Open Source Learning Tools Make STEM Possible in Underserved Schools

by Mark Barnett

One of the major obstacles to providing a rich STEM education program is the high cost of materials, equipment and technology. Many STEM focused high schools or STEM academies have invested thousands of dollars to provide students with high tech amenities, such as robots, tablets and 3D printers. Purchasing these materials is cost prohibitive in many school districts that are located in low-income areas. Students who are in at-risk situations are less likely to have opportunities to use high tech equipment found in STEM focused schools.

Luckily, there are many engineers, scientists and hackers who are dedicated to providing low cost, open source tools that can be used in education. The term open source refers to the idea that the design files and original code of a particular technology are available to see and reproduce. Open source tools also are usually available free of charge or available through a donation to the creators.

The power of open source tools and technologies allows a diverse group of people to contribute to making these technologies better. When a technology is open source, anyone can use it, edit it, make it better or create a different version of it.

There are quite a few open source tools and technologies that have become popular for their use in education.

The open source movement has even taken hold at the White House and the U.S. Department of Education. In 2015, the Department of Education, Office of Educational Technology started an initiative called GoOpen to promote the use of open education resources and open source tools (see http://tech.ed.gov/open-education). The Office of Educational Technology says that open education resources “increase equity, save money, keep content relevant and empower teachers.” There are currently 14 states that have taken on the initiative of encouraging their school districts to “GoOpen” and explore the use of open source resources and tools.

Open Source 3D Printing

3D printing in education has proven to be beneficial from the science and math classroom to the art and theater class. Students are using 3D printers to make learning come to life by making models, exploring architecture or designing prosthetics. Many traditional desktop 3D printers cost more than $3,000 and are expensive to maintain. This technology should be available for all students to use, but the price can be an issue for most schools.

Still, there are three open source manufacturers of 3D printers that I recommend for use in education. Each of these manufacturers offers education pricing and technical support for users: Printrbot (https://printrbot.com), Lulzbot (https://www.lulzbot.com), and Prusa Research (http://www.prusa3d.com).
Open Source Computers
The average cost for a student laptop ranges from $400 to $1,200, and many schools cannot afford for each student to have their own laptop. But there is a global open source manufacturer of a $35 computer called the Raspberry Pi that is being used in classrooms all over the world.

The Raspberry Pi Foundation (https://www.raspberrypi.org), which manufacturers the single board computer, is based in London and has been helping educators use their computers through a professional development series called Picademy.

Open Source Software
There are hundreds of open source software tools that can be used to replace expensive software from vendors, like Microsoft and Adobe. Libre Office is a popular open source replacement for the Microsoft Office Suite (see https://www.libreoffice.org).

Blender is another popular open source tool that can replace software like Adobe Photoshop and Illustrator (see https://www.blender.org).

Students can create their own games, stories and animations in a free-to-use, open source software called Scratch (https://scratch.mit.edu). Developed at MIT, Scratch brings the world of digital animation, coding and designing to an easy to use platform. Students from all over the world are using Scratch daily to create new projects.

These are just a few examples of open source software tools that are being used in classrooms in lieu of their expensive counter parts.

Open Source Textbooks and Resources
One of the most expensive costs that schools incur each year is the cost of textbooks and curricular resources. Paper-based textbooks often are old, worn and outdated. Web-based open source textbooks fall under the category of open educational resources (OER), which are freely accessible, openly licensed documents and media that are useful for teaching, learning, and assessing as well as for research purposes.

There are many providers of OER content, and the field is quickly growing. One the most popular resources to access OER content is through OER Commons (https://www.oercommons.org).

A proponent of OER content, First Lady Michelle Obama helped to release an Open eBooks app through the ConnectEd White House initiative that aims to provide OER content to Title I schools, military bases, special education programs and librarians. The app brings open content to device users with thousands of popular titles to choose from (http://openebooks.net/app.html).

Getting Started
Open source tools and open education resources can help to close the gap that exists between the availability of STEM resources at schools in underserved areas. One barrier to the adoption of these tools and resources is simply exposure and awareness. Many schools have never heard of open source tools or OER content, or are apprehensive to try them.

One way to get started with open source tools and OER content is to form a team at your school to investigate the use of these tools and practice using them with small groups of students. It also may be beneficial to form a professional learning community at your school and build a network of users, experts, researchers and educators who can help guide the process of adopting these tools and resources.

With the expansion of open source tools and OER content from the White House and globally, it is certain that you can expect to see more. If you or your school is interested in exploring or adopting these ideas, feel free to contact IDRA for more information.

Mark Barnett is IDRA’s chief IT strategist. Comments and questions may be directed to him via email at mark.barnett@idra.org.
Focus: Culture of Poverty vs. Culture of Possibility

Differences as Deficiencies – 
The Persistence of the 30 Million Word Gap

by Sofía Bahena, Ed.D.

In researching language development and acquisition, it is critical to value the unique assets that students bring to the classroom. Otherwise, research conclusions can lead to years of policy and practice that is ineffective or even detrimental to students and communities.

In a much-cited study, Hart & Risley (1995, 2003) introduced the so-called “word gap,” referring to one of their most popular conclusions in which they estimate that, by the time children enter school at age 3, there would be a 30 million gap in words heard, on average, between children of poor parents and children of professional parents. In their study, Hart & Risley observed 42 families from Kansas City, Mo., over the course of two and a half years for an hour each month. Thirteen of those families were considered to be of upper socio-economic status (SES), 10 families were middle SES, 13 families were lower SES, and six families were on welfare at the time of the study. Children were 7 months to 9 months old when the study began and were followed through the age of 3.

Hart & Risley contend that poverty has a deleterious impact on early vocabulary growth, the quality of verbal interactions, and subsequently on later educational outcomes. In more recent years, other researchers have explored similar questions of language acquisition by immigrant, low-income, families (e.g., Fernald, et al., 2013; Fuller, et al., 2015).

In the two decades since Hart & Risley’s original publication (1995), it has continued to receive mass media attention (e.g., Hotchkiss, 2015; Shenk, 2010; Sparks, 2015) and resulted in numerous local initiatives across the country (Hotchkiss, 2015; Pierce, 2016). Its findings have further been extrapolated to imply that this early “word gap” can have long-term educational implications, including success in high school (e.g., Bellafante, 2012).

Yet several experts in the education and linguistics field have raised concerns about the study’s measures, data collection, theoretical basis, conclusions, and sampling.

Critiques of the Hart & Risley Study – Vocabulary Measures

Critiques of the measures relate to the internal validity of the vocabulary measure and cultural blind spots in coding the data. In a review of their book, Nation (n.d.) argues that Hart & Risley use the quantity of language children are exposed to as a measure of the children’s vocabulary size. Yet, he continues, “Cumulative counting of word types in a series of limited language samples is not the way to measure vocabulary growth” (Nation, n.d.).

Dudley-Marling & Lucas (2009) similarly argue that inferring vocabulary size from the differences in language heard is overstated and unwarranted: “What is particularly striking about Hart & Risley’s data analysis is their willingness to make strong, evaluative claims about the quality of the language parents directed to their children” (p. 363).

Michaels (2013) points out that the six quality features used by Hart & Risley to code the data “have to do with politeness and cultural preferences, based on middle-class, academic researchers’ impressions that their features result in higher quality interactions” (p. 26). It is therefore unsurprising to find a relationship between socio-economic status and the “quality” of language used in the participants’ homes. Such coding ignores cultural differences.

Michaels further explains, “People from different cultures talk differently to infants, and no one approach has been shown to be cognitively superior to another in helping children acquire their native language or grow up to be smart” (Michaels, 2013, p. 29). Indeed, she continues, upper-class American families are unusual, (cont. on Page 4)
that early vocabulary size had a significant impact on later academic outcomes generally.

However, Michaels (2013) suggests that “there is no evidence that vocabulary size correlates with ability to reason with evidence, interpret others, or think abstractly” (p. 27). She further points out that Hart & Risley themselves find no correlations between language patterns and third grade academic outcomes in reading, writing, spelling, verbal and nonverbal reasoning, or IQ (see Hart & Risley, 1995, p. 161, 173) – only measures specifically related to language.

Critiques of the Hart & Risley Study – Sampling
Furthermore, the differences identified by Hart & Risley – findings that have sprouted the multiple initiatives, foundations and research – have been generalized to the overall low-income population based on the observation of only six families on welfare from Kansas City, all of whom were identified as Black.

As Dudley-Marling & Lucas (2009) point out from 2003 Census data, “Only 25 percent of the 33 million Americans living below the poverty line are Black” (p. 364). To say that this sample is representative of the general population living in poverty would be a gross overstatement.

Persistent Deficit Bias
So why have these findings remained popular despite scholarly critiques? Flores & Rosa (2015) propose the term raciolinguistic ideologies to describe the conflation of “certain racialized bodies with linguistic deficiency unrelated to any objective linguistic practices” (p. 150). In this way, even if unconscious, the bias of the researchers could have informed the conclusions of Hart & Risley’s findings, especially if there was no explicit introspective process to examine their own positionality.

Flores & Rosa explain that approaches to language education tend to position minoritized students’ language use and development as a “racial Other.” In the Hart & Risley study, there also is a conflation of race and class, given that all six families receiving welfare services were Black. These, then, are two layers of bias that further frame the study, and others like it, within a deficit framework that views minority and low-income families as lacking.

An Asset-Based Alternative
An alternative to a deficit perspective is an asset-based approach. Flores & Rosa (2015) note that the “goal of additive approaches is to valorize students’ diverse linguistic repertoires by positioning their skills in languages other than standard English as valuable classroom assets to be built on rather than handicaps to be overcome” (p. 153).

In an earlier post, Flores (2013) offers a language socialization framework as a way to compare the language differences – not deficiencies – across income levels. Instead of valuing one type of practice over another, the starting point thus focuses not on what needs to be “fixed” and instead on how to draw connections between students’ home language practices and what is needed to succeed in the school setting.

Dudley-Marling (2014) has expressed doubt in efficacy of scholarly critiques to temper the deficit language found in public rhetoric; instead, he proposes that scholarly work highlighting students’ competencies when “they are engaged in thoughtful, engaging curricula” – a “high-expectation curriculum” (Dudley-Marling & Michaels, 2012) – as a more effective way to counter deficit perspectives.

Access to high quality curriculum and acknowledging the “word wealth” found in minority and low-income communities (Orellana, 2015) is a more promising start to addressing the educational inequities found in U.S. public schools (Robledo Montecell & Goodman, 2010; Kamez, 2016).

Sofía Bahena, Ed.D., is an IDRA senior education associate. Comments and questions may be directed to her via email at sofia.bahena@idra.org.

See references for this article at www.idra.org/IDRA_NL_current/
Confusing Correlation with Causation

by Sofía Bahena, Ed.D.

It is common knowledge that correlation does not imply causation. Mark Wilson (2014) humorously illustrates this point in a series of graphs depicting near-perfect relationships, such as the one between the divorce rate in Maine and per capita consumption of margarine in the United States ($r=0.99$) (see more at Tyler Vigen, n.d.). By even the most conservative of standards, this correlation would be deemed statistically significant; however, one would not argue that eating more margarine causes divorce. Yet, researchers sometimes make similar conclusions that imply causal relationships when in fact they are only correlational (such as in the word gap premise discussed on Page 3).

Confirmation bias may partially explain why we are inclined to confuse correlation with causation. Psychologists have written extensively about this widespread tendency to interpret relationships in a way that aligns with our preexisting beliefs (Nickerson, 1998). Because we are all vulnerable to this bias, it is important for both producers and consumers of research to be aware of confirmation bias and how to avoid it. For example, we can do the following.

Explore our own lens. The term reflexivity refers to an introspective process in which researchers are “attentive to and conscious of the cultural, political, social, linguistic and ideological origins of one’s own perspective” (Patton, 2002, p. 65). Though reflexivity is a process generally practiced in qualitative research, it is useful for quantitative work as well. The way that statistical analyses are conducted and interpreted are just as informed by the quantitative researchers’ lens as is the work of an ethnographer. The same rationale follows for how readers respond to any given study’s findings.

Begin with a clear theoretical framework. In critiquing the perceived “language gap,” Dudley-Marling & Lucas (2009) warn against elevating method over theory, a process that ignores our innate biases and perspectives. They emphasize that “data collected by physical and social scientists only have meaning in the context of some theoretical framework” (p. 366). For this reason, it is important to draw from relevant research and begin with a strong theoretical foundation.

Theory is important in identifying the key research questions to ask, measures to collect, and hypothesizing relationships between variables of interest (Murnane & Willett, 2011). Likewise, when we read research, we must identify the theoretical foundation the authors are building on, testing or complicating.

Contextualize findings or conclusions. Though we may not be able to avoid confirmation bias completely, we can at least contextualize our findings or conclusions within our own lens and a broader theory. By simply acknowledging the ways in which our own perspectives influence our work and interpretations, we can better understand the relationships at hand and potentially discover new insights.

Causal inferences are justified, not by the strength of relationships, but by the design of the research study.

Resources
Six Students received prizes in a national competition among participants in the Coca-Cola Valued Youth Program, a nationally-recognized cross-age tutoring program of the Intercultural Development Research Association. Coca-Cola Valued Youth Program tutors wrote about how the program helped them do better in school and how they had helped their tutees to do better.

There were competitions at both the middle school and high school levels in the United States. Winners from each competition were awarded $200 for first place, $150 for second place and $100 for third place along with commemorative certificates and trophies.

First Place High School Winner
Stefan García
12th Grade, Odessa High School, Texas
In his essay, Stefan wrote: “The Coca-Cola Valued Youth Program has been mainly about being a leader. To be a leader you must guide, care and nurture the people you are leading... Some people just understand that being lost is so close to being found. The night is darkest just before the dawn. So when everything seems hopeless, faith is an essence. The level of faith in a leader will show just how much they are willing to do for the people they are guiding... Another point I wanted to make about being a great leader is that you not only help others with problems, you help build their courage, confidence, intelligence, and as a human being overall. The Coca-Cola Valued Youth Program opened my mind to better thinking. Also the program reminded me every day that time is limited, not only in class, but in life.”

Second Place High School Winner
Irma Tinoco
11th Grade, Odessa High School, Texas
Irma wrote in her essay: “The first day I met my kids [tutees], I was pretty excited. As the days went on, I started to get closer to them, and then I realized that I didn’t want to be a failure. These kids motivated me to push further in my education. When you have little ones who look up to you like you’re some kind of super hero, you don’t want to let them down. So every time I think about skipping, I think of how much I struggle in school, and I don’t want that for them.”

Third Place High School Winner
April Bermea
11th Grade, South San Antonio High School, Texas
“...I feel better about myself knowing I will walk the stage with my friends and graduate. I never felt so proud of myself and hearing my mom say, ‘Wow, my daughter is going to graduate!’ That makes me the happiest person. I wouldn’t change any of this experience. I just want to make my family proud of me.”

First Place Middle School Winner
Alexandra Sánchez
8th Grade, MS 331 The Bronx School of Young Leaders, New York City
In her essay, Alexandra wrote: “Everyone needs that person who supports them no matter what, no matter the circumstances. That supporter builds a confidence in a person. After a while, a person starts doing the stuff on their own. My tutees at first called me all the time to help them with questions. After a while of motivating them and telling them they could do it, they started believing they could too... I felt like I accomplished something... When I look back at this job, it won’t just be that I helped them with work, I helped them find the capability in themselves, even if they don’t fully understand it themselves.”

Second Place Middle School Winner
Mykel Jones
8th Grade, John Still K-8 School, Sacramento
Mykel wrote in his essay: “When I began middle school, I didn’t worry about much. It was okay to have one F and average grades. Most of the time, I wouldn’t participate in school... Without this job, I would have not gotten the inspiration to do great things. Now I am passing all my classes with A’s and B’s. I help my mom with anything she needs help with, and I am a more patient and understanding person. Also, I’m showing up to work right on time. I’m grateful to have this opportunity to be in the Coca-Cola Valued Youth Program.”

(cont. on Page 7)
Third Place Middle School Winner
Melakii Uribe
8th Grade, Robert C. Zamora Middle School, Texas

“This program changed my attitude because my attitude was negative in the beginning,” wrote Melakii. “I’ve started to respect people more. The students [tutees] taught me how to have confidence and how to make other people happy too. It also has helped me to be more respectful to my family and teachers and classmates. The Coca-Cola Valued Youth Program is a great program for kids who get in trouble, like me. I’ve been getting into trouble ever since I can remember. I am a different person when I am in class with my tutees. I am the one setting the example and helping them with work. I thought I wasn’t smart enough to help them, but now I know I am. In the end, I’m proud of what I’ve accomplished through this program. I thought I was tutoring and helping [my tutee], but, really, he was helping me.”

Honorable mentions were awarded to students in schools that submitted multiple student essays; these students had the highest score at their campus.

- Isabel Martínez, 10th Grade, South San Antonio High School, Texas
- Jessica Suchil, 12th Grade, Odessa High School, Texas
- Sabrina Alemán, 8th Grade, Dwight Middle School, San Antonio
- Lesly Barba, 7th Grade, César Chávez Middle School, La Joya, Texas
- Mirzi Cantú, 7th Grade, Dr. Javier Saenz Middle School, La Joya, Texas
- Mariah De Luna, 8th Grade, Zamora Middle School, San Antonio
- Brittney Fernández, 7th Grade, Irene M. Garcia Middle School, La Joya, Texas
- Shannon Holmes, 7th Grade, Carstens Elementary-Middle School, Detroit
- Jeffrey Rios, 8th Grade, New Open World Academy, Los Angeles
- Mabel Rivera, 8th Grade, MS 331 The Bronx School of Young Leaders, New York City
- Aria Russell, 8th Grade, John Still K-8 School, Sacramento
- Nikaulis Taveras, 8th Grade, Captain Manuel Rivera, Jr. PS/MS279, New York City
- Anai Treviño, 7th Grade, Domingo Treviño Middle School, La Joya, Texas

While not yet in middle school, fifth grade tutors in the Coca-Cola Valued Youth Program PS94 Kings College School in New York City wrote their own essays. Below are the top three scorers.

- First Place Elementary School - Abdul Abdulai
- Second Place Elementary School - Brian Martinez
- Third Place Elementary School - Skylah Nix

The Coca-Cola Valued Youth Program, created by IDRA, is an internationally-recognized cross-age tutoring program. Since its inception in 1984, the program has kept more than 33,600 students in school, young people who were previously at risk of dropping out. According to the Valued Youth creed, all students are valuable, none is expendable. The lives of more than 661,000 children, families and educators have been positively impacted by the program.

Aurelio M. Montemayor, M.Ed., Presents Bilingual Commencement Address

Aurelio M. Montemayor, M.Ed., IDRA senior education associate and lead trainer, was honored to present the commencement address for the PSJA College, Career and Technology Academy for the Pharr-San Juan-Alamo ISD in the Rio Grande Valley. In congratulating the graduates – in English and Spanish – he peered into their future saying:

“In spite of all the challenges, you will get the education you need. You will do it. You will survive and succeed. Why? Because you come from families that have worked hard for many years... tough labor, poorly paid, but they haven’t given up on you. In your own home, someone has done the cooking, the cleaning and even the nursing. How well has that been paid and yet how important is it to all of us? None of us should forget that blessed sweat and toil of our families. So go for it. It will pay off in many ways.”

[“Aunque habrían muchos retos como quien va a conseguir la educación que tú necesitas. Lo vas a hacer. Vas a sobrevivir y tener éxito. ¿Por qué? Porque procedes de familias que han trabajado duro durante muchos años ... trabajo duro, mal pagado pero nunca se han dado por vencidos en apoyarte. En tu propia casa, alguien ha cocinado, hecho la limpieza e incluso cuidado enfermos. ¿Qué tan bien se ha pagado y sin embargo que tan importante a sido para todos nosotros? Ninguno de nosotros debe olvidar ese bendito sudor y trabajo de nuestras familias. Así que dale con ganas. Te dará sus frutos en muchos maneras.”]
Focus: Culture of Poverty vs. Culture of Possibility

Subscribe Today!

Sign up for IDRA’s free email newsletters!
http://budurl.com/IDRAsubscribe

Get IDRA’s Classnotes Podcast via iTunes or online
http://www.idra.org/Podcasts/

Meet Mark Barnett, Chief IT Strategist

Mark Barnett leads IDRA in the area of technology implementation for both internal uses and externally for use by schools, libraries, museums and community centers. He has a deep interest in advocating for equal opportunity technology education and believes that access to the Internet should be a civil right. Mark also volunteers for several community organizations and spends time with his family. For the past four years, He has volunteered with FIRST Robotics in the Alamo region in mentoring teams, organizing events and judging competitions. The Alamo region of FIRST Robotics is home to over 300 teams from Austin to the Rio Grande Valley and supports teams from kindergarten through high school. Mark says that robotics is great way to form a community of support that makes math, science and engineering come to life.

For the past year, Mark also has volunteered at a local school that promotes peace through culture. He has served as director of education at the Circle School since 2015 and will lead the school through a national impact program called the Change Maker Schools where he will help each classroom facilitate a project aimed at learning about social justice and community service through year-long projects. Every Sunday, you can find Mark and his family in San Antonio serving food to the city’s homeless population through the local chapter of Food Not Bombs. He wants his children to know how to stand up for those in need and to advocate for those without a voice so that future generations can be prosperous and peaceful.

Assuring equal educational opportunity for every child through strong public schools that prepare all students to access and succeed in college