country. Most kids—even those in elementary school—are eager to share aspirations that might be fanciful (princess or superhero) or complicated (a game designer, chef, and basketball star) or seriously focused (medical doctor who will find a cure for breast cancer to help a family member). These career goals might change many times or persist throughout childhood; what they offer is direction in what to study and motivation to persevere through challenges.

Career dreams come from movies, TV, books, games, and role models. Career goals also come from input from parents, teachers, and peers. For kids without disabilities, careers that connect to interests and talents are proposed. For students at the California School for the Blind, careers were suggested by family members that seemed suitable for a person who is visually impaired. For instance, students were encouraged by family members to consider careers as transcribers or teachers for the visually impaired. When one student expressed interest in marine biology, she was advised that it wouldn't be possible because she was blind. The adults in her life weren't trying to limit her aspirations. They just couldn't imagine a career in STEM for her. How many persons with a visual impairment have you met or seen portrayed in a movie or book who was a marine biologist, chemist, or engineer? While we didn't know of any when we launched Techbridge Girls at the California School for the Blind, in time we discovered there are successful persons who are blind working in chemistry, biology, and engineering.[9] We made it a priority to introduce our students to these role models.

It is exciting to note that the California School for the Blind has taken great strides over the years to support career exploration and promote STEM education. Its offerings during the school year and summer include classes in robotics and coding, workshops in media and storytelling, and field trips to NASA Ames Research Center and the San Francisco 49ers STEM Education Program.

The Missed Opportunity: Family Engagement

While I am proud of the work that Techbridge Girls accomplished in partnership with the teachers and students at the California School for the Blind, I have one regret. I wish we had engaged more with the students' families. As a residential program we didn't have direct interaction with families. The students lived on campus during the week and returned home to their families across the state on the weekends. At the time, I had a narrow vision of family engagement—family STEM events held at schools at the end of the school year. If I had a do-over I would explore other ways to connect with families who couldn't come to an event, but who could have engaged in STEM experiences. Now I have lots of ideas, in part based upon what I've learned from programs across the country that are reimagining family engagement in their communities in innovative ways. We could have provided take-home activities for the students to share with their families. We could have shared a curated set of resources including books and websites related to the STEM projects completed by the students. We could have used books and videos to introduce role models who were blind or visually impaired studying and working in STEM fields. We could have sent home questions for kids to ask their parents and for parents to ask their kids about STEM careers. And importantly, we could have asked what the families were interested in and responded to their interests. I hope that my lesson learned will help you.

Deaf Kids Code Imagines and Creates Opportunities in Tech

Technology could be the great equalizer for persons with disabilities. But it's not. Not yet. Shireen Hafeez, founder of Deaf Kids Code, is working to change that. Over 1 million jobs are projected to require computing expertise by 2020. Hafeez sees the opportunity in this projection and believes that the digital age can be the great equalizer for the deaf and hard of hearing. Coding languages are universal and visual, which allows one to have an equal voice and participation in the world. One in eight people in the U.S. 12 years and older has hearing loss, so the potential for her work is considerable.[10] As Hafeez points out, deafness spans across races and gender, faiths, national origin, and sexual orientation.

Hafeez started the work based on personal experience. As the mother of a deaf son, she evolved from being a parent advocating for hearing aids for her son to leading a nonprofit with an audacious goal--improving inclusion and empowering students who are deaf and hard of hearing both socially and economically. Her local grassroots effort has developed into a high-demand organization that promotes computer science and design thinking through project-based learning. Workshops are offered for kids in
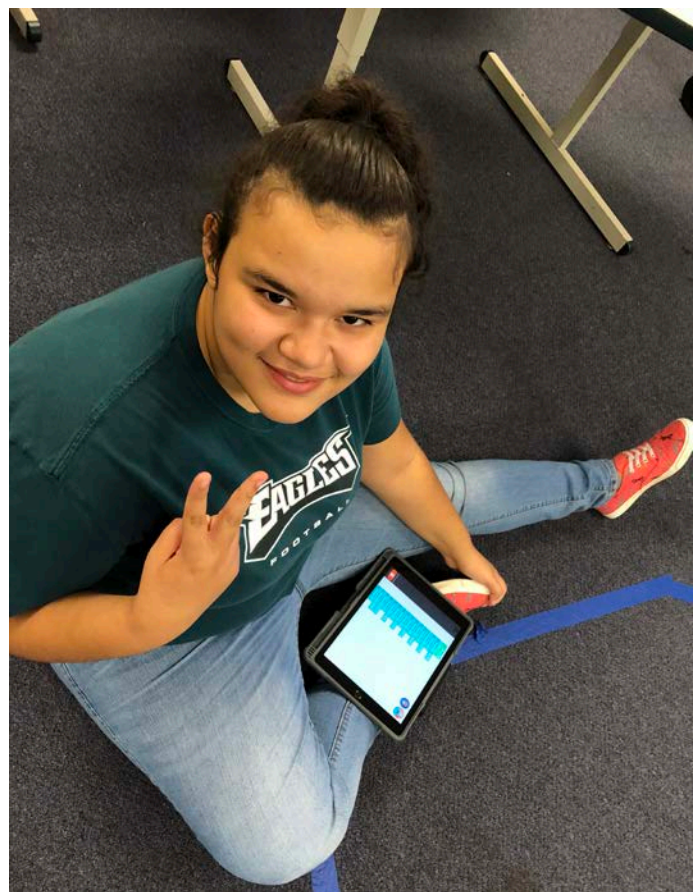

Photo Courtesy Deaf Kids Code

middle school and the work is supported with grant funding and technology from Dell Youth Learning partner.

While efforts by Code.org have made coding into a big, bold movement, less than one percent of students with hearing loss that Hafeez works with have prior experience with computers. This doesn't stop or discourage Hafeez. "Lack of prior experience doesn't hinder a kid's ability to learn code, and neither does being deaf," Hafeez says. "In fact, deaf and hard-of-hearing children can excel at coding by leveraging the skills they use to tackle daily challenges. Our children are natural innovators, problem solvers, and visionaries because they are navigating in a world that does not bend towards inclusion or accessibility. Because of their ability to function on those levels, they are natural creative thinkers."[11]

In the workshops, students learn to code and make something useful from recycled materials. What start out as random items – like berry cartons and cereal boxes – become programmable creations. The kids receive tutorials on hardware and use Blockly programming languages to create complex command sequences for their creations. Their hearing impairment offers a perspective and purpose for their work. For example, one youth created an accessible, flashing doorbell because he can't hear the doorbell. This is project-based learning at its best.

Invention: "That's the Magic"

Deaf Kids Code isn't just another program to learn coding languages. Hafeez stresses that the workshops are not a contest and the end-game isn't solely to teach coding. Rather they are about freedom of expression, creativity, and invention. She aims for life-changing impact by changing attitudes and sparking the innovative spirit. Hafeez notes, "I'm going to have them show me their greatness. I want to lift and ignite that sense of agency." She gives them freedom to create whatever they want and to power through the challenges along the way. She believes in their capacity for greatness which empowers them to see their own potential. "And that's the magic," Hafeez creates.

Imagining the Future: Gateway to Careers

Deaf Kids Code works to reduce the staggering statistic of unfulfilled potential. The program follows up on lessons in coding and presents job possibilities in technology with job shadows, field trips, and internships. The youth are encouraged to aspire boldly. Hafeez draws connections between what kids know and the possibilities for their future. "So, who uses Instagram? How many of you use Snapchat?"

> *Seventy percent of people who are deaf or hard of hearing are unemployed or underemployed.*[12]

Hafeez asks, "Who has more power in this world? A user of technology or a creator?" Hafeez doesn't just want the program to enable her students to do more with technology that's been created by others. She wants them to imagine breakthroughs and design new technology. She closes her workshops with these questions to youth, "The next time you interact with anything that's digital or uses technology, that uses electricity, anytime you play a game, anytime you're on the Internet and you're looking at a website I want you to think Why not me? Why can't I create something like that? Why can't I create something better than that?" The kids walk away from Deaf Kids Code inspired, and more confident. Following workshops, over 95 percent of attendees report they can see themselves in a STEM-based career and want to continue learning more coding.

Engaging with Parents

As the mother of a son who is deaf, Hafeez has credibility among the parents who bring their kids to Deaf Kids Code. At workshops, Hafeez explains to parents the "big picture" about Deaf Kids Code. It's more than just another coding program for their children. Her founder story describes her belief in deaf kids' ability to impact the world regardless of the challenges they may face. In fact, Hafeez explains to parents, "They may be better than anybody else because they are born into a world that doesn't bend towards their challenges. So, they're the ones that are having to be innovative and problem-solve in a world that doesn't lean towards natural accessibility."

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> Shireen Hafeez, Founder of Deaf Kids Code

With limited STEM options for their children, parents' value Deaf Kids Code; some drive three hours to bring their child to workshops. Hafeez recounts how one family purchased a modified computing kit and now their child helps with technical support in their small rural community which has limited resources. Hafeez acknowledges the importance of parents taking extraordinary measures to access STEM opportunities like Deaf Kids Code for their child. "It's just unbelievable. And this is a young kid - I think he's hardly 10, and that's just one of many, many examples of parent engagement, parent involvement." She also recognizes that there aren't enough opportunities for these families. Not yet.

What's Next for Deaf Kids Code?

Hafeez is growing an ecosystem for deaf students with online and project-based learning that will help them build their portfolios in middle school and high school. Hafeez is working with Purdue University's EPICS team to translate Khan Academy educational videos to American Sign Language. This will open learning opportunities to students who are deaf and thereby expand their access to careers in STEM. This work is intended to help address the unemployment gap for those who are deaf or hard of hearing. Hafeez sees this as a win-win opportunity tapping into a big source of diverse talent for tech jobs—youth who are deaf and hard of hearing. [13]

Call to Action: Make a Commitment

The need for STEM opportunities like those described in this case study far exceeds what is currently available for youth with disabilities and their families. There are few programs like Deaf Kids Code that are created especially for youth with disabilities. There are few organizations like

Photo Courtesy Deaf Kids Code

Techbridge Girls that adapt their STEM curriculum for youth who are blind and visually impaired. There need to be significantly more effort and resources devoted to making every STEM program accessible so that youth with disabilities and their parents feel welcome and successful.
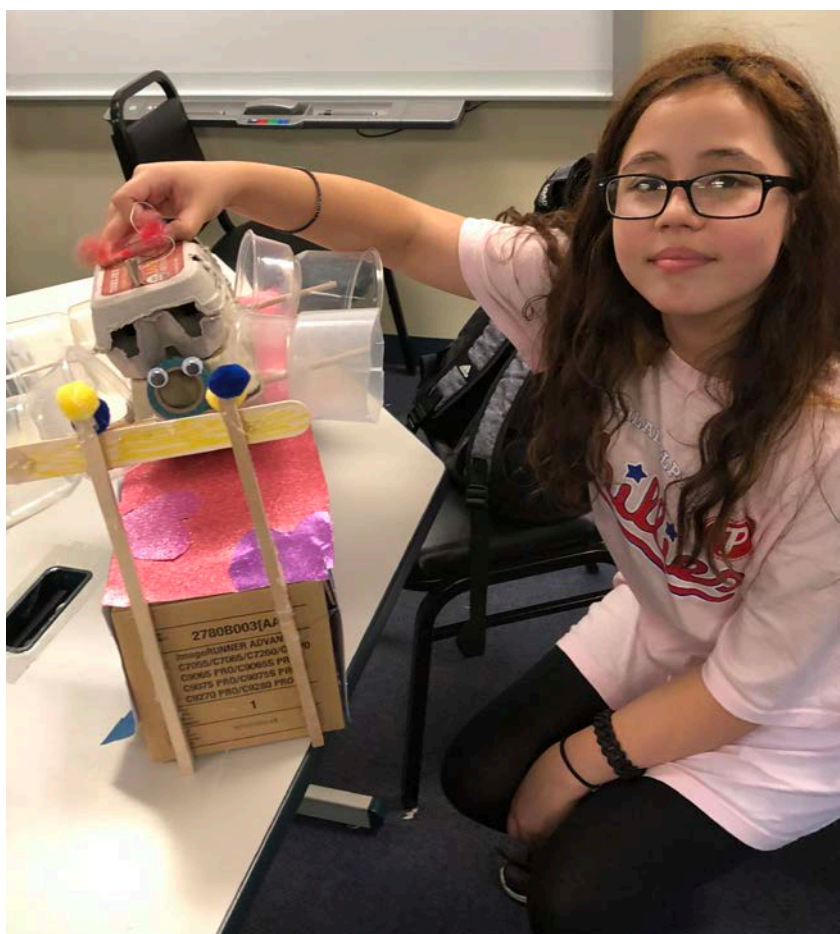
We all need to stand up and speak out for the inclusion of youth with disabilities and their families in STEM programs. STEM Next Opportunity Fund will elevate the critical need for funders, out-of-school-time providers, and industry to include accessibility strategies so ALL kids can participate in the STEM economy. Through case studies, social-media campaigns, and collaborations with STEM Next's partners, we will ensure accessibility is a priority in the STEM ecosystem. Which steps in this call to action will you take up?

01 ✔ **Make sure that children with disabilities and their parents feel welcome and supported in afterschool and summer STEM programs.** Personally encourage parents to enroll their child in STEM programs and invite youth with disabilities to check out activities. On program materials, include photos of youth with disabilities and language that explicitly welcomes all youth. Imagine the impact for youth with disabilities if national organizations and out-of-school-time networks across the country committed to these actions in STEM programs.

02 ☐ **Create new STEM curriculum with design principles that make activities and resources inclusive from the start.** Enlist support to revisit current curriculum and adapt it so that all youth can engage and all families feel welcome.

03 ☐ **Demonstrate commitment to this work by supporting professional development.** Staff are more likely to engage youth with disabilities in out-of-school-time STEM programs when they are confident and competent.

04 ☐ **Look deeply at who is included in research and reports on diversity in STEM programs in K-12 and in the workforce.** Make sure that youth and adults with disabilities are included and if they aren't, point out the omission.

05 ☐ **Demonstrate a commitment to STEM for all with funding that enables programs to make this work a priority.** Funding for curriculum development, professional development, staff time, and family engagement will help ensure accessibility.

06 ☐ **Celebrate and amplify the work of those who are embracing inclusion in STEM.** Use social media to share success stories and praise leaders and staff for the work.

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☐ **07** When invited to participate in a workshop, webinar, or panel, look to see that persons who can speak about the experiences of persons with disabilities are included. If they aren't, point out the omission and ask the organizers to include these perspectives.

☐ **08** Speak up for the needs of youth with disabilities as well as their families when policies for STEM programs are being decided. Commitment needs to be backed up with policy and resources, so inclusion isn't just a hope.

We can't leave it up to the parents of children with disabilities to advocate for access to STEM resources for their children and for programs for themselves. We all need to contribute to this work; everyone benefits when persons with different abilities are around the table. By participating together in STEM programs, youth with and without disabilities have the chance to get to know and appreciate similarities and differences. These positive experiences are important for parents too and help them see the possibilities for their child.

Resources for Inclusive STEM Programming

Here are resources to help support more inclusive STEM programming. These include professional development for staff, strategies for working with families, and examples of programs leading the way in STEM for all.

- **Kids Included Together** provides support and resources to serve students with disabilities and their families. Afterschool programs' staff are more confident and comfortable serving students of all abilities when they have training.

- The National Girls Collaborative Project has **a resource list** for helping make STEM programs inclusive for youth with disabilities. The list includes support for K-12, higher education, and careers.

- Girl Scouts offers **tips for fostering an inclusive troop culture** that can support out-of-school STEM programs. Strategies include making meeting places accessible, communicating frequently with parents, and being flexible with program structure.

- **This special article in Afterschool Matters** offers recommendations for professional development to support the inclusion of children with special needs in out-of-school-time STEM programs.

- **The Kinetic City Empower Project** is an American Association for the Advancement of Science (AAAS) initiative for more accessible STEM learning for youth with disabilities. The project uses universal design to adapt after-school STEM activities to improve their accessibility and to promote independence along with social and cognitive engagement.

- The **DO-IT (Disabilities, Opportunities, Internetworking, and Technology) Center** increases the participation of individuals with disabilities in academics and careers, especially in fields like STEM where they have been underrepresented.

- **PTA Special Education Toolkit** offers resources to support and empower parents.

Linda Kekelis, PhD, is a consultant with a longstanding commitment for ensuring that all youth, particularly girls and youth of color, have access to STEM opportunities. Family engagement has been a passion for Linda and at the center of the research and programs she has led. She is an advisor at STEM Next Opportunity Fund. lkekelis@gmail.com @LindaKekelis

We welcome your feedback on this case study.
Send us your comments and questions to info@stemnext.org.

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