The Digital Divide

Bringing Low-income Students to the Cutting Edge of Technology

by Katie Linek

On a beautiful Saturday morning during the summer, laughter and excitement echoed through the computer room at The Prospect, a Community Residential Resource Center (CRRC)* in the South Bronx, operated by the nonprofit organization Homes for the Homeless. This Saturday is the final day of Coding Made Easy, a program where volunteers from the organization New York Cares meet with children to help them learn the basics of coding. A handful of children click away at their computers as the volunteers answer questions and guide the children through a series of games that teach them the basics. As the children have fun, few of them realize just how important the skills they are gaining are for their future.

Modern technology is an integral part our daily lives. It has changed the way people live, work, learn, and play and is crucial for the progression of society. Unfortunately, this rapidly evolving world may be leaving low-income students behind.

Technology has been hailed as an equalizer of educational opportunity. Access to the Internet can change an underprivileged child's life by providing access to the same tools and resources as other students. That is, if his or her family can afford it. Access to technology costs money, putting a barrier between low-income students and success by creating a digital learning gap.

"The digital learning gap has three key factors," explains Jason Tomassini from Digital Promise, a national organization that works to improve the opportunity for all Americans to learn through technology and research. "First is access. Studies show that low-income households are less likely to have Internet access and technology at home, and low-income schools are less likely to have the types of Internet speeds and infrastructure that allow them to do truly interesting and effective teaching."

* CRRCs combine the basic services of a traditional homeless shelter with programs for families living in both the shelter and the surrounding neighborhood.

Low-income homes and schools are less likely to have the technology infrastructure needed to be effective in helping children learn. Digital Promise is a national organization working to improve the opportunity for all Americans to learn through technology and research. Photo courtesy of Digital Promise.

Low-income students often do not have the same access to technology as their more affluent peers—both at home and at school. The 2012 Pew Report "Digital Differences" found that in households with an income of $30,000 or less, only 62 percent of people used the Internet versus 90 percent of people in households making $50,000–74,999. According to the Census Bureau, one in four U.S. households do not have Internet access.

The Internet brings a world of information to the fingertips of low-income students, engaging and empowering them. That is why organizations such as EveryoneOn are working to change this limited access. EveryoneOn is a national nonprofit working to eliminate the digital divide by making high-speed, low-cost Internet service, computers, and free digital literacy courses accessible to all unconnected Americans. Through partnerships with local Internet service providers, they are able to offer free or low-cost Internet service in 48 states and the District of Columbia. Their Connect2Compete program provides Internet

and devices to students and families that qualify for the National School Lunch Program (often used as an indicator of low-income status).

At school, the digital divide continues. Many low-income schools do not have technology in the classrooms and some evidence suggests that schools in low-income neighborhoods that do have technology tend to use computers for drill and practice sessions rather than for creative or innovative projects. In a Pew survey of teachers, teachers of low-income students tended to report more obstacles to using educational technology effectively than their peers in more affluent schools. Among teachers in the highest income areas, 70 percent said their school gave them good support for incorporating technology into their teaching. Among teachers in the lowest income areas, that number was just 50 percent.

Many schools are now offsetting this lack of access with one-to-one laptop initiatives, which provide each student with their own laptop to use both in and out of school. Roanoke County Public Schools in Virginia was an early adopter of one-to-one digital learning, launching their laptop initiative in 2002. There, all high school students are provided with laptops, allowing teachers to integrate interactive lessons and personalize learning for each student. An important part of this program is empowering teachers to use the laptops in creative and innovative ways, with the support of an instructional technology resource teacher in every high school. Because of this innovative approach, Roanoke County Public School District is part of Digital Promise's League of Innovative Schools, an elite network of superintendents and district leaders leveraging technology to improve student outcomes.

A national research project on one-to-one computing found that schools that implemented these initiatives saw increased engagement in school work, improved academic performance, decreased dropout rates, and increased graduation rates. Another benefit of one-to-one laptop initiatives is that students may be the first in their families to have a laptop, and inevitably teach family members digital literacy skills.

While access to adequate equipment and reliable high-speed connections is a concern, improving the way that technology is employed in learning is even more important. "Another key factor of the digital learning gap is

There are three key factors to the digital learning gap: access, participation, and whether students are using technology powerfully. Photo courtesy of Digital Promise.

Girlstart participants consistently out-perform their peers on state-mandated math and science tests, and they enroll in advanced math and science courses and STEM electives at a significantly higher rate than their non-enrolled peers. Photo courtesy of Girlstart.

participation," says Tomassini. "Not only do you need the access, but students need to be supported and to know the best ways to participate in technology. Are students digitally responsible? Do they understand that there is a difference between using these tools for learning and using these tools for entertainment?"

When given access to technology, affluent children and low-income children use it differently. They select different programs and features, engage in different activities, and come away with different kinds of knowledge and experience. This may be due in part to the influence adults have on children's computer use. In one observational study, affluent children accessing the Internet were frequently accompanied by parents who asked and answered questions, made suggestions, and directed them away from games and toward educational opportunities. A majority of low-income children however, were observed accessing the Internet on their own. This resulted in affluent children reading more words, accessing more educational information, and feeling less frustrated when learning to use technology.

"The final factor is whether or not they are using the tools powerfully," says Tomassini. "Are teachers able to try completely new things and get results that would not otherwise be possible because they now have access to technology? That is where we want to make sure that low-income students and classrooms are getting to."

Tomassini continues, "We want them to have the same access to really interesting projects. We want them to be inspired—to be creative and creators of content, not just consumers of content. It is still necessary, even after you have provided the access, to make sure that we are not just putting devices in classrooms and calling it a day; that we are actually using it to really enhance learning for students that might not have a lot of really strong learning opportunities to begin with."

For Hire: One Million Tech Workers

Digital literacy is a commodity in today's workforce; basic computer skills are now a necessity in most jobs, as every industry grows more and more reliant on technology. The digital learning gap not only puts low-income students at a disadvantage in the workforce later on in life, it influences the careers that they choose. Low-income students are severely underrepresented in science, technology, engineering, and math (STEM) careers.

"Very often low-income students have all kinds of things stacked against them," says Claus von Zastrow, COO and director of research for Change the Equation, a non-profit initiative to improve STEM education in the United States. "On the one hand, they are less likely to have family members or direct role models who are STEM professionals. Very often they are in schools that are not as well equipped with STEM resources, they are much less likely to have teachers experienced in STEM, and the list goes on and on."

That is why The Saratoga, a CRRC operated by Homes for the Homeless in Jamaica, Queens, invited the Great Neck South High School Robotics Team to come visit students in The Saratoga's after-school program. Along with working as a team to research, design, and construct robots, the robotics team brings their enthusiasm for science and technology to younger students in

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the community. While at The Saratoga, the team spoke to the kids about robotics, demonstrated a robot they built, and then gave students a chance to control the robot themselves. Afterward, students had the opportunity to put what they had learned into action by building robots of their own.

"It is great when outside organizations come in and show the kids something they may not ever get to see," says Michael Fahy, administrator at The Saratoga. "Then we are able to follow it up on a smaller scale. It means a lot for a child to learn something here and then go to the outside community and say, 'I built a robot!'"

Another program, Austin, Texas-based Girlstart, works to increase girls' interest and engagement in STEM through innovative programs. In the 2012–13 school year, 68 percent of their participants were economically disadvantaged. Their after-school program reaches more than 1,300 4th–6th grade girls in high-need schools in Central Texas with free STEM education programs each week for two semesters. This after-school program encourages young women to believe in themselves and to pursue paths to higher education and greater career opportunities in STEM. Research shows that participants in Girlstart's after-school program consistently out-perform their peers on state-mandated math and science tests, and they enroll in advanced math and science courses and STEM electives at a significantly higher rate than their non-participant peers.

Girlstart meets Change the Equation's rigorous principles, gaining the program a spot in Change the Equation's searchable STEMworks database of in-school and out-of-school STEM learning programs that embody the best research on what works in STEM learning. Programs in STEMworks must demonstrate success in areas such as capacity to meet a critical need, sustainability, scalability, partnerships, and rigorous evaluation. In addition, programs must offer challenging STEM content, incorporate hands-on STEM practices, inspire interest in STEM, and address the needs of youth, such as girls and students of color, who are less likely to pursue STEM fields.

The best opportunities for low-income students lay in the STEM field. The Department of Commerce found that STEM workers earn 26 percent more in wages than comparable workers in non-STEM occupations. Not only that, but STEM is a rapidly growing field. A 2015 report from Change the Equation projects that between 2014 and 2024, the number of STEM jobs will grow 17 percent, as compared to 12 percent for non-STEM jobs. Among these STEM occupations, computer science is the only STEM field where there are more jobs than there are students coming into the field. In fact, computer science drives 60 percent of new jobs in STEM.

Moreover, the U.S. needs to find roughly one million more tech workers within the next five years, spurring an even greater drive to close the digital learning gap and inspire low-income students

to join the field. Currently, high-income, white males dominate the computer science field, however, dozens of schools, organizations, and politicians are joining the effort to change that.

Computer Science: Coming to a School Near You

Some suggest that low-income students are just not interested in computer science, but most students have not had any exposure to it. Only 10 percent of U.S. high schools offer it as a course and only nine states allow computer science to fill a math or science requirement—until now. In New York City, Mayor Bill de Blasio recently announced that all of the city's public schools would be required to offer computer science to all students. Chicago pledged to make computer science a graduation requirement by 2018 and to offer computer science to at least a quarter of elementary school children by then. In San Francisco, computer science is mandatory through the eighth grade. Various other schools in cities across the country have recognized the importance of computer science and have implemented their own programs.

In October 2015, The STEM Education Act was signed into law by the president, officially including computer science as a STEM subject and taking a major step toward including computer science in the curriculum of all U.S. schools.

Everyone Can Have a Superpower

Many organizations are reaching out to low-income children across the country and providing them an opportunity to change their lives. Programs like #YesWeCode aims to teach 100,000 low-income kids how to write code. Another program, Hack the Hood, introduces low-income youth of color to careers in tech

by hiring and training them to build websites for small businesses in their communities. Google's free program, CS First, increases student access to computer science education through after-school, in-school, and summer programs.

Code.org, a non-profit dedicated to expanding access to computer science, likens the skill to a superpower in their short film Code Stars. In it, Mark Zuckerberg, founder of Facebook, explains, "One of the biggest misconceptions about computer science and programming overall is that you have to learn this big body of information before you can do anything."

That is what each of these programs has in common—their effort to make computer science less intimidating and more approachable to those who previously thought it was out of their reach.

"It took me some time to realize that creating things with your hands, or creating code, creating programs, is just a different way to express creativity," says Elena Silenok, creator of Clothia.com, who was also featured in the short film.

At The Prospect in New York City, the children are using a curriculum from Code.org. Each child takes part in one of three courses based on their age and the difficulty level of the course.

"Code.org is a program online that basically helps teach kids the fundamentals of coding," explains Melissa Pallay, one of the New York Cares volunteers. "Essentially they complete different questions and programs and they go through different levels and exercises to teach them the fundamentals of programming, like loops and functions."

Similarly, the Massachusetts Institute of Technology (MIT) developed a new computer language to help facilitate that much-needed user-friendliness. Scratch is a visual drag-and-drop language that lets students program their own interactive stories, games, and animations. It is provided free of charge and is used by in-school, after-school, and shelter programs across the country to bring computer science to low-income students.

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"Using a set of about 100 commands that can be snapped together visually, you can create just about anything and learn the fundamentals of more advanced languages," said one teen about Scratch. In Code Stars, an elementary school teacher explains, "What I saw my students take away from using Scratch and programming in our classroom is that they are willing to push through problems. It really builds critical thinking. It builds problem solving. It is something that they can then apply to math in the classroom or reading skills."

From the White House to Your House

Even the White House has focused its efforts on this computer science push, recognizing that technology is an essential ingredient of economic growth and job creation.

"We should be making it easier and faster to turn new ideas into new jobs and new businesses," said President Obama in 2011. "And we should knock down any barriers that stand in the way. Because if we are going to create jobs now and in the future, we are going to have to out-build and out-educate and out-innovate every other country on Earth."

Bringing more diversity into the tech field can only serve to expand the talent pool and keep the U.S. on the cutting edge of innovation. Steve Wozniak, co-founder of Apple, recognized this fact when supporting the organization #YesWeCode. "Diversity brings so much more to the table, and by focusing outside of the usual and rewarding all sorts of people in tech, we can only make it better. #YesWeCode is doing exactly that."

In 2013, President Obama released a video kicking off the Hour of Code campaign, an online event organized by Code.org to promote Computer Science Education Week. The Hour of Code is a one-hour introduction to computer science, designed to demystify code and show that anyone can learn the basics. "Learning these skills is not just important for your future, it is important for our country's future," Obama said in the YouTube video. "If we want America to stay on the cutting edge, we need young Americans like you to master the tools and technology that will change the way we do just about everything."

He continues, "Do not just buy a new video game—make one. Do not just download the latest app—help design it. Do not just play on your phone—program it."

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In 2014, President Obama took it a step further when he became the first president to write a line of code. "Part of what we are realizing is that we are starting too late when it comes to making sure that our young people are familiar with not just how to play a video game, but how to create a video game," he said at the Hour of Code event. "One of the great things about America is that we invent and make stuff, not just use it."

Learning How to Think

Even if a career in computer science is not of interest, every American should gain a basic understanding of the subject. A general computer science curriculum largely consists of critical thinking, problem solving, and logic—skills that students will need in order to compete for the best jobs, whether or not they go into the tech field.

According to a 2015 report from Change the Equation, simply being able to use a smartphone or Facebook is not enough. To be successful in a global economy, children must become fluent in the technologies that are revolutionizing our lives and our work.

Nearly 40 homeless and at-risk children participated in Coding Made Easy at The Prospect. As they receive their certificates of completion, they all agree that they had fun and that coding was not so hard after all.

"Although only 10 percent of schools teach computer science classes, even one hour of exposure can be enough to change a student's life, as it did mine," said Code.org founder Hadi Partovi. "In the 21st century, this is not just a course you study to get a job in software—it is important to learn even if you want to be a nurse, a journalist, an accountant, a lawyer, or even a president."

There are numerous benefits to learning computer programming. It teaches problem solving and algorithmic thinking, it stimulates design and creativity, and it strengthens math and reading skills. Beyond that, learning how to code can increase confidence when using computers, instill courage to try new things, build perseverance when tackling difficult problems, and provide a sense of belonging in a field that plays an essential role in the 21st century.

In addition, computer programming provides children with a new tool to express themselves in ways they were once unable to. It is now part of general literacy; it is necessary to understand and communicate with the different technologies that run the world.

"Programming makes a really big difference in how you view the world and how you solve problems," says Pallay, the New York Cares volunteer at The Prospect. "I think kids and really anyone of any age can benefit from learning how to program. Getting them to do it at such a young age really sets them up for something great."

Mark Zuckerberg, founder of Facebook, a company that has revolutionized the way people interact online, had a private tutor as a child to help encourage his love of computers and went on to attend a prestigious school. Not every child has those same advantages. Imagine all of the children who could make a difference in the world if someone was there to encourage their love of computers.

The world is rapidly changing. If we want children to be successful when they leave school, we have to invest in preparing them for that change.

Nearly 40 homeless and at-risk children participated in Coding Made Easy at The Prospect, writing over 13,500 lines of code, proving that anyone can learn to code and have fun doing it. ■