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ODYSSEY

The Influence, Impact, and Opportunity of Technology

GALLAUDET UNIVERSITY
LAURENT CLERC NATIONAL DEAF EDUCATION CENTER

ODYSSEY

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The Clerc Center, a federally funded national deaf education center, ensures that the diverse population of deaf and hard of hearing students (birth through age 21) in the nation are educated and empowered and have the linguistic competence to maximize their potential as productive and contributing members of society. This is accomplished through early access to and acquisition of language, excellence in teaching, family involvement, research, identification and implementation of best practices, collaboration, and information sharing among schools and programs across the nation.

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On the cover: *Technology has become a critical tool in the classroom, changing the way students learn and communicate as well as how educators present information, perform assessments, and document progress.*

We would like to thank all of our student and teacher models from the Clerc Center for their assistance in illustrating this issue and teacher Michelle Gough for the use of her photos.

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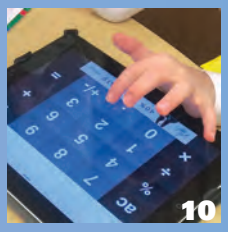

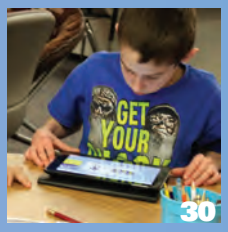

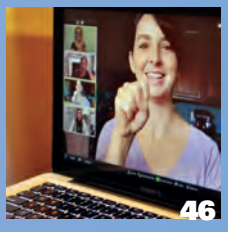

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CLERC CENTER

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CREATING CONNECTIONS AND SHARING RESOURCES FOR DEAF EDUCATION

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"Any sufficiently advanced technology is indistinguishable from magic."

~ Arthur C. Clarke

Technology is redefining education as never before. It does more than innovate communication and collaboration among parents, students, and teachers; it also allows us to reimagine deaf education and professional training opportunities. Never before has the pathway to learning and networking been so expansive that there is literally no limit to the impact we can make on deaf and hard of hearing children and ourselves.

As education is being redefined, so is our concept of technology. It was not long ago that the word invoked thoughts of steam-powered engines and rumbling locomotives, which characterize the era during which deaf education in America began. If those early educators could see the technologies that permeate and reinvent our everyday lives, they would—in the words of science fiction author Arthur C. Clarke—call us magicians.

It is vital to recognize that the evolution of technology over the past two centuries is also a celebration of milestones in communications and incredible legacies and connections in deaf education:

- In the 1830s, Samuel Morse invented the telegraph to develop a means of communication for his deaf wife; this connection with the Deaf community led to the donation of land that is today part of the Gallaudet University campus.
- The telephone emerged in the late 19th century, possibly with its genesis in providing another communication option to the Deaf community. This paved the way for TTYs and then videophones.
- In 1972, the National Captioning Institute conducted the first public demonstration of television captioning at Gallaudet University.
- The Internet, as ubiquitous as it is essential, was a project led by Vinton Cerf, who is hard of hearing.

Today, the gamut of our learning, training, and networking technologies is based on one or a combination of the above inventions and innovations. They include game-changers such as videoconferencing solutions, captioning technologies, assistive devices, and social media apps. The next big thing in deaf education will most likely be permutations, convergences, and enhancements of today's technologies.

Decades of experience have shown me that parents and teachers are themselves indistinguishable from magicians. However, whereas their many challenges are timeless, our classrooms and libraries today bear little resemblance to those of generations past. So how can technology help us as parents and professionals who work with deaf and hard of hearing children? How are tablets and apps, webinars, wearable gadgets, and other tools *tools*?

While magicians do not tell, parents and professionals know the value of information sharing. This issue of *Odyssey* presents stories of our interactions with technologies that are, at their root, stories of us. I am appreciative of the contributions of our authors and invite your comments at *Odyssey@gallaudet.edu*.

—Edward Bosso
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Captions, Whiteboards, Animation, and Videos: Technology Improves Access

By Jennifer S. Beal-Alvarez and Joanna E. Cannon

The field of deaf education lacks rigorous research that supports any singular instructional practice (Luckner, Sebold, Cooney, Young III, & Muir 2005/2006; Easterbrooks & Stephenson, 2012). However studies indicate that technology, frequently used during instruction with students who are deaf or hard of hearing (Easterbrooks, Stephenson, & Mertens, 2006; Kaplan, Mahshie, Moseley, Singer, & Winston, 1993), is motivating for students (Alessi & Trollip, 2001; Cannon, Fredrick, & Easterbrooks, 2010; Cannon, Easterbrooks, Gagné, & Beal-Alvarez, 2011; Nikolaraizi & Vekiri, 2012), and that it can facilitate student learning (Beal-Alvarez & Easterbrooks, 2013; Cannon et al., 2010; Cannon et al., 2011).

In a review of research-based studies, we found that most instruction in classes of deaf and hard of hearing students included use of multiple facets of technology (Beal-Alvarez & Cannon, 2014). This may be advantageous because technology allows a combined visual and verbal presentation of information, and this may strengthen students' processing and retention (Paivio, 1991, 2006; Sadoski & Paivio, 2004). We categorized these facets of technology as text, pictures, animation, and sign language (Beal-Alvarez & Cannon, 2014). Here is a look at how technology incorporates each of these within the classroom.

Text

C-Print, CART, Captioned Videos, Tablets, and Whiteboards

Text used to be exclusively encoded in print and paper; students read books and wrote on paper. Today writing enters the classroom in a variety of digital formats, and multiple studies have looked at its effects. For deaf and hard of hearing students, most digital text enters the classroom via captions. Captioning serves two purposes: it gives students access to

Photos by John T. Consoli and Michelle Gough

information, and it allows them to communicate. Studies indicate that when there is any kind of audio stimulus—whether through video or simply in the surrounding environment—deaf and hard of hearing students always prefer captions over no captions (Cambra, Silvestre, & Leal, 2008/2009; Lewis & Jackson, 2001). Students demonstrated no preference over how the captions were edited, but evidence indicates that expanded captions—showing definitions and labels for illustrations and maps—allowed better comprehension than captions that were simply the visual representation for spoken words (Anderson-Inman, Terrazas-Arellanes, & Slabin, 2009; Szarkowska, Krejtz, Klyszejko, & Wieczorek, 2011; Ward, Wang, Paul, & Loeterman, 2007).

C-Print, a system that captions spoken English through speech-to-text technology, was found to be more effective for comprehension at the middle school and high school levels—but not at the college level—than interpreters who used American Sign Language (ASL) (Stinson, Elliot, Kelly, & Liu, 2009). At the college level, studies show mixed results for student comprehension whether the information was presented through C-Print or CART, the predominate speech-to-text technologies of the classrooms, through interpretation via ASL, or through presentation of simultaneous speech-text translation and ASL interpretation (Marschark et al., 2006; Stinson et al., 2009).

However, students' comprehension may improve when captions appear at a slower rate and when students are provided with a printed transcript (Tyler et al., 2009). For students in middle school, 120 words per minute provided the optimal speed for comprehension; when captions appeared at the rate of 180 words per minute, the typical speed for adult viewers, comprehension declined (Tyler et al., 2009). Further, younger children may require captioning at rates of 60-90 words per minute for maximum comprehension (Deafness Forum of Australia, 2004).

Wireless technology enables the use of text through personal computers, tablets, iPads, class whiteboards, and Internet access. When paired with scaffolding software and teacher instruction, technology increased students'

engagement and performance in solving math problems (Liu, Chou, Liu, & Yang, 2006). In the Liu et al. (2006) study, teachers used technology to model the steps in solving math problems and to provide students with opportunities for practice and teacher feedback.

Text and Pictures

LanguageLinks

When software, embodied in the product LanguageLinks, was used in the classroom, elementary students' English language skills increased (Cannon et al., 2011). When LanguageLinks, which combined pictures, games, and text, presented sentences for which students selected the correct syntax, was used, students' grammar skills improved and their engagement in learning deepened (Cannon et al., 2011). Reading level predicted the rate of students' growth as they advanced through the software program; students who read at higher levels progressed at faster rates.

Animation

Baldi and Tetris®

Digital animation has come to the classroom, and animation has been used to increase students' vocabulary and thinking skills. Barker (2003) and Massaro and Light (2004) found that students were able to rapidly increase their vocabulary identification and production after working on speech skills by watching "Baldi," an animated avatar that modeled vocabulary articulation, and selecting corresponding words in print.

Similarly, students who used a 3-D reality version of Tetris to place shapes in designated spaces on the computer screen increased their cognitive skills by expanding their flexibility in thinking and pattern inference (Passig & Eden, 2000a, 2000b). This animation software permits students to look at items from different perspectives, which may increase their understanding and critical thinking skills. Further, students' ability to successfully participate in an animated game may promote motivation to stay on task.

Video and Sign Language

Improving Language Skills

Multiple studies have looked at video technology paired with embedded or live sign language as a way to increase students' vocabulary and comprehension. In some instances, sign language is included within the video and classroom teachers use sign language to elaborate on the material either before or during viewings.

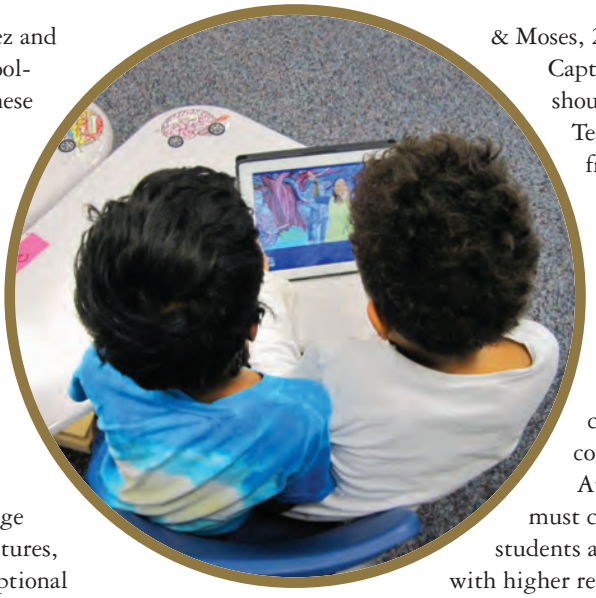
For example, in one study preschool students increased their literacy engagement, including signing and fingerspelling vocabulary, after repeated viewings of stories presented in sign language. The videos embedded a narrator who prompted students to sign along and provided wait time for students to do so before continuing, encouraging active participation (Golos, 2010). When teachers added live instruction to the viewings, stopping the video and prompting students to answer related questions, students' literacy behaviors and engagement increased further (Golos & Moses, 2011).

Similarly, teachers used repeated viewings of stories presented in sign language with both late elementary-aged (Cannon et al., 2010) and high school-aged (Guardino, Cannon, & Eberst, 2014) deaf students who had emergent literacy skills. Teachers combined pre-teaching math vocabulary with reading math storybooks and repeated viewings of the stories on screen, where the text was presented in sign language. In these studies, all students increased their ability to identify the targeted words.

Videos, paired with teacher and class discussion, have also aided in teaching ASL. Elementary students increased their use of classifiers—handshapes and movements that reflect physical attributes and motions of objects (Neidle, Kegl, MacLaughlin, Bahan, & Lee, 2000; Supalla, 1986)—when teachers used videotaped stories presented in sign language, stopping the video to identify and discuss the classifiers when they were used and prompting student discussion (Beal-Alvarez & Easterbrooks, 2013).

The Accessible Materials Project at the Atlanta Area School for the Deaf (AASD) developed videos that presented stories in two formats: an ASL format and a "connect-to-print" format with English-like signing presented with text on screen. An overview of the creation and availability of these and other

materials is provided in Beal-Alvarez and Huston (2014). According to a school-wide survey, AASD teachers used these sign language materials with students of all ages and within all content areas. Additionally, the videos were sent home with students to view with their families (Beal-Alvarez & Huston, 2014).



Using digital books, parents in Mueller and Hurtig's (2010) study increased their frequency of storybook reading with their pre-school children, and parents and children increased their sign language acquisition. The books included pictures, text, and sign narration as well as optional embedded questions. Comprehension can vary based on how the information is presented. For example, when students aged 9-18 years were presented with stories in four formats—print only, print and picture, print and sign language, and sign language only—the highest comprehension rates were in the print and picture format (Gentry, Chinn, & Moulton, 2004/2005). Further, when Reitsma (2009) compared student performance in two digital formats, he found students performed better when material was presented in print and pictures rather than in print and signs.

Finally, participation in Cornerstones™, an interactive curriculum that includes video-based stories with captions, interactive games, on-line hypertext books, story maps, graphic organizers, and clip art adaptions in ASL, Total Communication, Signing Exact English, and Cued Speech, increased word identification for most students aged 7-11 years (Wang & Paul, 2011).

Implications for Teachers

Technology and Teachers: Classroom Partners

Teachers need to be aware that the use of technology during their instructional time may be essential. (See Luft, Bonello, & Zirzow, 2009, for a technology abilities assessment.) Results of a collection of technology-based instructional studies support both the use of technology-based activities and the need for "in the flesh" teacher instruction. Teacher instruction paired with technology appears to be more effective than use of technology alone (Cannon et al., 2010; Golos, 2010; Golos & Moses, 2011).

Results of a collection of technology-based instructional studies support both the use of technology-based activities and the need for "in the flesh" teacher instruction.

Captioned materials and information should be included in every classroom. Teachers can expose students to text frequently by providing captions for instructional movies, morning announcements, and in-class video productions. Students can caption their own videos and use this activity to improve their skills in ASL and English. Finally, students can learn to self-advocate for the provision of captioning across instructional and community settings.

At the same time, however, teachers must consider the reading levels of their students and the speed of captions as students with higher reading levels read at faster rates. In addition, it is important to remember to allow time for students to process the information presented via captioning.

Teachers might administer both sign language and reading assessments (Beal-Alvarez, 2014) to ensure individual students receive effective technology-based presentations. Teachers should especially consider their instruction in:

- reading and comprehension of captions,
- using a sign language interpreter effectively, assisting students in apportioning their attention among technology components,
- matching individual students to the technologies that are most beneficial to them, and
- fostering students' ability to self-monitor their own comprehension of captions.

Recent educational legislation calls for evidence-based practices, meaning instructional practices that are supported by rigorous research (Common Core State Standards Initiative, 2010; Individuals with Disabilities Education Improvement Act, 2004; Institute of Education Sciences, 2013). Meaningfully incorporating technology and pairing it with in-the-flesh teacher explanation and class discussion improves learning.

Note: *Beal-Alvarez and Huston (2014) provide a detailed overview of the creation and availability of these materials. See also* www.facebook.com/accessiblematerialsproject *and* www.youtube.com/user/AMPresources.

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iPads for Access, Independence, and Achievement

By Victoria Bricker

Technology enables young deaf learners to take charge of their own learning and to succeed.

Zane, one of my ninth grade students, was having difficulty. He was a bright student who desired more than anything to fit in with his peers. When he was 2 years old, he became deaf from meningitis. He received a cochlear implant and his mom began working with therapists to teach Zane to hear and talk. I first met him when he was in fifth grade. With technology, Zane's hearing loss had been reduced to 40 dB, and our school district was providing him with a 504 plan that included preferential seating, teacher checks for understanding, captioned media, and use of an FM system.

I admired Zane. He tried hard and he exceled in his classes, partly as a result of being empowered by his parents' confidence that he would succeed in whatever he put his mind to. Throughout his elementary years, I worked with his teachers to ensure he had auditory access and was keeping up with class instruction. In sixth grade, Zane refused to use the FM system. Not wanting to be different from his classmates, he expressed dislike of having to cart the microphone from class to class. His parents supported his decision, and Zane rose to the challenge. He made good grades though it took extra focus and concentration. Zane had the drive and the desire to be independent and to do things on his own. I continued to admire him and his hard work.

When he entered high school, Zane enrolled in honors courses for all of his classes.

Photos courtesy of Victoria Bricker

Above and right: Photo of Zane in 2013; Zane and family friends relax at Island Rocks Beach in 2013.

The high school, a historic building with beautiful wooden floors, high ceilings, and tall windows, has architectural beauty but poor acoustics. After a month of classes, Zane, his parents, his teachers, his counselor, an assistant principal, and I discussed Zane's accommodations at a 504 meeting. We decided that Zane would be entitled to sit where he could hear the best, to ask clarifying questions to check for understanding, and to have all media captioned in the classroom. At the same time, his teachers would be required to repeat relevant student comments, to face the class when speaking, and to not speak while writing on the board.

After the first grading period, Zane was doing well in all of his classes except Algebra. In Algebra, he received a C. By this time, I knew that normally math was easy for Zane; something was awry. His family called a meeting to discuss Zane's needs in Algebra class. During the meeting, Zane stated that he was having difficulty hearing and understanding the instructor. I suggested giving the FM system another try—perhaps only in Algebra class? Zane was adamant in his refusal, and his parents supported this decision.

As we sat in the meeting, I reviewed his class notes. The notes showed that he was doing a fine job of copying the equations from the board, but the critical details about how to apply the equations were missing. Clearly Zane was missing key spoken instruction. He needed to watch the teacher while she spoke. This presented a potential problem as he acquires information through lipreading and he wasn't able to watch the teacher speak and write down instructions at the same time. When he was at home Zane had the equations, but he couldn't remember what the teacher had said—partly because he simply had not heard it.

At the meeting, Zane was given the option to meet with the math teacher outside of class. His parents and I, feeling this was not enough, began to explore other options. I recalled how in college I had used a handheld mini cassette recorder in lecture classes, but that seemed so outdated in today's technology. I met with the high school technology team to look at recording programs we could install on Zane's student-issued laptop. We found a

Above and right: Tobina, pictured here and with classmate Zyrique, is now able to independently complete classwork using an iPad.

recording and note-taking program that looked promising and had it installed. However, when after a week I checked with Zane, he reported that he could not use the program effectively. He was not proficient at typing so he was not able to type notes in real time, and the recorded audio did not match the text. Hand writing equations on paper and then trying to match them to the recording on the laptop after class was time-consuming and frustrating—and ultimately not successful.

It may not have been back to square one, but it sure felt like it. Then a week later Zane's mom called me. "An iPad!" she said. She had found something called SoundNote, an iPad app by David Estes (2014). Estes, describing SoundNote, noted that it allows students to type and draw while recording audio. "Just tap a word and SoundNote will jump right to that point in the audio," he explained. This sounded like a great idea, but it was 2012 and only 10 special education teachers had school-issued iPads. I was one of those staff members since I was participating in a pilot program to discover if this technology would even be useful in the school setting. I found the iPad to be a great educational device and could see the potential for students. Could we convince the school district to provide Zane with an iPad?

Our request, perhaps not surprisingly, was immediately turned down. It was too expensive, the Exceptional Children Department said. iPads had not yet proven to be a tool our school district would adopt for student use; further, schools just didn't buy computer devices for individual students. "We need data," I told Zane's mom, "and a trial session."

The school agreed. Zane has a wonderful grandmother who loaned him her iPad for a few weeks. Zane began using SoundNote, which allowed him to write equations and record the lecture in real time. To study, Zane would plug a patch cord directly from the iPad into his cochlear implant and touch an equation, and the teacher's lecture would pick up exactly at that spot. For the first time, Zane had access to the teacher's lecture; he could learn independently with a tap of his finger.

A few weeks passed. When it was time for his Algebra unit test, Zane had the tool he needed to achieve. He scored an A. We met with school officials to demonstrate Zane's improved educational outcome using the iPad with the SoundNote app. Zane spoke to the administrators, explaining how the iPad had provided him with access to his class and independence in his school work. He no longer had to rely on the teacher outside of class or on his classmates to get information. He could now handle his learning himself. Zane was nervous speaking in front of the administrators, but he demonstrated how he could write equations on the screen and play back the teachers' recorded lecture. He showed how he could move the recording to any part of the teacher's explanation with just the touch of his finger.

Zane's math teacher spoke, too, noting how much Zane had improved on homework assignments and quizzes and remarking that the improvement had occurred in such a short amount of time. After some deliberation and hesitancy, the decision was made: our school system would pilot a program for children with cochlear implants to have iPads in their classes. I was thrilled! Zane had opened the door for other deaf children to have the user-friendly technology we had been looking for; all of our deaf students would have iPads.

Our Classrooms Today

As an itinerant teacher of the deaf and hard of hearing, I work primarily with mainstreamed students ages 3-21, and I have seen technology open up possibilities that we never before dreamed these students might have. The iPad, with its array of technology, is now available for educational use in my school district. This device and its technology have enabled not only deaf students but also deaf students with disabilities to experience more independence and educational success.

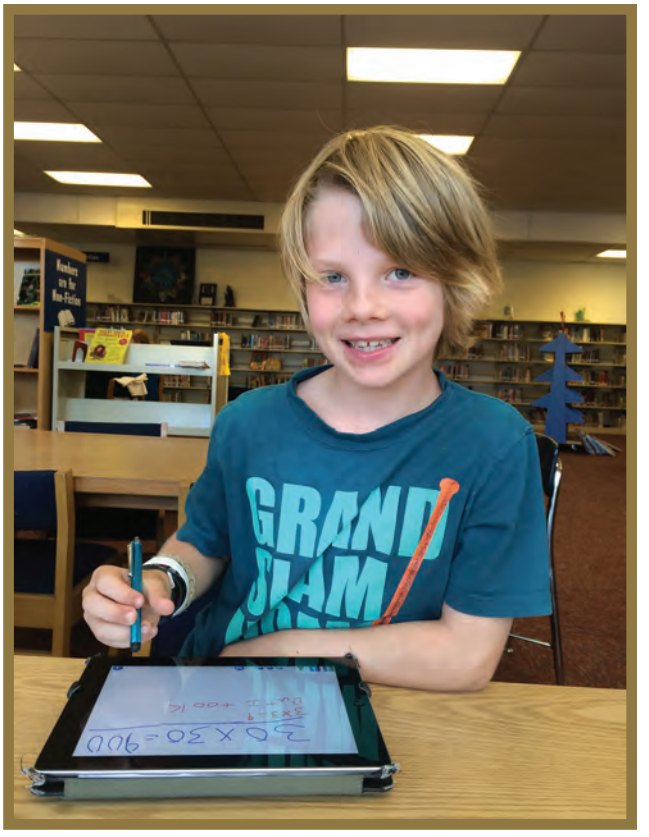
Tobina, for example, an 11-year-old girl who is deaf and has cerebral palsy with a language delay and physical motor challenges, was formerly dependent on others to assist her with access to learning and navigating educational tools. Reading books was difficult; it took effort to turn pages and she would drop the book, lose her place, tire out, and become extremely frustrated. The iPad has been invaluable for her as it allows her to download and read books on screen, turning pages with a simple swipe. In addition, a "Raz kids" app saves quiz data and allows Tobina's educational team to track and monitor her independent reading comprehension. When Tobina encounters an unknown word in text, she uses a dictionary app—or a picture dictionary app—to discover the word's meaning. A spelling app enables her to test when she is ready and allows her teacher to grade and to save the results. For math, she can use virtual counters, including an abacus app. Like Zane, Tobina can plug her cochlear implant into her iPad audio and work in the class alongside her peers without disturbing others. When she completes her assignment, she can e-mail her work to her teacher.

Access = Difference = Improvement

Access to instruction is key to students' success. Deaf and hard of hearing students who gain skills to become independent learners are better prepared to pursue higher-level education with confidence and to have independence in the work place environment (Anderson, 2014). As an itinerant educator, I work with students' teachers and parents—and teamwork is essential. We share ideas to benefit students along their journey of learning.

Since I am in a small school system—Asheville City Schools in Asheville, North Carolina—I work with 25 deaf and hard of hearing students who have Individualized Education Programs or 504 plans. Providing iPads to deaf and hard of hearing students in order for them to access curriculum and to foster academic independence started as a search to help a struggling ninth grade student. It was a journey that included the students' parents, our school system, and, perhaps most of all, the student himself. This endeavor led to discovering how iPads can be used in the classroom and was instrumental in making iPads an important part of our toolkit for engaging deaf and hard of hearing students in our school system.

Today's deaf and hard of hearing students are pioneers, showing adults what they can do independently when given the technology that provides them with access to learning. With high expectations from their parents and teachers and today's technology in place for meaningful educational use, these students will be ready for college and careers.



Above: Winslow learned how to write with a stylus in order to use the SoundNote iPad app.

Winslow, a deaf fourth grader who received a cochlear implant last summer, has become our most recent student to receive an iPad. He arrived at our school in November and has been practicing ever since. I know Winslow, Tobina, Zane, and other deaf and hard of hearing students will be equipped to go out into the world with greater knowledge and capabilities to be successful and independent thanks to all the people who work with, teach, and nurture them and who believe in their success—and thanks to the access provided by technology.

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Building Bridges, Robots, and High Expectations

By Fiona Bennie, Charlotte Corbett, and Angela Palo

Fiona Bennie, MS, Ed, earned her master's degree in deaf education from the University of Rochester/Rochester Institute of Technology. She has been teaching at the Horace Mann School for the Deaf (HMS), a Boston public school, for 10 years. She is the science coordinator for HMS and enjoys doing fun things like teaching and coordinating hands-on experiences for students.

Charlotte Corbett, MA, earned her master's degree in educational technology and leadership from George Washington University. She has taught technology-based classes with deaf and hard of hearing students for nine years at HMS. A child of deaf parents, she loves exploring the integration of language and technology.

Robots! They bring to mind the world of the future, in which the landscape is populated with autonomous walking, talking machines—machines known to our students as "transformers." At the Horace Mann School for the Deaf (HMS), the oldest public day school for deaf students in the United States, 40 of our students, almost half of the student body, participated in an after-school program where they not only imagined these machines but created them.

Originally a club, the Deaf Robotics Engineering And Math Team, or the DREAM Team, became an official school activity last year. All 20 of our HMS students in grades three through five participated as well as 20 more in grades six through eight. We met weekly for two hours after school for two months. During the first hour, we used a curriculum guide from Engineering is Elementary, an educational component of the Museum of Science, in Boston, to face the challenge of building bridge prototypes. During the second hour, students worked to develop their own LEGO robots with the goal of competing in the Boston Public Schools Robotic Olympics. During both hours, students explored activities related to science, technology, engineering, and math—the STEM areas that promise exciting possibilities for future careers.

One of the elementary students' tasks: to create and build a bridge prototype and, as a separate challenge, construct functioning robots. The bridge was built over the course of several weeks as students learned about and engaged in the engineering design process. For both the bridge and the robot design challenges, students identified the problem; brainstormed solutions; planned, created, and tested a prototype; and then improved their original designs.

The elementary students also used LEGO NXT and WeDo LEGO kits to build and program robots to perform simple actions with gears and levers. For example, young computer programmers set and modified the rate at which the seesaw they built would rise and fall; similarly, those who used LEGO to create monkeys could set up a drum for their monkey to bang and control how rapidly the monkey would bang it. The Mindstorms NXT kit allowed older students to build more complicated devices. For example, students built one device in

Photos courtesy of Fiona Bennie, Charlotte Corbett, and Angela Palo

which a sensor could distinguish colors.

Both challenges required students to follow and create diagrams and engage in the engineering design process. At the same time, as they worked together they developed skills in what we call the five C's:

- communication
- collaboration
- critical thinking
- cooperation
- creative problem solving

The program allowed students to put the five C's into practice.

Building Bridges

Learning Through Narrative, Teamwork, and Hands-on Creation

The elementary students engaged in engineering through *To Get to the Other Side: Designing Bridges*, from the curriculum developed by the Museum of Science. We selected this unit because of its use of personal narrative. Research indicates that personal narratives may help students who are from minority affiliations "to identify with or apply themselves to more technical studies or the physical sciences" (Cunningham & Lachapelle, 2014). In our narrative, the main character,

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Javier, builds a bridge to get to his island where he maintains a play fort. We saw Javier's blended family and Salvadoran culture as an added plus.

Using what they learned about bridges and the engineering design process in reading about Javier, students explored how forces act on different structures, including beams, arches, and suspension bridges. Students worked in teams to think critically, discuss their ideas, and design and construct their own bridge prototypes. When they were finished, HMS held an engineering expo. This allowed students to share their work with—and show it off to—the rest of the school.

Robotics

Competing Citywide

When the students began work on making robots, experimental play was part of the instructional design, and students freely explored their LEGO Mindstorms NXT kits and their programming potential. Once one student mastered a particular programming trick, he or she was quick to share the new skill with other.

We knew that we wanted the students to compete in the annual Boston Public Schools Robotic Olympics so we had them construct robots based on themes from the competition. Students picked their Olympic challenge and worked in teams on designs and prototypes.

Students found that most of the designs they developed initially would not quite work and required additional tinkering. For example, the line-following robot could turn left but not right. Students analyzed this. They figured out what worked, what didn't work, and how their robots could be better designed just like professional engineers would. We worked with the students to help them understand that valuing failure builds the determination, the "grit," that allows them to make the most of their education. We took heart from Cunningham and Lachapelle's (2014) statement that "A student doesn't fail; a particular design fails" (p. 125). Understanding that learning means taking risks empowers students to make changes, to keep thinking, and to keep trying. It fosters an attitude and a mindset that is valuable throughout life.

In the end, we were pleased and proud of our students, the robots they developed, and their performance in the citywide Olympics. In fact, several of our students won Olympic awards:

- **Muna Abanoor**, a third grader, and **Janelys Rodriquez**, a fifth grader, placed second in what turned out to be the most popular event of the competition, the "Freedom Trail." In this category, students designed robots that advanced along a blue line, as do Boston visitors who follow the Freedom Trail, a path of bricks that winds through the historical sites of America's founding.

After-School Engineering and Robotics Support Students' Learning

Here are just a few of the standards that we address in our after-school program.

NGSS: Engineering and Design Standards

Elementary School Level

3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Middle School Level

MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

CCSS
RST.6-8.9
Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

- **Mohamed Abanoor** and **Andy Chow**, seventh graders, placed third. Everyone enjoyed their entry in the "Boston Tea Party" event, in which student-designed robots pushed miniature boxes of tea over the edge of a 15" boat without allowing the robot to fall over the edge, too.
- **Shawne Johnson**, a third grader, won first place in the "Fenway Park Challenge." He designed a robot that swung and hit a miniature baseball, and it rose the highest of all up the Green Monster, the famous wall in Fenway Park.

Seeing their work, Jeremiah Ford, our principal/headmaster, was impressed. "I just hope that they don't replace me with a computer," he chuckled. Ford noted that education in STEM at HMS allows our students to look at engineering as a solution-based tool; further, it brings equality and opportunity to our deaf and hard of hearing students.

The STEM Future

On Our Screen

The STEM program is underway this year and will continue at HMS. Each year the theme will be different and the program will focus on a different engineering challenge. This year students are working as ocean engineers, designing underwater submersibles. In upcoming years, the program will include engineering challenges in the environmental and biomedical fields. Students who attend HMS will have three years of experience in STEM studies.

Our goal is that they gain knowledge and skills in STEM fields, develop skills in communication and teamwork, and develop a broader understanding of engineering careers. Participation in this program allows students to excel at academically rigorous

tasks, feel a sense of accomplishment, and experience the camaraderie that comes with being part of a team. We hope these experiences will ignite a passion and confidence in more of our students to pursue a profession in STEM. We expect to see them thrive.

For more information, visit *www.eie.org/eie-curricul um/engineering-design-process*.

The teachers and staff at HMS extend their deepest thanks to the following organizations and individuals without which/whom our program would not have been possible: Amelia Peabody Foundation, Boston Public Schools, Machine Science, Raytheon, TechBoston, Randee Pascall-Speights, Elsa Herrera, Kristin Osborne, Jeremiah Ford, Jeremy Ford, Melissa Chiet, Violeta Calderon, and Maximo Moya.

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Doing Engineering—

A BLUEPRINT FOR THE CLASSROOM

While every design process is different, our students followed the steps developed by the Engineering is Elementary Project of the National Center for Technological Literacy at the Museum of Science in Boston. Using their engineering design process, we challenged students to:

- **Ask:** First, the students defined the problem. They discussed how others had approached it. They discussed the constraints of their solution. They brainstormed and researched, working together as a team.
- **Imagine:** Once they realized that there were multiple ways to solve a problem, the students shared their ideas with each other, explored the ramifications of each possibility, and selected the best one.
- **Plan:** After selecting their design, the students, like their professional counterparts, developed diagrams, made a list of materials, and planned their prototypes (i.e., robots and bridges).
- **Create:** As their projects moved from conception, to design, to reality, the students put together their robots and their bridge prototypes.
- **Improve:** The students were encouraged to critique their final products. What worked? What didn't? How could their designs be improved?

This model—really a listing of the philosophical underpinnings of the work we do in the classroom—is critical because the cycle is followed not only by students in classrooms but by scientists and engineers every day on the job throughout the world. Experience with this process provides students not only with a blueprint for their work in the classroom but for their professional lives as well.

More information about the Engineering is Elementary Project can be found at *http://eie.org/overview/engineering-design-process*.

A Closer Look: Measuring Program Impact

By Fiona Bennie, Charlotte Corbett, and Angela Palo

In order to measure the impact of our after-school engineering experiences, we tested our elementary students before and after they participated in the program—and testing revealed that our students improved their attitudes about engineering and understanding of what it meant to be an engineer. Further, the girls changed their attitudes most dramatically, from a negative perception to a positive perception. Classroom observations and students' engineering notebooks showed that students also improved their engineering vocabularies in both English and American Sign Language (ASL).

ENGINEERING CONCEPTS

Our elementary students demonstrated a stronger understanding of engineering; they showed increased knowledge that creativity and math are important aspects of an engineer's work. Replying positively to phrases such as "writing reports for other engineers is important," students showed an improved understanding that communication is critical. Having used engineering notebooks throughout the project, students recognized that writing, organizing, and communicating ideas were highly important to the engineering design process.

GENDER DIFFERENCES

Remarkably, prior to entering the program, gender differences in attitudes toward technology and engineering between male and female students were significant. The pre-test showed girls' interest in professions in science, technology, engineering, and math—the STEM professions—began decreasing as early as second grade. By third grade, a significant gap had developed as girls showed far less interest in engineering than boys.

After their experience with the DREAM Team, the girls who took the post-test showed that this gap was reduced; there was significant improvement in girls' attitudes toward engineering as a field of study. On 14 of the 15 attitudinal measures, girls showed increased interest in and appreciation for engineering. After participating on the DREAM Team, ratings for girls shot up on statements such as:

"I would enjoy being an engineer when I grow up."

"I would like a job where I could invent things."

"Engineers help make people's lives better as part of their job."

INCLUSION OF DEAF ROLE MODELS

A critical benefit of the program was the inclusion of deaf adult role models and partners. These role models—Randee Pascall-Speights, Elsa Herrera, and Kristin Osborne—explained many of the concepts, including those implicit in the engineering design process, in clear academic ASL. A deaf high school student, Maximo Moya, served as a mentor for our middle school DREAM Team and also provided an ASL role model. This created a collaboration of teachers with expertise in content and deaf role models with expertise in ASL that supported student learning. The adults benefitted, too, as hearing teachers learned conceptually correct ASL and deaf mentors learned engineering principles.

By having sophisticated language users on staff, students became conversant in the vocabulary of engineering. Since students were introduced to appropriate vocabulary, they were able to clearly communicate. The sign vocabulary enabled them to better interpret both the two-dimensional diagrammatic representations and the three-dimensional LEGO parts of the robots they would build.

The modeling of academic ASL also increased students' understanding of the engineering storybook *To Get to the Other Side: Designing Bridges*, which students frequently referenced both while collaborating with each other and while recording ideas in their engineering design notebooks. Team leader Pascall-Speights read the text aloud in ASL to the elementary students. She used technical vocabulary, appropriate grammar, handshapes, and directionality to help students develop a deeper understanding of engineering concepts.

In summary, objective measures administered before and after the students participated in the program showed the following positive impacts:

- the experience helped all students better understand the field of engineering,
- participation enabled female students to feel more positive about engineering, and
- the deaf adult volunteers helped students develop academic vocabulary in ASL and English.

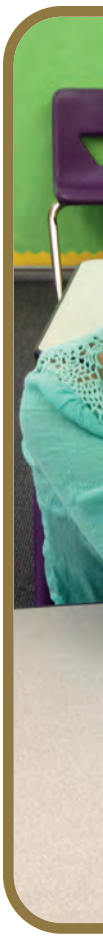
Subjective observations merit consideration as well. Teachers observed students working together, maintaining attention, and accepting suggestions from each other to develop new ways of looking at a problem.

Perhaps Maximo summarized best what the students learned, remarking, "There's never just one right answer or way of thinking about things. Being creative means thinking with an open mind. Looking at the world and imagining different possibilities is how to be a creative person."

Joey Baer, EdS, digital media technology education specialist, has worked as a social studies and instructional television teacher at the California School for the Deaf in Fremont for 21 years. With a master's degree in deaf education from San Jose State University and an education specialist degree from Gallaudet University, Baer believes that technology should play a huge role in Deaf children's education and that we should not wait any longer in developing materials.

Developing ASL Text in the Bilingual Classroom

By Joey Baer and Rory Osbrink



One would never deny students pen and paper in the classroom—and one should never deny Deaf* students today's technology. Deaf students are visual learners, and technology—integral and accessible—should be part of every bilingual classroom. Deaf students need to learn to manipulate the hardware and software that allows them to express themselves and to advance their knowledge. Our students need mastery of both general technology and visually oriented technology in order to maximize learning potential.

Pages and MS Word are among the plentiful and well-understood resources for manipulating and publishing printed English. For Deaf students who use a visual language, manipulating and publishing through video is essential. Video allows students to express themselves and communicate better. It can facilitate students' understanding of American Sign Language (ASL) and English; it can permit students to use this understanding to manipulate both ASL and English and use them to complement each other, even within the same publication.

At the California School for the Deaf in Fremont, we have been fortunate to have a strong technological presence thanks largely to our school's Deaf-centric philosophy.

Developing Video-texts

Students need to understand what we mean when we refer to "ASL text" or "video-text." They need to understand how to effectively express ASL and capture it on video, and they need to understand that these ASL presentations can require the same intensive care and

Right: Students do group work on projects, allowing them to support each other in both ASL (via live discussion) and English (via computer).

Photos courtesy of Joey Baer and Rory Osbrink

attention as any printed work.

The field of ASL publication is still new to K-12 education. Here's a step-by-step look at how to use video to develop students' skills in technology and narrative—and improve their understanding and use of ASL.

1. DEFINE THE PURPOSE. Prior to filming, teachers make sure they explain the purpose of the document that they want their students to create. Is this a homework assignment? A video essay? A test? A final exam? Should references be used and included? As the academic expectations become higher, the presentation must use appropriate software to improve the quality of its production. Teachers should also discuss the concept of "register" with their students (i.e., how ASL, like English, is used differently depending on circumstance); day-to-day conversations are phrased and developed differently than extended text in academic publications. For the classroom, students learn to employ academic ASL.

2. DISCUSS THE CONTENT. Once the purpose is defined, the content follows. What is the subject? Are students presenting answers to questions? Are they developing an essay? A formal document?

3. IDENTIFY THE AUDIENCE. Related to purpose and content is audience. For whom are the students developing the video-text? Will students share their work with each other? Their schoolmates? The general public?

4. PLAN A FORMAT. Should the video-text be only in ASL or should it be in both ASL and English? If it should be

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Above: The student responds to ASL literature, having videotaped her answers to her teacher's questions related to a story her teacher signed in ASL.

in both languages, how should this be done? Should the ASL simply be captioned? Should formal English accompany ASL text?

5. FOLLOW THE "TEXT DEVELOPMENT" PROCESS. Just as most people cannot generate text in English by typing it in a single effort, texts in ASL often require multiple drafts. When students produce ASL text, they have to follow the same procedure with which they write academic documents: they must brainstorm, generate multiple drafts, get feedback, and edit their work. How many drafts should students expect to produce? What is the teacher looking for in each draft? The rough draft of the ASL presentation is sometimes developed through creating storyboards, in which students generate a script in a frame-by-frame lineup of illustrations and text.

6. EVALUATE. Evaluations should be formative (occurring at intervals throughout the video's creation) and summative (occurring after the video is complete). Teachers should use some type of checklist for students to fill as a part of their formative work. This checklist will vary depending on the type of assignment. For the summative evaluation, teachers should develop a rubric that highlights their expectations (e.g., Was the video-text focused on an academic subject? If so, which language was highlighted? Was the register appropriate—was academic ASL used appropriately? Did the student follow the assignment? Was software used effectively?). Rubrics presented at the time a project is assigned help students to understand the teacher's expectations and prepare to achieve high-quality work.

Other Video Tips

Keeping the following pointers in mind will help students in creating better quality video-texts.

CLOTHING

A green screen—so called because the color is green—positioned in the

background of filming allows for any type of background, solid color, pictures, or picture-in-picture to be projected behind the signer. This means that green should not be the color of any of the narrator's clothing. If clothing has green in it, expect the green portions to reflect whatever is projected on the screen. Avoid shirts with stripes or colorful logos because these interfere with audience perception of the on-camera signing. We actually encourage teachers to have a wardrobe of approved clothing at the ready as a backup.

FRAMING

Signing space, not automatically within the video frame, must be considered. If text or photos are added, these may infringe on natural signing space. Make sure that the person signing is aware of the parameters in which signing occurs. Movie editing software, especially Final Cut Pro, allows movement of the frame around the signers. Still, it is quicker to have the signers aware of the limitations in advance and for them to sign within a designated space.

Framing shots are all about composition, and that is another point to keep in mind before starting to record. If pictures or text are planned for the video, the "Rule of Thirds," a theory of visual composition that maintains an image will carry more interest and energy if its elements are placed along points where the image divides into thirds, is recommended. If a picture-in-video is added, the signer should move either right or left into the third of the frame to leave room for the picture.

STUDIO SET-UP

Studios do not have to be elaborate or to have expensive equipment. A simple but ample space with a computer, including a webcam or camcorder, two sets of lights, and a solid background will suffice. If you want to be able to insert illustrations into the background, the chroma keying

A Primer: Developing ASL Text with Deaf Students

By Joey Baer and Rory Osbrink

These technologies—both hardware and software—will allow you and your students to use ASL effectively in your classroom.

Webcam—PC or Mac
For quick productions, as opposed to productions requiring more sophisticated cameras, a webcam or the camera built into a laptop will work fine. (Note: The quality of webcam recording is usually not as good as the quality of self-contained devices designed to capture and record video.)

Photobooth—Mac
Photobooth is an excellent application for quick video drafts or homework assignments. It is very easy for students to learn how to use.

iMovie—Mac
iMovie is a basic video editing software application. (Tip: Study the icons because iMovie often upgrades but the icons remain unchanged.)

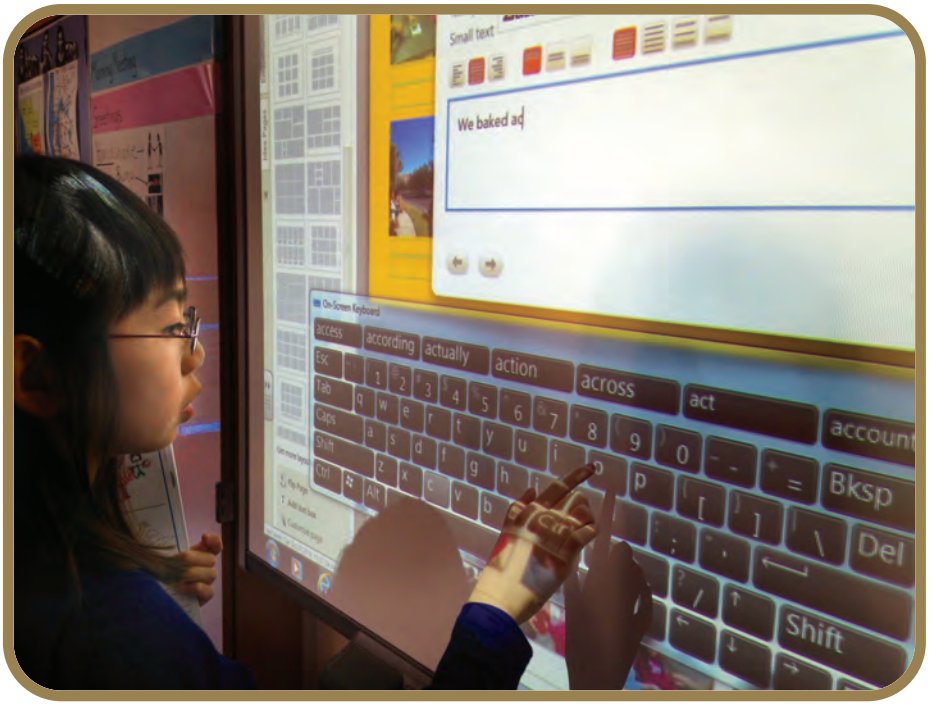
Windows MovieMaker—PC
Windows MovieMaker is a basic video editing software application.

Final Cut Pro—Mac
For lengthy productions or those requiring higher resolution and formal publications, Final Cut Pro allows quality and nuance in video editing.

Screenflow—Mac
Screenflow is a screen recording program that allows software to capture live action on the screen of the computer as a video file. This file becomes a visual stand-alone video, which serves as an excellent tool for presenting tutorials. Screenflow allows editing and works well for formal and polished video-texts.

Quicktime—Mac or PC
Quicktime allows screen recording and permits teachers to give students immediate feedback on their work. Quicktime does not allow editing; it records the action in a one-shot screen recording.

SMART Board—Mac or PC
A SMART Board or similar type of hardware should be a priority in every classroom. The SMART Board allows live typing and enables students to see instant translations of ASL through typing into English. For example, students may sign or type discussions related to recent books. The teacher may also project print from the books and ask students to translate the English into ASL. The SMART Board is interactive, which allows for full control of presentations, and it includes software that allows for visual and hands-on manipulatives to be used, such as moving pictures to match video clips of individuals using ASL and printed English.



process, it would be better to use any kind of solid green or blue background because these colors differ most distinctly from human skin tones.

Studio space should be saved for finalizing formal documents. Use a webcam, built-in camera, or inexpensive camcorder for the successive drafts that lead to the final document. Try also to consider camera angles, especially when zooming in for handshapes or facial expressions; consider wide, medium, and close-up shots.

Teachers and parents as well as students should be able to use the studios to create videos for instructional purposes. For instance, we have parents take turns weekly in creating spelling lists for the classroom. The greater the variety of people in the videos, the greater the variety of signing styles—and this gives our students a greater range of exposure to ASL.

Teacher Alert: Background, Foreground, Distribution

It is also important to be aware of the environment and to make sure the background in off-camera areas is clear of clutter and distractions. Activities as simple as a person passing by can easily distract both the signers and, eventually, the viewers.

Students need to be monitored, and teachers should see what students are working on. The background needs to be neutral or covered with either a green or blue screen for ASL productions. In addition, diversity in the school's student population should be respected, especially when making videos for distribution. ASL is unique in that the person travels with the language. Therefore it is essential to have signers of both genders and various ethnic groups represented. Who students see affects their learning; selecting individuals from diverse groups can help all students achieve.

Differentiated Instruction

Videos allow for differentiated instruction (i.e., creating materials for a variety of student abilities and needs). For example, we presented the biography of Laurent Clerc, the Deaf Frenchman who helped establish deaf

education in the United States, in three different levels of ASL so that teachers can match the level of signing in the video with the signing that is most readily understood by their students. This entailed holding the content the same but making changes in the style of presentation. For example, the duration of the video clip varied; longer videos were made for more advanced signers and shorter videos were made for less advanced signers.

We hope to develop and produce more videos for students with various degrees of signing comprehension and to be able to share those videos with students in other schools. We encourage school-wide meetings among teachers, IT staff, students, and parents to explore different technologies that will push their Deaf students' development of skills that increase their bilingual awareness and ability.

Professional Development

All of this technological support cannot be achieved without professional development with experts who know how to use the technology in a way that best benefits Deaf learners. Training needs to be allocated for updates in current software, locating quality resources, creating videos, categorizing and tagging videos, and identifying and recording new bilingual strategies. All of these professional development activities need to be planned out and prioritized.

Technical and Technology Support

Each school needs to ensure that the instructional division and technological division have the same bilingual vision. This requires an administration that understands and embraces a true bilingual philosophy so that recording becomes a question of "How?" rather than "Why?" This is critical when considering the prioritization of funds for purchases in technology, location of wirings, wireless hubs, and the speed of Internet access. Rich—still unfathomed—potential is held within these technologies. With technology, we can truly advance bilingualism in deaf education and provide complete access for Deaf students.

** The authors wish to capitalize the "d" in "Deaf" to include children with all degrees of hearing levels—profound, moderate, severe, and mild, and children who use hearing aids, cochlear implants, and other assistive devices—and to emphasize the unique visual linguistic needs of Deaf children.*

Screen Recording: An Essential Classroom Tool

By April McArthur, Jenn Christianson, Raye Schafer, and Pamela Whitney

Technology has opened up avenues for deaf and hard of hearing students that were previously inaccessible. No longer dependent on such equipment as chalkboards and filmstrip projectors, tools such as Smart Boards, computers, and even iPads have become part of the standard educational experience for many children. For teachers at the Washington School for the Deaf (WSD), the technology that recently has proven to be most valuable is the screen-recording tool. Screen recording has become so integrated into our work that we cannot imagine living without it.

The screen-recording tool, which makes a digital video of what is displayed on the computer screen, has many applications. Not only can it be used for instruction and student engagement; it can also be used for assessment, documenting growth, classroom management, and professional development. Further, it enables teachers to support the development of American Sign Language (ASL) and English in an innovative and time-efficient way.

Writing

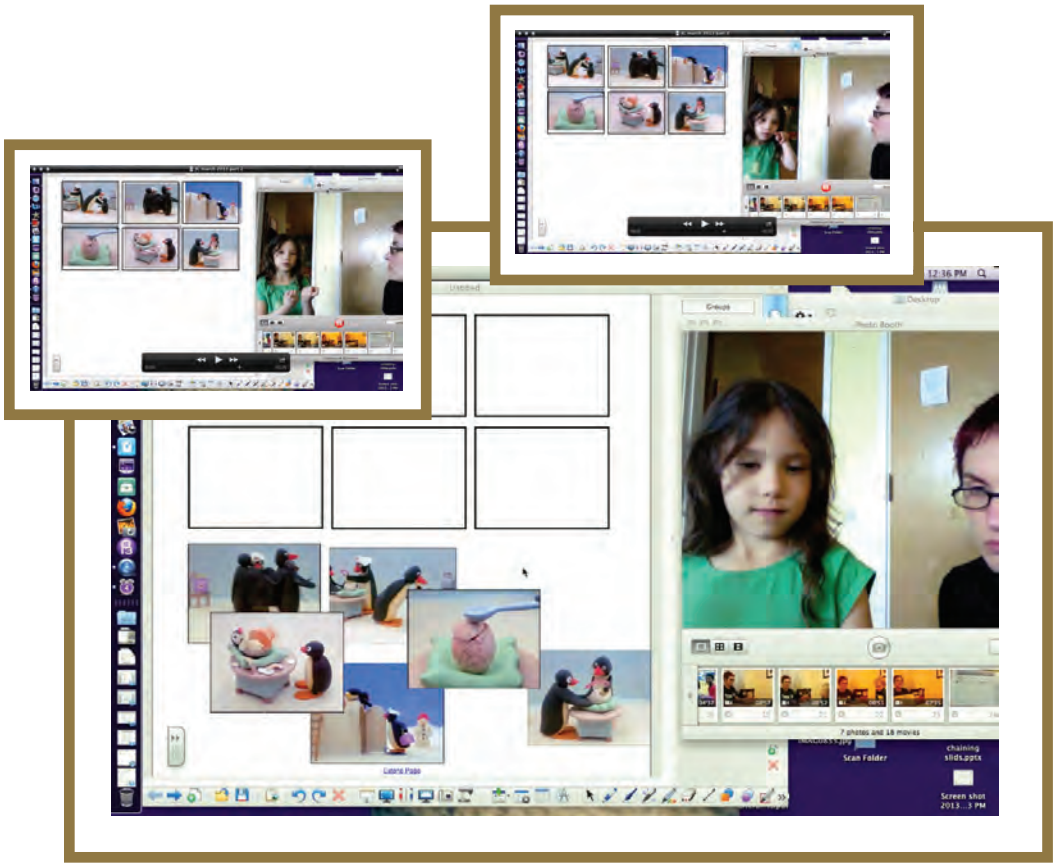
As every English teacher knows, writing is a process. In the classroom, this process means that students brainstorm, draft, revise, edit, and publish their work. In the past, teachers would read the students' writing and laboriously write feedback. However, this often was less effective as students would misunderstand or misinterpret the teacher's comments. Time was lost as students lined up for one-on-one conferences in which teachers explained and elaborated on what they had written.

Screen recording allows teachers to give feedback to students in ASL. Thus it often allows students to incorporate the feedback without waiting in line to talk with a teacher. Screen recording allows teachers to increase students' independence and maximize time spent on task in the classroom.

Photos courtesy of April McArthur, Jenn Christianson, Raye Schafer, and Pamela Whitney

April McArthur, MA, director of American Sign Language-English Bilingual Services at the Washington School for the Deaf (WSD) and the Washington State Center for Childhood Deafness and Hearing Loss, provides training and consultation to school district staff and administrators throughout Washington as part of the statewide Outreach Team. McArthur lives in Vancouver, Washington, with her husband and two children. She welcomes questions and comments about this article at *april.mcarthur@cdhl.wa.gov* or via videophone at (360) 553-4612.

Jenn Christianson, MA, a middle school language arts teacher at WSD, earned her degree in deaf education from Western Oregon University and has been teaching for 12 years. She has been an American Sign Language-English bilingual professional development mentor for the past five years. Christianson lives in Portland, Oregon, with her husband and son.



Here is how the writing process works using the screen-recording tool:

- Students submit their first drafts electronically. At his or her convenience, the teacher opens a student's work in MS Word on one half of his or her computer screen. He or she uses the other half of the screen to videotape him- or herself as he or she provides feedback. The camera is opened through Photobooth or QuickTime, and QuickTime is used to make a video of the computer screen, which now shows both the teacher's signing and the student's written draft. The teacher goes back and forth, moving his or her cursor within the document to specific structures that need to be addressed—typing, highlighting, and signing his or her feedback. For example, if a student writes a dialogue between two characters and does not use quotation marks, the teacher uses MS Word to show the student where to include the quotation marks, and he or she signs an explanation of why quotation marks are important. All of this is recorded on the computer screen as it unfolds and saved in a QuickTime file.

- Students view the feedback independently or view and discuss it with the teacher in conference. The same procedure—creating a QuickTime file of a written document and a reader-viewer who comments on it—is used for students who read each other's work, record their reactions, and give feedback to each other.

ASL Narratives and Grammar

When students are engaged in an ASL workshop, whether it is to create stories, poetry, or presentations, the screen-recording tool is equally important. Students submit their ASL drafts by recording their presentation in QuickTime. The teacher then pulls up the QuickTime file on the computer screen, pausing the recording to discuss elements of the narrative and recording him- or herself as he or she signs feedback. For example, if the student introduces a character into the story with only a name sign, the teacher may pause the video and explain that when introducing someone in ASL narratives, it is important to fingerspell the individual's name prior to using his or her name sign.

The screen-recording tool also allows us to focus explicitly on ASL grammar. For example, in a preschool lesson on fall weather patterns, students studied classifiers—ASL grammatical features that depict aspects of pronouns, adjectives, adverbs, and verbs. Our ASL assistant made a video to illustrate how ASL depicts leaves falling by quantity, speed, and movement. First, she found a video online that showed

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Pamela Whitney, MA, a preschool teacher at WSD and an early childhood education specialist, has worked in the Elementary Department at WSD since 2000. She has taught preschool, worked as a specialist in the birth-3 Parent-Infant Program, and is an American Sign Language-English bilingual professional development mentor. She and her husband, Rick, live in Vancouver, Washington, with their three children.

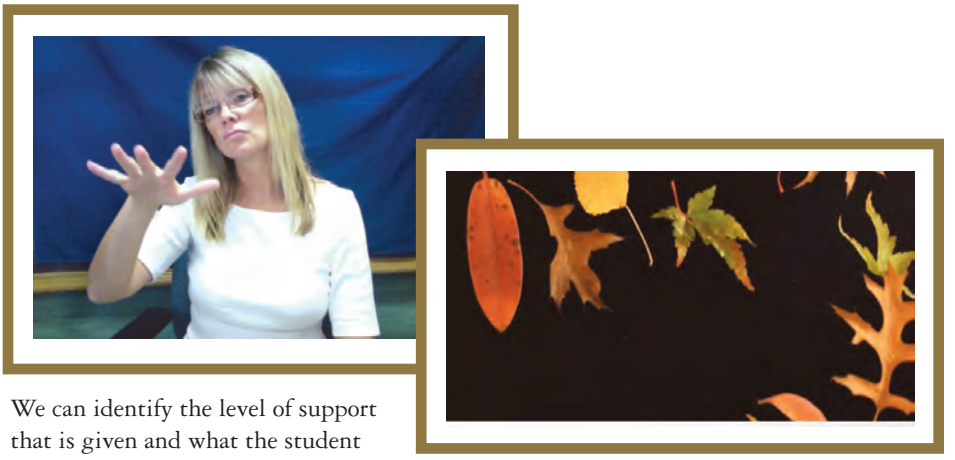
images of leaves falling from trees. She eliminated unwanted portions of the video—the text and advertisements—by clicking and dragging the mouse to selectively screen record the falling leaves, and she recorded only a short excerpt of the video. Finally, she superimposed the video of herself signing onto the video of the falling leaves.

The children viewed the video in our ASL center and practiced their ASL classifiers. As a final activity, each child individually recorded signing versions of leaves falling to represent the successive stages of the fall season. All of the clips were combined into a single movie, which was displayed in the foyer, much to the delight of the students, parents, and staff, as well as visitors to the campus.

Analysis and Documentation

Screen recording is also used to gather language samples and to analyze how students view, summarize, and retell short narratives, foundational skills correlated to literacy development. For example, we record students as they view short animated stories and record them again as they retell and summarize the stories. We do this by setting up two windows on the computer screen. One window displays the original video; the other window displays the student as he or she watches the video. Using a screen-recording program, both windows are encoded into one video file.

The teacher observes students viewing the video clip and notes what the students paid attention to, how many times the students reviewed any single clip, the level of attention paid to particular events on screen, and how the students retold the story. Everything that is seen by the student is recorded, along with the interaction between staff and student. Using this technique, teachers are not testing the child's memory of a single event but rather the child's ability to comprehend and retell a series of stories to which he or she has had potentially multiple exposures. Screen recording provides detailed data.



We can identify the level of support that is given and what the student can do with help and without help, and we can ascertain how close a student is to mastery of a particular skill set.

The screen recording also becomes a valuable tool for sharing a student's language acquisition with family and other professionals. It allows teachers to record not only their interactions with a student, but also to document any modification and support provided. Screen recording allows teachers to view every aspect of the one-on-one interaction and to go back later to tally what kinds of supports were needed. In subsequent instruction, teachers can manipulate what is on the screen and modify instruction based on students' responses. Instruction is individually tailored to students' needs.

Professional Development

We've also found screen recording to be helpful for staff training and professional development. For example, as part of a WSD training series, teachers read and study articles and attend presentations. Then we break into small groups and have discussions based on responses to a video prompt or respond to written questions. Choosing their language, teachers craft their responses in either ASL or written English. Presenters then provide individualized feedback in ASL through screen recording.

Recording Success

After we began using screen recording in our classes, we immediately saw a difference in the classroom. Students became more engaged and showed increased motivation and confidence. Their expressive vocabulary—both in ASL and English—increased, and use of more descriptive language emerged.

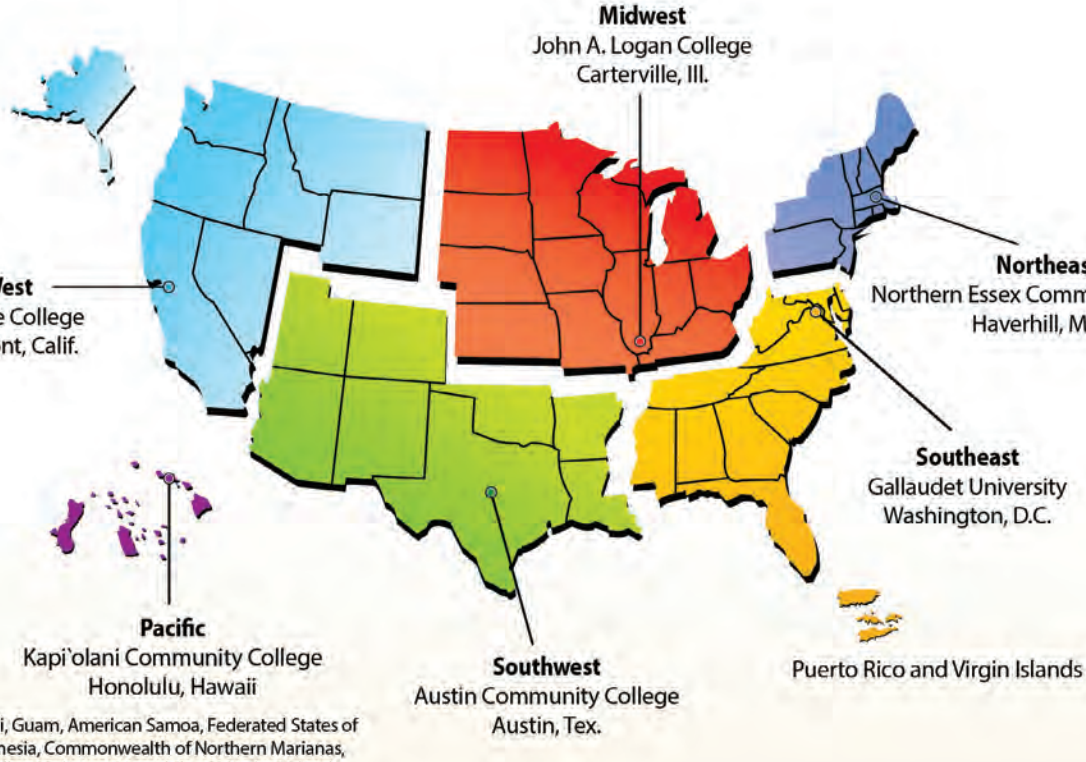
As a result, screen recording has allowed us to further raise our already high expectations for our teachers and students. As a learning tool, screen recording allows our students to develop their skills in ASL and English and their knowledge of how these two languages work. Students are able to delve into concepts in more meaningful ways, and they have more freedom to express themselves, show what they know, and demonstrate their understanding of content.

Whether students are working in ASL or English, there is no need to rely on memory. The feedback is recorded. They can view it independently, during an ASL or writing workshop, or while doing their homework. The feedback is durable; it can be watched over and over as students revise and edit their work.

As a teaching tool, screen recording allows instructors to meet students' needs, to capitalize on students' strengths, and to use ASL as a bridge to English. At the same time, learning to use the screen-recording tool has increased students' technological awareness and skills. For WSD, screen recording has proven to be an invaluable tool for teaching and learning in ASL and English and for supporting our mission for students to become bilingual, empowered, and successful. Today and tomorrow—the very BEST!

GALLAUDET UNIVERSITY | REGIONAL CENTERS

Sharing Resources Across the Regions



The Gallaudet University Regional Centers (GURCs) share the resources of the world's only liberal arts university for deaf and hard of hearing people with regions across the country through partnerships with Austin Community College in Austin, Tex. (Southwest), Kapi`olani Community College in Honolulu, Hawaii (Pacific), John A. Logan College in Carterville, Ill. (Midwest), Northern Essex Community College in Haverhill, Mass. (Northeast), and Ohlone College in Fremont, Calif. (West) as well as directly from Gallaudet University in Washington D.C. (Southeast).

Through the host institutions, Gallaudet University and the Laurent Clerc National Deaf Education Center, the GURCs offer extension courses, training workshops, and technical assistance to address the educational, transition, and professional development needs of deaf and hard of hearing people, their family members, and the educators and other professionals who work with them.

Rachel Saulsburry, EdS, MS, is a graduate research assistant with Strategic and Interactive Writing Instruction at the University of Tennessee. She taught deaf and hard of hearing students as an itinerant teacher for six years and is now a PhD student in literacy and English as a second language education. Her research interests include itinerant teacher preparation, itinerant instruction, and collaboration among service providers working with deaf and hard of hearing students.

Jennifer Renée Kilpatrick, MS, MEd, is a research associate at the University of Tennessee at Knoxville, where she is also enrolled as a PhD student in literacy studies. She has taught students with a wide range of disabilities in resource and inclusion settings in public schools and was a middle school reading and language arts teacher at a residential school for deaf students. Her research is focused on the language and literacy development of deaf and hard of hearing students and the preparation and professional development of the teachers working with them.

GETTING STUDENTS EXCITED ABOUT LEARNING:

Incorporating Digital Tools to Support the Writing Process

By Rachel Saulsburry, Jennifer Renée Kilpatrick, Kimberly A. Wolbers, and Hannah Dostal

Technology—in the form of digital tools incorporated into writing instruction—can help teachers motivate and engage young children, and it may be especially critical for students who do everything they can to avoid writing. Technology may bolster student involvement, foster the engagement of reluctant or struggling writers, and support writing instruction. However, it does even more. A look at the use of technology in two classes shows how technology can create authentic writing opportunities and impact young writers' choices. Not only do students in these classes engage with their assignment, but they also interact with their audience, explore the purpose of their assignment, and understand their assignment's impact.

We feature these classrooms because the technology the teachers selected was either inexpensive or free and easy to learn and use. Just as importantly, these technological tools assist more than one part of the writing process; they are useful in planning, organizing, and sharing the finished writing product with the intended readers.

Skype and the Wireless Keyboard

Three deaf and hard of hearing students in an upper elementary public school class used Skype, the well-known program that allows face-to-face communication through cameras via computer in real time, and a shared wireless keyboard that allows users to

Photos courtesy of Rachel Saulsburry, Jennifer Renée Kilpatrick, Kimberly A. Wolbers, and Hannah Dostal

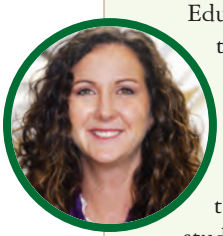
operate a keyboard at a distance from their computer. Their goal: to research the purchase of a class pet.

The students—fifth grader Izzy*, fourth grader Juliet, and third grader Andrew—could actively participate in discussion with teacher Nancy Ware, who, untethered from her position at the class computer keyboard, sat with them as they discussed and assembled the text.

Ware, who has taught deaf and hard of hearing students for 28 years, works with students in the elementary grades using various communication approaches. She pulls Izzy, Juliet, and Andrew out of class together to provide writing instruction using spoken English. Izzy is reading and writing close to grade level and is constructing multiple paragraphs with interesting details. Juliet has, in addition to hearing loss, a disability that impacts her short-term memory. She typically writes six or seven incomplete sentences and, at times, uses the same words to begin each sentence, such as "I was playing. I went home. I ate with mom." Andrew has vision difficulties and receives special services from the school's occupational therapist. Handwriting is a laborious task for him, and his writing is difficult to decipher. While Andrew usually has multiple ideas and can recognize and supply rich details, he struggles to convey them through writing.

Ware has been focused on expository writing— writing that informs—for six weeks. During this time, she and her students have explored texts, and they have written their own texts together and individually on topics they have researched. Ware has used expository-specific graphic organizers and checklists to support instruction during group, guided writing, shared writing, and independent writing. As a final lesson, Ware asked the students if they would like a class

Kimberly A. Wolbers, PhD, is an associate professor at the University of Tennessee in the Department of Theory and Practice in Teacher Education. Her research interests include language and literacy instruction for deaf and hard of hearing students, with a focus on strategic and interactive writing instruction.



Hannah Dostal, PhD, is an assistant professor of reading education in the Department of Curriculum and Instruction and a research scientist for the Collaborative on Strategic Education Reform at the University of Connecticut. Dostal has served as a middle school teacher of deaf students and a writing intervention coordinator for deaf and hard of hearing students in grades K-12.

The authors welcome questions and comments about this article at *rsaulsbu@vols.utk.edu*.

pet; the students replied with an excited, "Yes!" An opportunity for an expository writing project—and writing for an authentic reason—was underway.

After some discussion, the students agreed that they wanted a fish. They researched both the type of fish they wanted and the fish's needs (e.g., type of food, size of the tank, type of water that the fish would require). While working with her students, Ware wished that she could take them to a pet store to research the topic further. Then she had a great idea: she could use Skype to bring the pet store to them!

Ware set up an interview via Skype between the students and Ginger Yandel, a PetSmart employee. The students drafted questions and, on the day of the interview, each student asked Yandel questions and recorded her responses. During the interview, the students and Ware took turns using the wireless keyboard to type the answers to their questions into a shared document. At the end of the interview, the students asked Yandel and Ware if they could use the information to create a flier to be displayed for PetSmart customers; both agreed. Yandel shared the types of questions customers often ask, which helped the students to better understand their audience and decide what to include in their flier. After the interview was over, the students continued their research and then, with the teacher's assistance, developed both a flier for PetSmart customers and an informative essay about their soon-to-be-acquired pet for younger students who would also be involved in caring for the fish.

The students developed a shared text in a Word document that was projected, taking turns typing with the wireless keyboard. Together they brainstormed sentences, and Juliet and Andrew typed the first draft of the sentences. Izzy edited the text on screen before they reread the draft together. Once the flier was completed, Ware took it to PetSmart. She scheduled another meeting with Yandel via Skype and the students were able to get feedback directly—and to learn what customers thought of their flier.

Reflecting on the assignment, Ware noted:

Skype allowed me to make the research process more interesting. It also gave my students a better understanding of what their readers might want to know. They became so excited asking questions and getting responses.

The wireless keyboard [permitted me] *to be more interactive with my students and* [permitted them to be] *more engaged during lessons.*

The community participation … now that my students know someone else is reading their work, they are more invested in the entire writing process.

This writing project was successful in many ways: It included a topic of interest, multiple uses of digital tools, an authentic task, and a real audience, and the students were motivated to engage in their assignment from beginning to end.

The project demonstrated the benefits of Skype for researching a topic and connecting with an audience. Skype could also permit sharing writing and communication with other students. Consider the possibility of students using Skype to share their work with other students in American Sign Language (ASL) as well as in spoken and written English. Giving students the opportunity to share their writing via Skype allows them the chance to receive feedback on their work from other readers. For struggling writers, reading their own text can be easier and more meaningful than reading other texts.

Skype allows connection between classes in neighboring schools, different states, and even different countries. It vastly reduces the obstacles to bringing visitors into the classroom.

Popplet and Book Creator

Five ethnically diverse groups of third-, fourth-, and fifth-grade students used individual iPads equipped with Popplet, a program that allows users to position text, drawings, and photos in a variety of visual layouts, and Book Creator, a program that allows users to create digital books by adding text, annotations, drawings, photographs, and even video and audio to blank pages.

Susan Mitchell, who has taught language arts for seven years, works with students with a wide range of writing proficiencies, from students who have demonstrated mastery of 10 sight words to students who are writing multi-paragraph essays. Many students have unique learning needs characteristic of visual impairments, cerebral palsy, auditory processing disorders, and language delay. Some communicate in ASL, while others use sign-supported speech.

Mitchell spent nine weeks working with students on a writing form known as "recount writing," in which students write about a past personal event, working on sequencing, past tense, perspective—whether they use first or third person—and consistency. They had read and written recounts as a class and individually when Mitchell asked them to choose an event from their own lives to write about. She began the unit by sharing an event from her own life, and showed the students how she wrote about the event in Book Creator and developed the associated plan using Popplet.

Mitchell projected her Popplet plan on the SMART Board and left it there as a model while students began to create their own plans. While they worked, Mitchell circulated the room to offer help and discuss the students' ideas. Students were excited and engaged in planning. They focused on their task and worked independently, which allowed Mitchell to give individual attention to her beginning writers, helping them to find and label pictures with vocabulary to represent their ideas. With the more advanced and independent students, this was not necessary; she was able to look at the plans and make suggestions about where they might expand their ideas or add more details.

Students partnered up to read each other's plans and ask questions that they had as readers. Then they began drawing and importing pictures to create their books. This served as an extension of their planning and helped them further organize their ideas. Using Book Creator, they tackled page after page, writing text and assembling photos. With the students thoroughly engaged, Mitchell was able to continue to individually conference with students and provide individualized feedback, support, and instruction. The final step was that of video; students added an ASL interpretation of the printed English text on each page. When they were done, Mitchell saved the students' books on her class iPads in a virtual class library. As the year progressed, the class library grew. During reading time, students were able to read their classmates' stories. The young authors

Digital Tools for the Classroom

By Rachel Saulsburry, Jennifer Renée Kilpatrick, Kimberly A. Wolbers, and Hannah Dostal

iPAD (*www.apple.com*)—iPads are perhaps the single most important piece of technological hardware to get into the hands of deaf and hard of hearing students. These portable devices can be used both inside and outside of the classroom to support instruction, build students' language, and offer students another vehicle for expressing their knowledge. iPads can be effectively used during all parts of the writing processes. Cost: $399 and up, with discounts sometimes available for educators.

BOOK CREATOR (*www.apple.com* and *www.redjumper.net/bookcreator*)—This app allows the user to create books. Pictures can be imported or taken using the camera, inserted, and manipulated. Text or writing tools can be used to add annotations to the pages, with different colors available for both. Sound can also be added, and the books can be shared via iBooks, Evernote, Dropbox, and Google Drive. Cost: $4.99 for the Apple version; $2.49 for Android.

POPPLET (*www.popplet.com* and the iTunes App Store)—Popplet is an iPad app that allows users to position text and graphics in a variety of visual formats, including webs and lists. Cost: Free for the basic version; $4.99 for the more advanced version.

SKYPE (*www.skype.com*)—Easily downloadable, Skype allows face-to-face communication around the world. Cost: Free.

WIRELESS KEYBOARDS (*www.amazon.com*)—Cost: $20 and up.

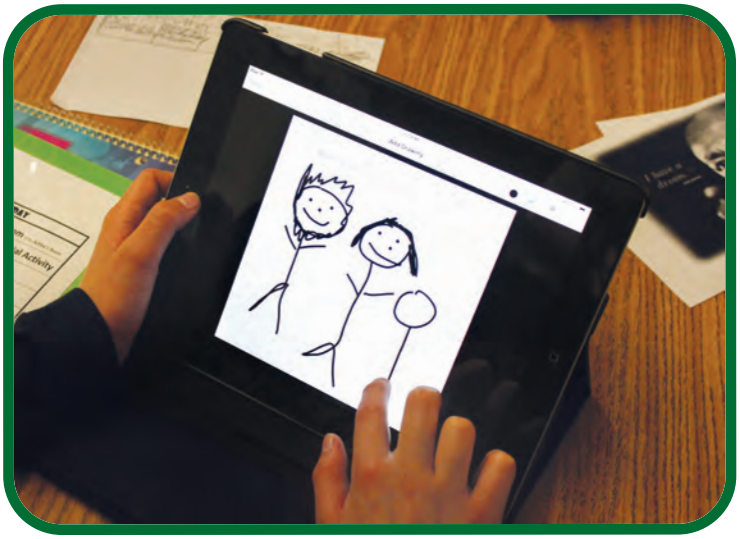
We are living in a technology-infused world where most of our students live digitally connected lives.

would read the books during independent reading through the remainder of the year. Students also sent their books to a class of deaf and hard of hearing students at a school for the deaf in another state. They used Dropbox, the free on-line service; the other students read the books and provided feedback through a video they also shared via Dropbox.

Reflecting on her students' work, Mitchell noted:

> *The kids love making books using Book Creator.* {The software} *is VERY motivating! When students write their stories on paper, they get stuck. They don't know how to spell the words they need, they feel like their peers can see them struggling, and they give up. But when they use the iPads, no one else can really see their work in progress. And having the opportunity to use pictures as a support is invaluable. …It's not just my struggling writers. It actually really challenges my highest students to work harder and to do their best. I can't say enough about Book Creator.*

Mitchell has used Popplet and Book Creator in other ways, demonstrating their versatility. The students used Popplet to create think maps—illustrations and diagrams that showed their reaction to their reading. This helped them to organize their thoughts and demonstrate their reading comprehension. Mitchell also uses Book Creator to create varied levels of books for students. For example, when the students read a book about Barack Obama, Mitchell used Book Creator to make a lower-level and a higher-level book about the president. Integrating digital tools into her instruction has helped tremendously with differentiating instruction, she noted, and allowed her to meet the individual needs of her students.



Two Teachers, Two Classes: A Final Note

A glimpse into two classrooms shows how four digital tools were meaningfully integrated to support writing instruction with a wide variety of deaf and hard of hearing students. These tools allowed students to engage throughout the writing process; they assisted students with establishing an audience, planning, organizing, writing, editing, publishing, and evaluating their material.

We are living in a technology-infused world where most of our students live digitally connected lives. Integrating technology and finding the right digital tools motivates our students and fits their lives. It also fits into effective instructional practices.

**All names in this article are pseudonyms.*

Jennifer Mertes, AuD, is the director of Related Services and campus audiologist at the Maryland School for the Deaf. She has worked in The Listening Center; the cochlear implant center at Johns Hopkins Hospital in Baltimore, Maryland; and The River School, an inclusion program for students who are deaf or hard of hearing in Washington, D.C. She welcomes questions and comments about this article at *jenniferdavismertes@gmail.com*.

Auditory Technology

AND ITS IMPACT ON BILINGUAL DEAF EDUCATION

By Jennifer Mertes

Brain imaging studies suggest that children can simultaneously develop, learn, and use two languages. Bilingualism is common throughout the world, and children who are raised bilingually experience linguistic and educational benefits. For children who are deaf or hard of hearing and who have access to language through listening, these studies have special importance. They show that keeping expectations high may mean taking advantage of a natural bilingual opportunity; deaf and hard of hearing children can be fluent in both a visual language and spoken language.

A visual language, such as American Sign Language (ASL), facilitates development at the earliest possible moments in a child's life. Spoken language development can be delayed due to diagnostic evaluations, device fittings, and auditory skill development. While the auditory pieces are coming together, visual language should be used to support a child's cognitive development and social-emotional well-being. Once auditory access is established and auditory skills are developing, the two languages can be used to support education and bilingual approaches are available as teaching tools.

Research does not indicate that any single methodology is 100 percent successful when instructing children who are deaf or hard of hearing. Proponents of all methodologies boast of star students and admit to struggling students. A bilingual approach to deaf education ensures the best of methodological worlds: language development and literacy are the primary focus. Fostering development of a visual language and spoken language at the same time safeguards language acquisition and allows deaf and hard of hearing children to achieve their full potential.

Technology: Impact on Auditory Access

New auditory technologies—from cochlear implants, to hearing aids, to devices that allow sound to be carried to the brain through bone conduction—provide many deaf and hard of hearing children with improved access to spoken language. These devices

Photos courtesy of Jennifer Mertes

have become increasingly sophisticated; more deaf and hard of hearing children than ever before access spoken language so extensively they can learn through listening.

HEARING AIDS

Hearing aids are now "smart" in that they use digital processing to analyze the listening environments and optimize reception of speech. Even in adverse listening situations, where surrounding noise is loud and persistent, hearing aids allow some deaf and hard of hearing people to identify and understand the conversational signal.

Further, today's hearing aids allow improved amplification and processing of high frequency speech sounds. This has proven to be a powerful advance as these sounds—such as consonants *k*, *t*, *s*, and *f*—can influence the content of the message and are necessary for following the important grammatical structures that underpin comprehension. Spoken language contains sounds that vary in volume, pitch, and frequency. If a person can hear low frequency sounds but not high frequency sounds, he or she can hear someone talking but not understand what is being said. Children with this hearing configuration develop speech production skills that are intelligible, but their reception of spoken language and novel vocabulary is degraded.

Previous hearing aid technology provided limited access to these high pitched sounds due to limitations of microphones and sound processing; today, expanded bandwidths and the advent of frequency transposition and non-linear frequency compression allow sound to be shifted from high frequencies to a lower frequency, therefore making it more audible for the hearing aid user.

COCHLEAR IMPLANTS

Cochlear implant (CI) candidacy was previously restricted to those who were deaf and had minimal access to spoken information with hearing aids. Candidacy has now expanded to include individuals who are hard of hearing and have partial access to spoken language when wearing hearing aids. Previously, recipients were implanted in one ear only. Today CIs in both ears are recognized as the standard of care; and most children receive bilateral CIs or use a CI for one ear and a hearing aid in the other ear.

Right: The simplest approach to defining a child's auditory access is to complete a Ling 6 listening check. The Ling 6 sounds (*mm*, *oo*, *ah*, ee, *sh*, *ss*) can be used as a guide of which grammatical features a child can hear.

Recently the Federal Drug Administration (FDA) approved the use of a "hybrid CI," which takes advantage of residual low frequency hearing through an acoustical component connected to a CI sound processor. While the acoustic component allows the reception of natural sound, an internal component electrically stimulates the high frequency region of the cochlea. Today only adults have access to this technology, but the FDA is anticipated to approve expansion of its use for children soon.

So complete has auditory access become for some deaf and hard of hearing students that they can learn to read through auditorally based literacy strategies used with hearing children. These strategies may be modified on an individual basis to take into account the child's hearing levels. An auditory access profile developed for each child specifies what the child can hear and what parts of English are missed through listening alone. A multidisciplinary team can use this data to guide implementation of teaching strategies and monitor student progress. Instructional strategies, based on visual and spoken language, shift depending on the area of need. Through tracking language development data, teachers and specialists ensure concepts are understood and use each language to support the other.

Monitoring and Tailoring Teaching as the Child Develops

Teachers and professionals must continually:

- ***Assess linguistic competence in English and American Sign Language.*** A multidisciplinary team should continually assess the child's language development. Assessment can show how a child is developing language and help in setting goals to ensure that progress continues.
- ***Assess auditory skills.*** Auditory skills are a precursor to spoken language development. Areas to consider in auditory skill development include sound awareness, discrimination, identification, and comprehension.
- ***Build on the child's skills.*** For children with emerging listening skills, structured listening opportunities provide important support. Exposure and scaffolding are essential in this area.
- ***Alert to lack of progress.*** If progress is not forthcoming and if the child is unable to benefit from the equipment for whatever reason, use of a visual language for instruction should be considered.

A bilingual approach with children who wear amplification and who have auditory access to English is a vital consideration for many deaf and hard of hearing children. These children can be encouraged to develop both languages—visual and spoken—at the same time. This preserves the individual learning experience and results in improved literacy. Bilingual competence provides expanded opportunities for direct and accessible communication with family members, peers, professionals, and Deaf community members plus increased options for academic learning.

Deaf and hard of hearing children deserve language acquisition at the earliest possible age, and this is accomplished most surely through the children's accessible visual pathways. With children enrolled in bilingual programs that equally respect ASL and spoken English and facilitate development of both languages, parents and professionals can feel confident that children are receiving services designed with language and educational development in mind. No time is lost waiting for one language to develop. Both languages are utilized and facilitated in a systematic way to ensure each child's success.

TOOLS for SCHOOLS

THE SOUNDS of Speech

English Consonants

Adapted from Ling, Daniel (1976) Speech and the Hearing Impaired Child: Theory and Practice

Consonant	1st Formant	2nd Formant	3rd Formant	4th Formant
/p/			1,500–2,000	
/t/			2,500–3,000	
/k/	300–400		2,000–2,500	
/d/	300–400		2,500–3,000	
/b/	300–400		2,000–2,500	
/g/	200–300		1,500–2,500	
/m/	250–350	1,000–1,500	2,500–3,500	
/n/	250–350	1,000–1,500	2,000–3,000	
/ng/ (wing)	250–350			4,500–6,000
/f/				4,000–5,000
/s/				5,000–6,000
/sh/			1,500–2,000	4,500–5,500
/th/ (thin)				6,000
/h/			1,500–2,000	
/v/	300–400			3,500–4,500
/z/	200–300			4,000–5,000
/TH/ (that)	250–400	1000-1,500	2,000-3,000	
/ch/	200–300		1,500–2,000	4,000–5,000
/dg/ (jot)	200–300		2,000–3,000	
/l/	250–400		2,000–3,000	
/r/ (err)	600–800	1,000–1,500	1,800–2,400	

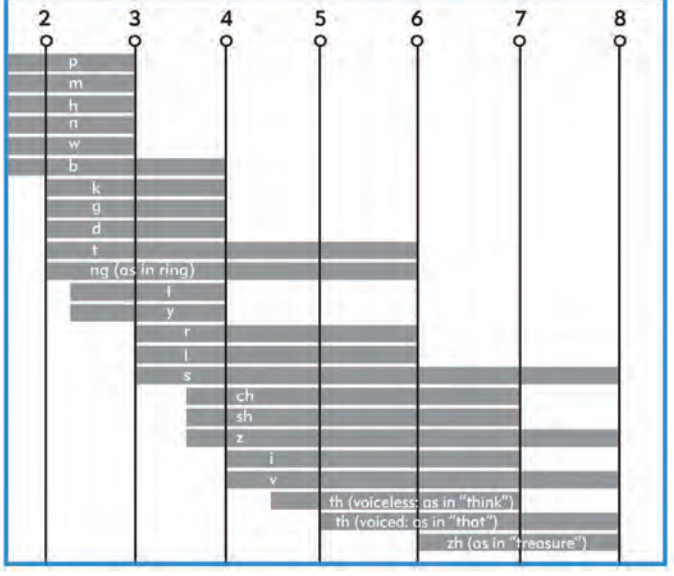
Vowels

Adapted from Ling, Daniel (1976) Speech and the Hearing Impaired Child: Theory and Practice

Vowel	Example	1st Formant	2nd Formant
/i/	bee	370	3,200
/ɪ/	bit	530	2,730
/ɛ/	bet	690	2,610
/æ/	bat	1,010	2,320
/ɑ/	box	1,020	1,750
/ə/	bail	600	1,680
/U/	book	540	1,410
/u/	boot	430	1,170
/^/	but	850	1,590
/ɜ/	bird	560	1,820

English Consonants—Age of Acquisition

Adapted from Sanders 1972 and Templin 1957



Tips for using The Sounds of Speech charts and tables

1. These charts and tables with vowel and consonant formant information are designed to assist you during therapy.
2. If the child doesn't have access to the sound(s) auditorily, he/she can not be expected to produce and/or imitate them. Review the child's audiogram to determine what sounds he/she is able to detect.
3. Remember to review the English Consonants—Age of Acquisition table before planning therapy goals for a young child.
4. It is important to note not only the first formant of the target sounds during therapy, but also the subsequent formants as well.

Bilingual Storybook Apps: An Interactive Reading Experience for Children

By Melissa Herzig and Melissa Malzkuhn

Melissa Herzig, EdD, is the education and research translation manager for the Visual Language and Visual Learning Lab (VL2) and cofounder and associate director of the new PhD program in educational neuroscience at Gallaudet University. She is responsible for leading assessments and evaluations of resources within VL2 and for working with schools, facilitating communication between researchers and educators. Herzig earned her bachelor's degree in biology from Gallaudet University and her master's degree and doctorate from the University of California, San Diego (UCSD). She worked at the Salk Institute and San Diego State University as a scholar researcher and was a postdoc at UCSD. She was also a teacher at a mainstream school for eight years and she worked as a supervisor for student teachers at UCSD. She created an assessment tool, the ASL Scale of Development. She was also a part of the national K-12 ASL Content Standards Development Team. Her areas of interest include ASL/English bilingualism, literacy, and reading motivation.

When it comes to reading, technology has changed everything for students who are deaf or hard of hearing. Reading was an experience that was text based; it consisted of negotiating combinations of words expressed in linear form on paper. How was it possible to develop reading materials for bilingual readers, especially if one of the youngsters' languages was visual and spatial?

Enter technology. The touchscreen made a revolutionary difference. In an unprecedented way, touchscreen tablets complemented our conventional and traditional printed books.

Enter the Visual Language and Visual Learning Lab (VL2). At VL2, the Science of Learning Center funded by the National Science Foundation at Gallaudet University, researchers explore themes of literacy and bilingualism for deaf children—and translate their findings into apps that allow deaf children to learn to read.

Enter The Baobab. *The Baobab*, the story of a curious little girl who embarks on a search for a fruit growing from a rare tree and gets into mishaps along the way, was the first downloadable app developed at VL2. Using the latest technology to provide reading for young deaf children, *The Baobab* opened a new field in education. For the first time, deaf children could participate equally with their hearing peers in exploring literature while developing literacy skills in American Sign Language (ASL) and English.

As we watched children enjoy the app, we studied how they read, how they navigated between English and ASL, and how both languages helped them develop strong bilingual literacy skills.

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The Benefits of Bilingualism

In recent years, researchers have turned their attention to the cognitive impact of bilingualism, and the benefits of using two languages have become increasingly apparent. Children raised in bilingual families exhibit stronger awareness of the style

Photos and illustrations courtesy of Melissa Herzig and Melissa Malzkuhn

and tone of language, stronger cognitive development, and higher levels of reading skill than children raised in families where only one language is used (Allen, 2015; Kovelman, Berens, & Petitto, 2013; Bialystok, Craig, Green, & Gollan, 2009; Jasińska & Petitto, 2013, 2014; Petitto, 2009).

To maximize the bilingual advantage, children must be exposed to both languages in their early preschool years. Unfortunately many deaf children, with tremendous potential for becoming ASL/English bilinguals, do not get adequate exposure to either language. These children miss out on much-needed linguistic experience—which has a huge impact on their learning and academic success (Petitto, 2009).

British researcher Gary Morgan (2006) found that deaf children rely on and benefit from sign language narratives. Narratives in ASL provide children with "opportunities to develop potential cognitive flexibility and metalinguistic abilities in order to facilitate the development of English literacy skills" (p. 338). In other words, exposure to ASL narratives and vocabulary allows children to develop skills to grasp concepts related to the understanding of English, and this, in turn, helps them become skilled readers.

Hanson and Padden (1990, 1994) found that when students read a story through a software program called HandsOn, which presents ASL and English side by side, they understood the story better than when they read the story only in printed English. Morgan (2006) concludes that this skill in comprehension is due to how children engage in a "contrastive narrative analysis task" (i.e., how children receive with both languages, processing each separately and deriving meaning through both).

It is this use of two languages—and the resulting contrastive narrative analysis—that stimulates the child's knowledge of how each language works and maximizes his or her ability to process linguistic information. Past studies have found that deaf children who experience stories in ASL and printed English are more

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The authors welcome questions and comments about this article at *Melissa.Herzig@gallaudet.edu* and *Melissa.Malzkuhn@gallaudet.edu*.

stimulated mentally than those who experience stories in only one of these languages, and this stimulation facilitates their becoming skilled readers (Morgan, 2006).

With the technological advances of touchscreen computing, we can develop bilingual resources to encourage cognitive development, bilingualism, and literacy growth in deaf children. Adam Stone (2014), who authored an ASL/English e-book, noted that both languages could be provided interactively on a touchscreen with vivid and sophisticated video capabilities. This allows children bilingual access to literature.

Kennedy (2004) found that middle school deaf students demonstrated higher levels of motivation and engagement when texts were accompanied by ASL presentations of the material. When they clicked on printed words, students expressed a preference for representations of the ASL sign equivalents.

Storybook Apps: Exciting in Two Languages

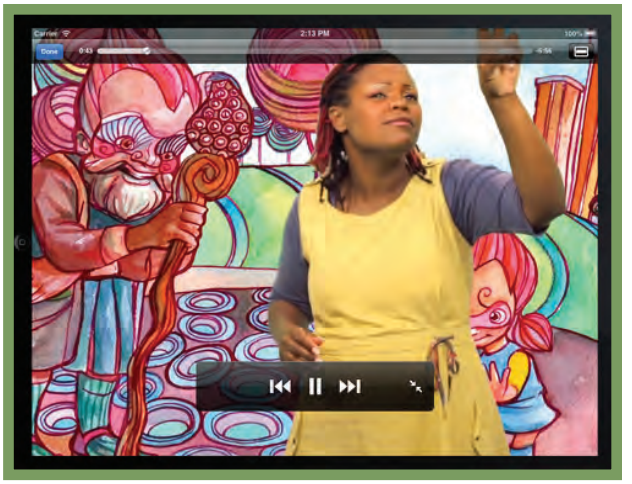
The Baobab, the first story app presented in ASL/English, was soon followed by *The Boy Who Cried Wolf*, *The Blue Lobster*, and *The Solar System*. Developed and designed under Melissa Malzkuhn, in VL2's Motion Light Lab, each storybook app provides young readers with rich, engaging literature in both ASL and English.

Research has shown that exposure to sign language storytelling nurtures the children's development of vocabulary and increases their skills in language and literacy (Berke, 2013; Mayberry, del Giudice, & Lieberman, 2011). Each app incorporates the latest research in language learning and bilingualism from research done at VL2 and established principles of literacy development; and each offers three ways of interacting with the content, identified as "watch," "read," and "learn."

WATCH—VIEWING THE NARRATIVE

In the "watch" mode, children view the narrative presented by a professional ASL storyteller in conjunction with high-interest visuals and animation. The extended narration, without any editing or interference, requires that young viewers pay attention and enjoy the flow, rhythm, and other elements of ASL storytelling.

Encouraging children to watch stories in ASL helps them learn to follow and understand the sequencing of events within a narrative and become familiar with the structures of narratives. This understanding prepares them for the process of reading, a process in which they will go from the whole story to its smaller parts (e.g., paragraphs, sentences, words, letters).



READ—ENJOYING THE TEXT

In the "read" mode, children view pages of English text on screen in a manner similar to the way most books are viewed in traditional children's literature. Each page features sentences in English accompanied by illustrations that help children connect words to meaning. There are also plenty of interactive options. Children can check out parts of the story in ASL or view videos showing the signs and fingerspelling for English vocabulary.

At their own choosing, they can alternate between ASL and English, tapping an on-screen "play" button that results in a pop-up window with an ASL translation of the page. This potential page-by-page translation allows children to focus on smaller units of meaning than those in the "watch" mode as well as to see how the two languages handle expression of similar information.

The "read" mode addresses one of the obstacles that many deaf children face as readers—an insufficient knowledge of vocabulary (Torgesen, 1986). Without understanding vocabulary, it is difficult to develop motivation and engagement (Herzig, 2009; 2014.) Motivation is what makes a person want to read, and engagement is what makes a person *keep* reading (Guthrie & Wigfield, 2000). In the "read" mode, children maintain both their motivation and engagement by proceeding at their own pace, choosing either to watch the ASL version of the page, read the text, or view the vocabulary words in ASL as signs or as fingerspelled words.

LEARN—VOCABULARY FOR ALL

In the "learn" mode, children are presented with a glossary that has vocabulary from the story in an alphabetized list. Children tap on each word to

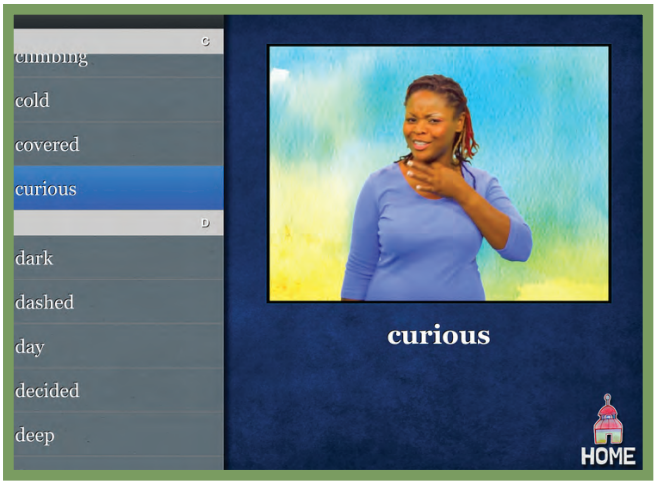
see its translation into ASL.

Translations both in the glossary and in text are handled through videos that incorporate "chaining"—a natural feature of ASL in which signers present a word in signed ASL, then fingerspell the word, then repeat the word in signed ASL. Research has demonstrated the usefulness of chaining as a tool to enhance literacy development (Humphries & MacDougall, 1999; Padden & Ramsey, 2000). Chaining helps the child build joint internal representations of the word in both languages and provides a means for linking fingerspelling to English print.

The "learn" mode emphasizes vocabulary; children deepen the connection to meaning between signed or printed words when they return to the story in "read" mode.

Lesson Plans—Complementary and Complimentary

Lesson plans are available for free for the storybooks. They can be downloaded in PDF from *www.VL2storybookapps.com*. The lessons are designed to promote ASL skills, awareness of how ASL works, and literacy in the classroom; they also encourage further immersion in reading.



Creating the Personal Storybook

In an effort to expand the field and the availability of bilingual storybook apps, VL2's Motion Light Lab is releasing a program called Storybook Creator, which allows an individual to create an app without writing a line of code. Users upload text, images, and videos to create new storybook apps through Storybook Creator in Xcode, Apple's standard app development software. This is a fantastic opportunity for educators, storytellers, artists, designers, and parents to create stories that benefit the bilingual learner.

ASL on iPads: Expanding the Field

Since the launch of Apple's iPad in 2010, over 20 ASL/English e-books and storybook apps have been created and the demand is high. This is an emerging field, and developers and educators need more empirical research in app design for bilingual readers, how children use the ASL/English readers, and the readers' effectiveness in literacy development.

At the time of writing, we were conducting assessments on the user experience of our storybook apps. We're looking at 44 deaf and hard of hearing students from four different schools, tracking how students use the app, how they interact with it, and to what they pay attention. From what we've seen, the majority of children, regardless of their language skills and hearing levels, show an interest in both languages.

In the Petitto Brain and Language Laboratory for Neuroimaging (BL2), we, with Dr. Laura-Ann Petitto and her team of students, many of whom are part of the PhD in Educational Neuroscience (PEN) program, are currently conducting a NSF-VL2 Science of Learning Center study with modern fNIRS brain imaging and eye tracking technology to measure precisely how children perceive and process the rich moving visual scenes in storybook apps. In this first educational neuroscience study of how young children process bilingual visual linguistic information—with one language in sign and one language in print—we seek to learn whether segmentation at the heart of fingerspelling in ASL may facilitate the young child's segmentation of visually presented printed strings of English letters, words, and sentences on the page en route to becoming successful readers. We are also examining whether deaf children who learn sign language early in life are advantaged or not in the visual linguistic processing of storybook apps relative to deaf children who learn sign language later.

At the same time, we continue to develop apps for children to enjoy, and we build on what the research has shown: Bilingualism—the mastery of two languages instead of just one—benefits all children. Deaf and hard of hearing children who are bilingual experience a deeper understanding of language, increased skills in reading, literacy, and enhanced cognitive development. As we look at our students and how they read, and as we develop new apps for them to learn from and enjoy, this knowledge is what infuses the purpose of our work.

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Pioneering Program

Teaches Families Sign Language Through Tele-Intervention

By Diana Poeppelmeyer and Lynn Reichert

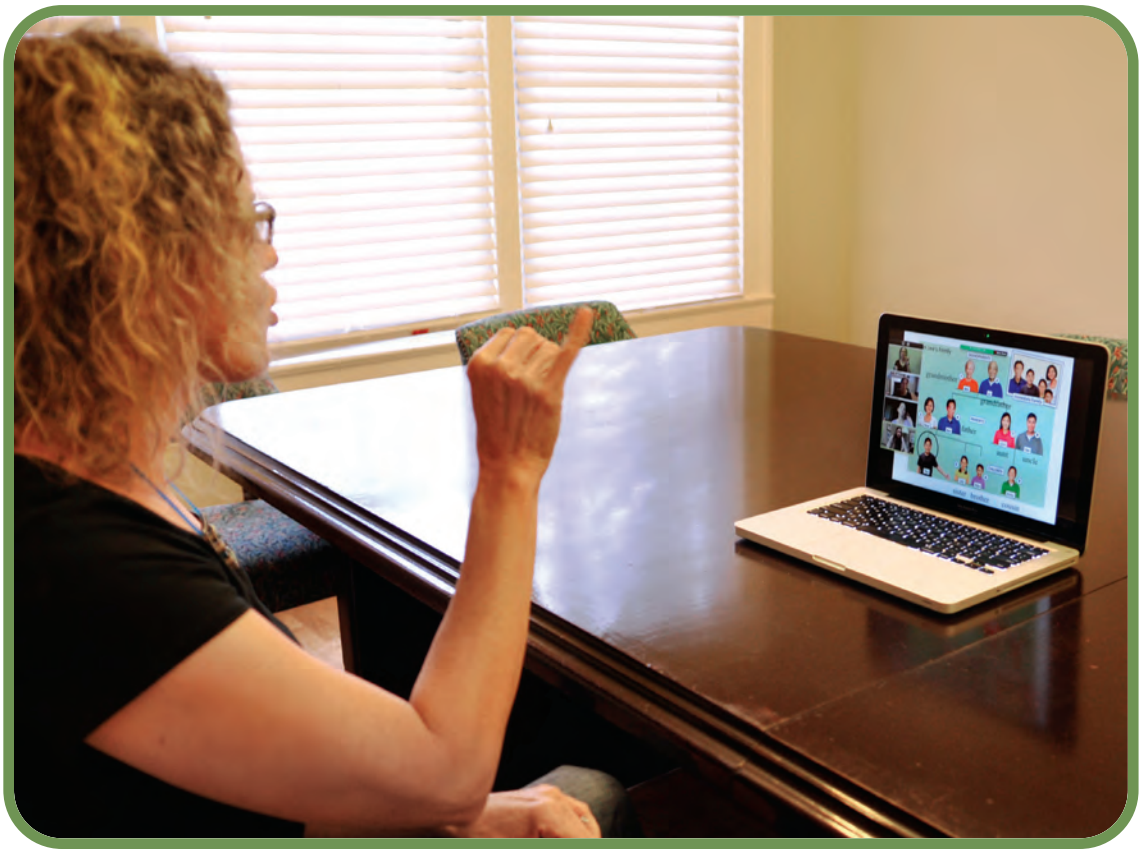
Educators in Texas used technology to implement a pioneering program that teaches families of deaf children sign language through tele-intervention.

A West Texas grandmother, who has custody of her deaf granddaughter, drove the child 52 miles to the nearest day program for deaf students—104 miles round trip—every day. The grandmother wanted to learn the sign language that her granddaughter uses, and the school offered weekly evening classes. However, to take classes required not only tacking on the additional miles to commute but also rearranging the schedules and routines of the other children in her home. By the time the grandmother settled the children in the car, arranged for their care upon arrival, attended class, returned home, and got the tired children into bed, she had only a few hours before the next 104-mile trip the following morning. Her desire to learn sign language could not be fulfilled; reality presented too many roadblocks.

She was not alone. While many parents and guardians understand that communication facilitates their children's success, getting to a sign language class can be a major logistical challenge. Transportation time and cost, finding babysitters for

Right: An instructor in ERCOD's Family Signs program teaches a group class via computer.

Photos courtesy of Diana Poeppelmeyer and Lynn Reichert



Lynn Reichert, MA, coordinator of the Family Signs program and a certified deaf education teacher and interpreter, has taught in oral, aural, and Total Communication programs. She has worked for 12 years in the field of deaf education and has taught American Sign Language at the high school and university levels. She welcomes questions and comments about this article at *familysigns@ tsd.state.tx.us*.

siblings, scheduling, and understanding the language of instruction can be insurmountable barriers. Additionally, some school programs with limited resources may not be able to offer sign language classes at all.

The Educational Resource Center on Deafness (ERCOD) at the Texas School for the Deaf (TSD) has reached out to these families with a program we call Family Signs. This is our story.

Looking Back

TELECONFERENCING AND TEACHING OVER DISTANCE

In 2005, a mother in a small town north of Dallas contacted ERCOD. She had been to ERCOD's annual Family Weekend Retreat and returned home enthusiastic about expanded communication possibilities for her son, who was still a toddler. When she discovered sign language classes were not readily available in her community, she contacted us. Since TSD had recently installed videophones campus wide, ERCOD staff decided to test this technology and accommodate the young mother, and we used videophone technology to teach her and her family sign language.

This was not the first time. The year before, we had tried to assist a family in a similar situation, but the family had no in-home high-speed Internet and the connection we set up in a nearby library resulted in a process too awkward to maintain. However, we learned from the experience, and with this second family in our pilot program, we required an in-home videophone. Once that was set up, the ERCOD instructor, who was certified both as a deaf education teacher and an interpreter, called weekly from her office in Austin to their home. For one year, the ERCOD instructor taught one-on-one classes via videophone for the mother, father, and hearing sibling of the 18-month-old deaf child.

The process and the teaching were successful. The deaf toddler was increasingly surrounded by family members who could communicate with him—and ERCOD had the beginnings of what is now Family Signs.

FAMILY SIGNS: SETTING UP A PROGRAM

Support for parents who wish to develop communication skills is critical. When parents have communication with their children, they are better able to express their concerns, expectations, and support. Bonding with children—and their social, emotional, cognitive, and linguistic development—depends on communication with those who love them. This transfers into better success in school. For deaf children in hearing families who choose sign language, this becomes problematic as their mothers and fathers typically do not already know sign language. Recognizing the lack of readily available sign language classes, we wanted to set up remote ASL instruction throughout Texas.

Initially Sorenson, a video relay provider, supported the program by providing videophones to 30 families throughout the state and a cadre of highly-qualified interpreters to serve as sign language instructors. Unfortunately Sorenson did not continue the program, and for three years ERCOD looked for other sponsors. Failing to find financial support, we ultimately turned to volunteer interns from Interpreter and Deaf Education Teacher Training programs in our state's colleges and universities. From 2009 until the spring of 2012, these students, who were advanced-level signers, served as teachers.

EVALUATION—AND UPGRADING

In 2011 we evaluated our program using the National Center on Hearing Assessment and Management's (2011) tele-intervention guide. This allowed us to do a side-by-side comparison of program components and showed that, with the exception of the use of professional instructors, Family Signs met the guidelines. The Joint Committee on Infant Hearing's (2007) position statement affirmed the importance of the role of professionals.

These documents gave us the impetus to pay professionals and to phase out volunteers. Our goal was high-quality service provision for Family Signs. In the spring of 2012, we added two paid instructors to our group of college and university volunteers. We immediately noticed that most families taught by the paid instructors requested to have their same teacher for the following semester. This was a good sign; not only did it mean that our teachers were establishing positive personal relationships, but moving to paid professionals meant that we did not have to train new instructors each semester. By the fall of 2012, we had six paid instructors and had discontinued the use of volunteers (Poeppelmeyer & Reichert, 2013).

Bonding with children—and their social, emotional, cognitive, and linguistic development—depends on communication with those who love them.

The Program Today

SIGNS OF SUCCESS

Today Family Signs is flourishing. All our instructors are paid and have degrees or certifications in fields relating to interpreting, deaf education, or language development. Videoconferencing is now free, which makes it easier for families throughout Texas to use technology to bring a professional instructor into their homes. Since neither professionals nor parents need to travel long distances, scheduling is flexible, allowing classes to take place at a time that best fits the family's needs. From 2011-2013, the Family Signs program served an average of 93 family members per year.

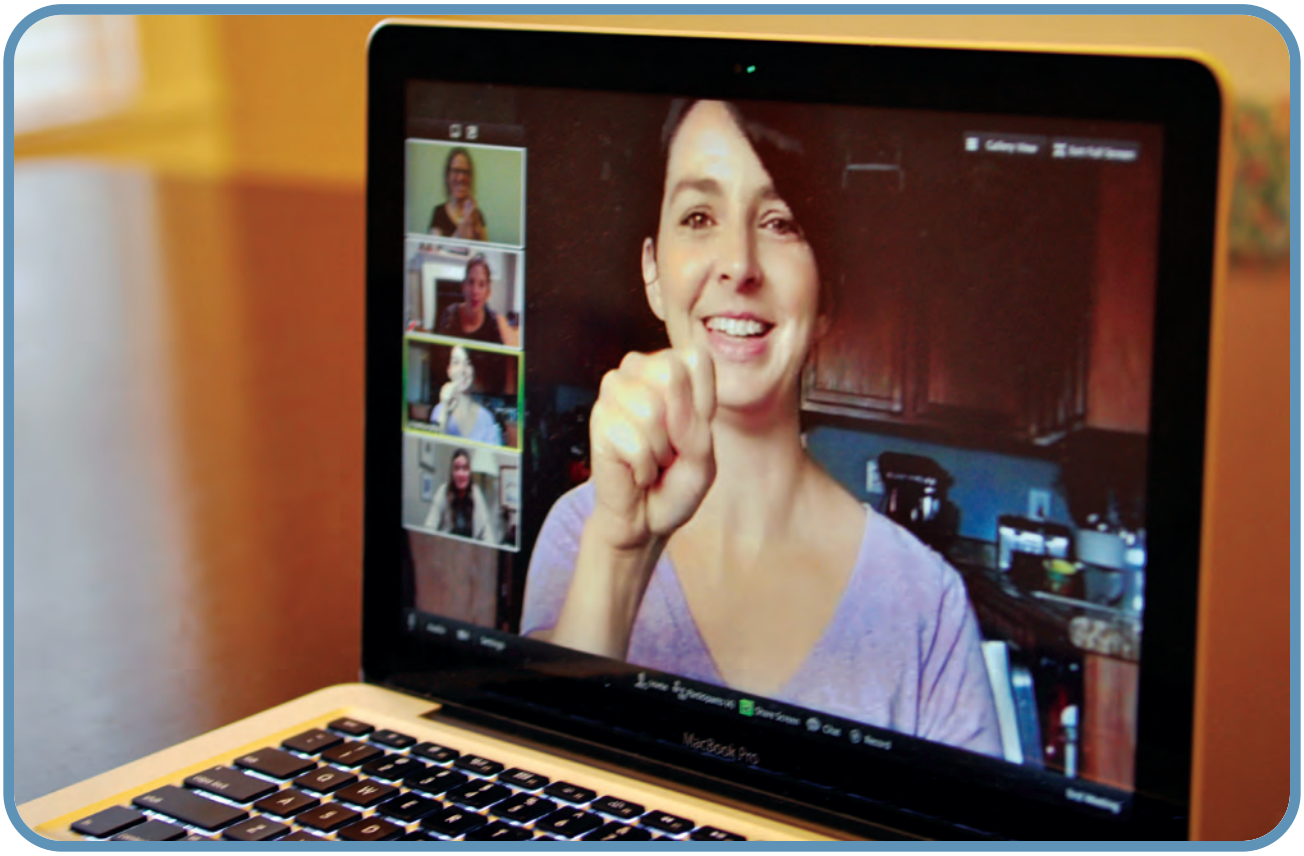
To be eligible for the program, families must:

- live in Texas
- have a deaf or hard of hearing child between the ages of 0 and 21
- have high-speed Internet
- have a computer with a webcam or an iPad (if the family does not have a webcam, our program loans them one for the duration of the class)

The technology for providing classes constantly changes. Originally we used only videophones, but then Skype and ooVoo offered the same free services. Now Google+ Hangouts, FaceTime, and Zoom are all possibilities. We use them all—the program depends on what the family already knows or what offers the best quality for class. Classes may be either one-on-one or include up to three students per instructor. A single class can have participants interacting from four different parts of the state.

Some challenges remain, and we are moving to address most of them:

- ***Some families do not have high-speed Internet in the home***. While in the past classes offered through the public library or school proved too complex to maintain, we have recently experienced success with a pilot program through Harris County Public Library in Houston. Our student is taking the class in the library, using Zoom video-conferencing on the library's iPad. Since Zoom only requires a one-time download of a browser plugin, it was



Above: Students learn sign language from home, participating online in a group class. Tele-intervention makes classes more accessible to families.

relatively easy to implement. We plan to offer the same setup to other families in Houston who don't have Internet access at home.

- ***Fluctuating bandwidth sometimes diminishes video quality***. Signing over the Internet using video applications such as Skype or FaceTime requires reliable bandwidth to and from each site, especially for uploading and downloading. The available bandwidth depends on the user service plan purchased from the Internet service provider, the type of connection, whether the connection is wired or wireless, and the competing Internet activities within the house, the neighborhood, and the rest of the Internet. A higher bandwidth is required when using signing than when using audio. Usually a minimum of 3 mbps (megabits per second) is required for clear signing. When registering for Family Signs, a prospective student is required to measure the bandwidth that he or she will use for class, but these numbers serve only as a guide. We deal with the families individually in creating solutions for bandwidths that do not meet minimal standards.

- ***Videoconferencing companies unpredictably change their interface***. Though our instructors can coach the students through setting up and using videoconferencing programs, we cannot control if, when, or how often these companies change their interface. When the student tries to sign in for class and a new interface causes the screen to look entirely different, the issue can take a full 30-minute class period to resolve. Since students average fifteen 30-minute classes each semester, losing a class to technology glitches can be problematic. To avoid changing interfaces, we are moving to Zoom, which allows the instructor to send a link to the student; the student joins the class through the link and does not need to deal with an interface.

- ***Some families use languages other than English or Spanish***. We have two instructors to serve our Spanish-speaking families and more for our English-speaking families, but we are ill equipped to handle any other languages that may be used in a students' home.

- ***We would like to honor parents who use different signing systems***. Since some regional day school programs for the deaf in Texas use Signing Exact English (SEE), we have one instructor who is SEE Center-approved.

- ***Some rural areas do not have high-speed Internet***. This is the one issue we have not been able to resolve.

OTHER PROGRAMS—AND SATISFIED INDIVIDUALS

While we offer four semesters of sign language classes with the goal of building confidence and independence in sign language, the outreach implicit in this instruction allows us to share information about other programs that will allow students to advance their signing skills. These programs are:

- Remote Shared Reading Project—Via tele-intervention, this project tutors parents on how to read to their deaf or hard of hearing children.
- Communication skills workshop—The workshop comprises an annual summer ASL immersion week at TSD.

Additionally, we share information about:

- Texas Hands and Voices—The Texas chapter of the national organization offers support, information, and resources to families of deaf and hard of hearing children in whatever communication they have decided to embrace.
- Texas Guide By Your Side—This family support program embodies the mission of Hands and Voices.

Additionally, each semester approximately two families request to join our program but cannot because they live outside of Texas. Fortunately Family Signs is not the only program of its kind. A few other programs offer sign language to families throughout their states via tele-intervention. These include:

- Iowa School for the Deaf, Parent ASL Class (*www.iowaschoolforthedeaf.org*)
- Kansas School for the Deaf, Family Signs Kansas (*www.ksdeaf.org*)
- Maine Educational Center for the Deaf and Hard of Hearing, ASL for Families (*www.mecdhh.org/parents/asl-for-families/*)
- Deaf Mentor Program First Step, in Wisconsin (*www.wesp-dhh.wi.gov/wesp/out_deafmentor.cfm*)

There are approximately 7,500 deaf and hard of hearing students attending school in deaf education programs and classes, private and public, throughout Texas (B. Pitts, personal communication, September 8, 2014). Learning signs through videoconferences is available for an increasing number.

Meanwhile, the grandmother who wanted so much to sign with her grandchild without adding a 104-mile drive to her week was finally able to use teleconferencing to take sign language classes from her home. She loved it, and today she constantly shares information about Family Signs. "'Thank you' will never be enough!" she told us. "I want to know {my granddaughter's} every thought—her dreams, her feelings, *everything*. I truly can't put into words what this program has done for me."

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TECHNOLOGY AND MULTIPLE DISABILITIES:

Learning What Works for Cree

By Catherine C. Valcourt-Pearce

My son Cree was born on April 16, 2010, via C-section at Sibley Hospital in Washington, D.C., after 15 hours of unproductive labor. After registering a 7 on the APGAR and then a 9, this beautiful, precious infant was swaddled and given to us to hold. Marveling over this new life, my husband Larry and I had no idea of the adventure that awaited us all.

On that first day, following up on Cree's prenatally diagnosed severe kidney reflux, the tech at the hospital did an x-ray and saw something wrong with Cree's heart. A pediatric cardiology consult determined that Cree had a congenital heart defect called total anomalous pulmonary venous return (TAPVR). He was transferred by ambulance several miles away to Children's National Medical Center (CNMC). We were warned that Cree might need open heart surgery the next morning. I touched my baby goodbye in his portable isolette, still numb from the waist down from my C-section and unable to raise myself out of the bed to kiss him. I didn't see Cree again for four days. When I did, my world fell apart.

The Diagnoses Keep on Coming ... So Do the Specialists

As it turned out, Cree only stayed in the Cardiac Intensive Care Unit overnight. He was then transferred to the Heart and Kidney Unit until he stabilized enough to be sent home so that he could grow bigger and stronger before his open heart surgery.

By the time I was reunited with Cree, however, other conditions had been diagnosed. In addition to his kidney reflux and TAPVR, doctors from CNMC noted that Cree had gastroesophageal reflux disease. He also had severe hypotonia, a poor suck reflex, and unusual toenails. CNMC's geneticists had recommended testing and through fluorescence in situ hybridization, which maps the genetic material in a person's cells, they—and we—learned that Cree had Phelan-McDermid Syndrome (*www.pmsf.org*), a rare syndrome identified in only

Photos courtesy of Catherine C. Valcourt-Pearce

Catherine (Cat) C. Valcourt-Pearce, MS, has worked at Gallaudet University's Laurent Clerc National Deaf Education Center, in Washington, D.C., for 20 years. She is both the coordinator of publications and development and managing editor of the Clerc Center's *Odyssey* magazine. She also served as a freelance content advisor for four children's books published by Enslow Publishers related to sign language and deafness. Valcourt-Pearce received both her bachelor's degree in English (writing) and communication arts and her master's degree in administration and supervision from Gallaudet; she received her publication specialist certificate from George Washington University. She and her husband, Larry, are the proud parents of four young sons—one hearing, one hard of hearing with multiple disabilities, and hard of hearing twins. Valcourt-Pearce welcomes questions and comments about this article at *Catherine.Valcourt-Pearce@gallaudet.edu*.

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PHOTO CREDIT ZHEE CHATMON

Clockwise from top left: Mama and Cree shortly after his birth; first family photo with Cree after he was released from CNMC; Cree being fit for a Kid Kart Xpress, his first wheelchair; relaxing at home usually with a smile or a giggle.

approximately 800 people worldwide at that time. Thirty-four days later, we would learn that Cree's syndrome was even rarer than we'd originally thought; his particular type, called ring chromosome 22, is found in only approximately 100 individuals worldwide. He also has a rare and eventually terminal chromosome disorder called neurofibromatosis 2 or NF2 (*www.nfnetwork.org*); as a result of this disorder, Cree is missing the tumor-suppressing gene and is at lifelong risk for tumors, especially on the brain, spine, and acoustic and optic nerves.

Before Cree was even a week old, technology had changed our lives almost as much as his birth and diagnosis. Medical technology allowed Cree to live; children like Cree who are not born into societies with strong medical services do not survive. Internet technology allowed Larry and me to become informed; we spent hours each day researching Cree's diagnoses and related symptoms. Social technology allowed us to join support groups on Facebook and to "meet" the amazing parents around the United States and in other countries who are raising children like our Cree and to not feel completely alone.

Cree eventually failed, and then passed, his newborn hearing screening test. He bounced in and out of the Heart and Kidney Unit until, at 7 weeks old, he had successful open heart surgery. He had successful bladder surgery to repair the kidney reflux at age 2. Also at age 2, he was diagnosed with epilepsy. At age 3, he had the first of several surgeries to remove benign NF2-related tumors. At age 4, he was diagnosed with hearing loss via a sedated auditory brainstem response hearing test at Georgetown University Hospital and received his first hearing aids. He was also diagnosed with cortical visual impairment, which is "a decreased visual response due to a neurological problem affecting the visual part of the brain" (American Association for Pediatric Ophthalmology and Strabismus, 2014).

Now age 5, Cree has undergone more surgeries, medical procedures, and exams than most people accumulate in a lifetime. He has anywhere from 12-14 medical specialists at any given time. He is a warrior!

IFSPs, and IEPs, and Accommodations—Oh My!

By the time Cree was 4 months old, he already had an Individualized Family Service Plan (IFSP) specifying his goals and therapies through the Montgomery County Infants and Toddlers Program

under The Arc Maryland (*www.thearcmd.org*). When he turned 3, an Individualized Education Program (IEP) was created for him with new goals and therapists. During these meetings, accommodations were discussed. We pushed for the addition of technology into Cree's therapies; they pushed back, saying it wasn't feasible yet. At that point, we had to agree. Cree simply didn't have the muscle strength.

Due to his severe hypotonia, Cree was, and still is, learning basic skills such as how to roll over onto his stomach, how to hold up his head during supported sitting. He may never crawl, or sit alone, or feed himself. He cannot speak or sign, although he can understand sign language since we've used it with him from birth. He usually has little to no interest in toys unless they play music. All these issues make use of assistive technology a challenge with Cree. Still, there has to be some way of incorporating it into Cree's life, both at home and at school. We want Cree to be able to tell us what he's thinking, how he's feeling, what hurts, what his preferences are to the extent possible. Mastering even "yes" or "no" will be life-changing for Cree (e.g., Are you hungry? Are you tired? Are you hurting? Do you feel sick? Can you breathe?).

Finding the Right Technology for Success

We use American Sign Language (ASL) as our primary mode of communication at home; with the exception of one son, the rest of us are deaf or hard of hearing. Technology is central to our lives. Text messaging, e-mail, FaceTime, and Facebook continue to keep us connected with family, friends, and other parents of children with disabilities. The Internet, closed captions on the television, and alerting devices such as flashing lights for the telephone and iPhone, vibrating alarm clocks, strobe smoke detectors, and baby monitors with light flashers are also a standard part of our daily lives.

For each of our children, we have tailored technology a bit to accommodate age and interest. For Cree, our only child who is both hard of hearing and has additional disabilities, we have found the following especially useful:

- ***Closed captions on a portable DVD player***—While he can't speak, Cree's teacher says he is able to recognize quite a few printed words, so the first type of assistive technology we introduced Cree to was a DVD player. We turn on the closed captions for each movie or show he watches. We believe that between hearing the words and seeing them on screen, Cree has a better understanding of—and surely gets more enjoyment from—his movies.
- ***Musical push-button toys***—Cree loves music, especially when wearing his hearing aids. We have several musical toys that are push-button activated. While Cree usually needs help in order to push the buttons, he will reach out to find a specific toy's button himself. He clearly knows how to turn the music on and where the buttons are. These toys not only provide entertainment, but they also offer incentive to encourage Cree's movement and cognitive development. It's also for this reason that we want Cree to begin to use other technology, including an iPad.
- ***Software and speech-generating devices***—Cree is learning to use eye gaze in his Building Bridges (preschool education) program to answer questions and participate in curriculum-related instruction with his classmates. Currently his teacher—who is both incredibly enthusiastic and extremely dedicated, and who knows Cree and his capabilities better than anyone but us—is using such materials as cards printed with "yes" and "no" and "happy" and "sad" faces as well as word cards for names, days of the week, letters, and numbers. Daily, the teacher asks Cree to choose from among two to four cards to identify his name, a specific word, a letter, a number, etc., and waits patiently while he uses eye gaze to do so. This can be hit or miss depending on how tired or frustrated Cree is; it's a process, but it's a skill that's slowly developing.

As a result, we asked that Cree be evaluated for iPad use; there are many helpful apps for children with disabilities similar to Cree's that might be useful when he gains better control of his arms and hands and which incorporate these same lessons or similar. We were hopeful that this process could begin at school. Cree was considered for Boardmaker Plus software and speech-generating devices such as the BIGmack Communicator (single message speech-generating device), the Step-by-Step Communicator, TechTalk, Go Talk 9+ and GoTalk 20+, Pocket Talker, and Cheap Talk. Since Cree can't sign or speak, this type of software/device could serve as a way for him to express more complete thoughts and ideas verses simply "yes" and "no" and other one-word answers. However, while Cree's teacher and speech-language therapist were supportive of beginning technology use, the Montgomery County Public Schools' InterACT

Helpful Technology-Related Websites

By Catherine C. Valcourt-Pearce

My husband and I often surf the Internet, hoping to discover current and new assistive technology and technology-related information that might benefit Cree as well as our twins. Below are some of the websites we have found helpful, including those that reference technology mentioned above for which Cree was evaluated.

- **American Society for Deaf Children** (see Knowledge Center), *www.deafchildren.org*
- **American Speech-Language-Hearing Association** (see Hearing Assistive Technology Systems), *www.asha.org*
- **Apple Store for Education**, *http://store.apple.com/us/browse/home/findyourschool*
- **Attainment Company** (see Go Talk 9+ and GoTalk 20+), *www.attainmentcompany.com*
- **Center for Accessible Technology in Sign**, *www.cats.gatech.edu*
- **Enabling Devices** (see Cheap Talk), *http://enablingdevices.com*
- **eSpecial Needs** (see Step-by-Step Communicator), *www.especialneeds.com*
- **Gallaudet University's Visual Language and Visual Learning Center** (see Storybook apps), *http://vl2.gallaudet.edu*
- **Harris Communications** (see Pocket Talker), *www.harriscomm.com*
- **Kids Together, Inc.**, *www.kidstogether.org*
- **Laurent Clerc National Deaf Education Center** (see Deaf Students with Disabilities Network), *http://clerccenter.gallaudet.edu*
- **Maryland Learning Links**, *http://marylandlearninglinks.org/955*
- **Maryland Technology Assistance Program**, *www.mdod.maryland.gov/MTAP.aspx?id=2665*
- **Mayer-Johnson** (see Boardmaker Plus Software and BIGmack Communicator), *www.mayer-johnson.com*
- **National Association of the Deaf** (see Assistive Listening Systems and Devices), *www.nad.org*
- **National Autism Resources** (see PECS), *www.nationalautismresources.com*
- **National Center for Technology Innovation**, *www.nationaltechcenter.org*
- **PBS Parents** (see Assistive Technology), *www.pbs.org/parents/*

(Interdisciplinary Augmentive Communication and Technology) Team who came to evaluate Cree decided, to our dismay, that Cree's responses weren't consistent enough to merit incorporation of these devices and denied the request.

We will ask that Cree be re-evaluated for such technology as the speech-generating devices in the near future, even as we hunt for grants for an iPad for Cree so that we may begin to experiment at home with some of the many helpful apps available for children with multiple disabilities. In the meantime, Cree will continue to work on mastering eye gaze. Already there are companies out there that make devices that give individuals access to the computer and the Internet through eye gaze—something that might become a possibility as Cree gets older.

Next Step ... Kindergarten!

Cree will soon be entering kindergarten, and we have been visiting programs for children with multiple disabilities. We have been impressed with the accommodations and the technology we have seen used already in these classrooms—sign language interpreters,

PHOTO CREDIT ZHEE CHATMON

iPads and apps, PECS (picture exchange communication system), switches, SMART Boards, closed captioning, FM systems, and even a wheelchair lift for one program that has a pool. Programs that combine no-tech and low tech options, such as the printed cards with words and pictures and switches, with higher tech ones, such as iPads, apps, and SMART Boards—make learning accessible, meeting Cree's needs and capabilities *right now* and as they are developing as well as serving as an incentive as he becomes stronger and more deliberate in his responses.

Exciting things are happening technology-wise that afford Cree far more access than he would ever have received even five years ago. Who knows what other kinds of technological inventions are on the horizon for deaf and hard of hearing students with additional disabilities? Whatever they are, we'll be on the lookout—and we'll be fighting for their incorporation. Cree deserves every opportunity to succeed.

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Tina Childress, MA, CCC-A, is an educational audiologist, consultant, trainer, and aficionado of all things technology related. A late-deafened adult with bilateral cochlear implants, Childress loves to learn, teach, and share with people face-to-face or via social media. She welcomes questions and comments about this article at *tina.childress@gmail.com.*

Right: Today's students are technology savvy, skilled in texting, e-mail communication, videoconferencing, and surfing the Internet for information.

FOR ALL STUDENTS EVERYWHERE:

Technology Means Independence in a Beautiful Digital World

By Tina Childress

I love technology! In fact, my love for technology is so strong that my nickname is "Techy Tina." I am a former hearing audiologist who became a deaf audiologist. I use two cochlear implants: one for each ear. Teachers, parents, and those involved in the lives of deaf and hard of hearing students should not fear technology but, like me, embrace it—and help their students to embrace it.

Technology benefits everyone, but perhaps especially deaf and hard of hearing students; it allows them direct access to the world around them and continued connection with others. Technology can mean increased access, independence, and self-reliance. The T-coil and all of the cables and accessories that come with hearing devices are essential for those that use hearing technology. Below are some of the options I've discovered in our new techy world. Read on!

Wearable Technology and Alert Signaling Devices

From the moment they wake up, and even before they wake up, today's teenagers can know if there is an emergency. While strobe lights, loud alarms, and bed shakers have been around for many years, a new technology is spreading today: the smart watch. The smart watch, a wearable computer that slips around the wrist like a watchband, shows texts and e-mail messages along with the time. In addition, the watch can function as an alert signaling device. Wearers can set up an alert at times of their choice and the alert occurs as a strong tactile vibration. Similar

Photo by John T. Consoli
Product photos courtesy of Harris Communications and Apple

vibrations occur when e-mail and text messages arrive. Apple has just released a smart watch that connects with the iPhone, but I have had a smart watch for a while. Mine is a Pebble watch, and before I put on my cochlear implants—when I can't hear, see, or feel my phone—I depend on it.

As much as connection, wearable technology and signal devices foster independence. Getting up and receiving a message is not dependent on a family member. These devices are one way that allow deaf and hard of hearing young people to take responsibility for their own lives.

Helpful Systems to Combat Environmental Noise

The most common complaint I get from hard of hearing individuals is how hard it is to listen in a noisy environment. This may be particularly difficult for deaf and hard of hearing students who use audition as they are still learning the importance of telling their teachers and friends where to stand and how to speak so they are able to understand them. It is definitely not easy for a young person to suggest that she and her friend go to a quieter place or a place with better lighting to talk. It may be even more difficult asking adults or an authority figure to do so. Several systems have been designed for use in public places. Students should know about each of them—and which is of most benefit for their unique needs.

The systems include:

- ***FM/DM systems***. Found most often in schools—but becoming more widely accepted in other listening-intensive situations like meetings—these systems send auditory information via an analog (FM) or digital (DM) signal. There are two parts to these systems: a transmitter that connects to the person speaking, speakers, radio, or whatever it is that the deaf or hard of hearing person wants to hear, and a receiver that is worn by the deaf or hard of hearing person. There are various microphone styles for the teacher and various receiver options for the student. Students might use a receiver directly plugged into their hearing aids or cochlear implants or the receiver may be in the form of a speaker that the whole class can hear. Sometimes a deaf or hard of hearing individual can use a microphone that looks like a pen and point it toward whatever it is he or she wants to hear.

- ***Infrared devices***. Most commonly found in theaters, infrared devices send auditory information through an infrared signal, which I like to think of as a cone of sound. The person with hearing loss sits within the cone using

specialized receivers. Several receiver options are available, including headphones that fit over the ears, plugging into hearing aids or cochlear implants with special cables, and neckloop receivers that connect to the T-coil in a hearing aid or cochlear implant. For deaf and hard of hearing individuals who do not need implants or hearing aids, some theaters offer receivers with headphones that can access the signal directly. Unfortunately, too many theaters use under-the-chin-style headsets, which do not work for those of us with amplification; under-the-chin-style headsets do not work well with earmolds and ear hooks.

- *Induction loop systems*. Found in a variety of settings, these systems are becoming more prevalent throughout the United States. The induction loop—a specialized perimeter of wire that surrounds a designated area—sends auditory information to a T-coil setting on either hearing aids or cochlear implants. Looped areas can be of varying sizes. Theaters, places of worship, live performance areas, and public meeting rooms in local libraries can be looped; so can cars and even favorite chairs. The beauty of loop systems is that individuals who wear a device that has a T-coil setting don't need any kind of special receiver to hear the sound. All they have to do is switch their hearing aids or cochlear implants to the T-coil setting and sit within the looped area.

Phones and Telecommunication

Today texting, e-mail, Instant Messaging, visual chatting, and videoconferences are standard practice. These technologies have leveled the playing field for participating in everyday communications. Families can keep in contact during the school day. At the end of the school day, students are able to let parents know if they want to stop and visit a friend on the way home. Like their hearing peers, deaf and hard of hearing students have full and continuous access to friends and family via text.

When deaf and hard of hearing people ask me, "What kind of cell phone should I get?" I recommend that they look at the Hearing Aid Compatibility (HAC) rating of the phone. Each of the major carriers is supposed to have a certain number of phones that are HAC rated, which means that they are less prone to interference. There is the "M," *microphone*, rating which gauges how strong the phone is. A high M rating means that when held up to the ear, the signal is relatively loud. There is also the "T," *telecoil*, rating, which shows how strong the T-coil signal is. A high T rating means that a robust signal is received. M4 and T4 are the highest ratings; M3 and T3 may be acceptable.

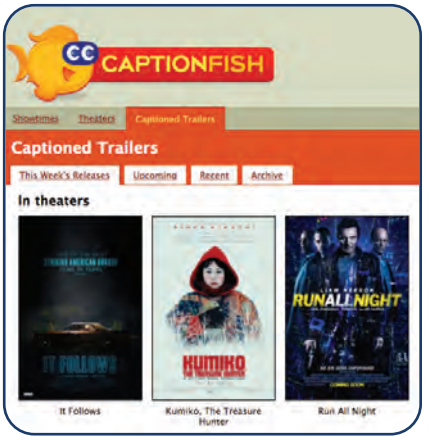
To find a phone's HAC rating, look in the "specifications" section of the literature for that particular model of phone. Also, check out the accessibility page of any of the major carriers; often these pages list the HAC rating of each phone.

There are also ways to caption phone calls. There are services that use voice recognition software to convert conversation to text, which is displayed on a screen on a specialized phone, on a computer, or on a mobile phone. There is also an app that uses live CART writers to transcribe your conversations and even to listen to your voicemail.

Individuals who use American Sign Language (ASL) have a choice of devices that enable easy communication. These include front-facing cameras on computers that allow direct communication with other ASL users and with hearing people through video relay. Video relay services throughout the country provide interpreting services between those who use ASL and those who use voice in real time. In addition, FaceTime, the Apple app automatically included on every iPhone, provides effortless face-to-face communication through which signing is fairly easily understood.

Movies and Plays

Accessibility in movie theaters and live theaters has come a long way! Caption systems include DoReMi's CaptiView and Sony's Entertainment Access Glasses. There are two technologies that display closed captions for individuals in movie theaters: one has a text display on a flexible gooseneck arm that has a base that fits into the cup holder of the theater seat, and the other displays captions in special glasses. Movie theaters tend to use one or the other—and the job of the deaf or hard of hearing individual is to find the theater that best matches his or her technology preference. My favorite source for finding captioned movies is Captionfish (*http://captionfish.com*) because it explains which technology is used in which theater for which movie.



Live theater, in addition to looping or other methods of enhancing access to sound, sometimes provides visual access to dialogue as well. Open captions show through various technologies that permit print to be displayed through light. Captions are usually set up on or near the stage. ASL interpreters are also available for various performances. Teachable moments occur as students learn to use this access—because they learn to plan ahead. Like all of us, they have to remember to ask about accommodations early!

Apps and Applicability

A few years ago I started collecting and categorizing apps, and this list has grown!

Categories include: accessibility, audiology, classroom tools, hearing testing, listening therapy, media players, personal amplifier, sign language, sound level meters, speech/language, and telecommunication. Take a few minutes to check out the listing and see if anything meets your needs. This list is ever-changing so be sure to come back often. The list can be accessed at *http://bit.ly/Apps4HL*.

If all of these suggestions seem overwhelming, here are some quick suggestions for navigational support:

- Talk with your audiologist.
- Check out recognized organizations through their websites and conferences:
  - Alexander Graham Bell Association (*http://listeningandspokenlanguage.org*)
  - Association of Late Deafened Adults (*http://alda.org*)
  - DeafNation (*http://deafnation.com*)
  - Hearing Loss Association of America (*www.hearingloss.org*)
  - National Association of the Deaf (*www.nad.org*)

Hearing aids, cochlear implants, captioning, text messages, and other technology have come a long way since they were first introduced. Some devices allow access to sounds that were impossible to hear before. Some enable understanding of sound through distance. Some allow sound to be made visual. Deaf and hard of hearing individuals of all ages can use the power of the Internet and digital technology. For deaf and hard of hearing students, access through technology will only increase and improve. As professionals involved with their lives, we can only guide and support them—and then watch as they take over. The future belongs to them.

Shay Taylor, MA, MEd, is a K-12 technology integration and e-learning specialist at Gallaudet University. She hails from the Washington, D.C., area and works with the Laurent Clerc National Deaf Education Center. Taylor is a freelance video editor and a nationally certified teacher with 12 years of teaching experience. Follow her on Twitter: @*teachertaylor2k*.

Right: Many websites, such as PhET, offer a wealth of visual and interactive resources to support students.

Powering Up Technology

from Passive Access to Active Integration

By Shay Taylor

For over 30 years, the rallying cry of many adults who worked with students who were deaf or hard of hearing was *access*. Finally we established the right of deaf and hard of hearing students to equal access in every academic space they entered, whether in a residential school surrounded by deaf peers or in a public school surrounded by those who hear. Technology was the tool of choice for providing the surest access in almost every situation.

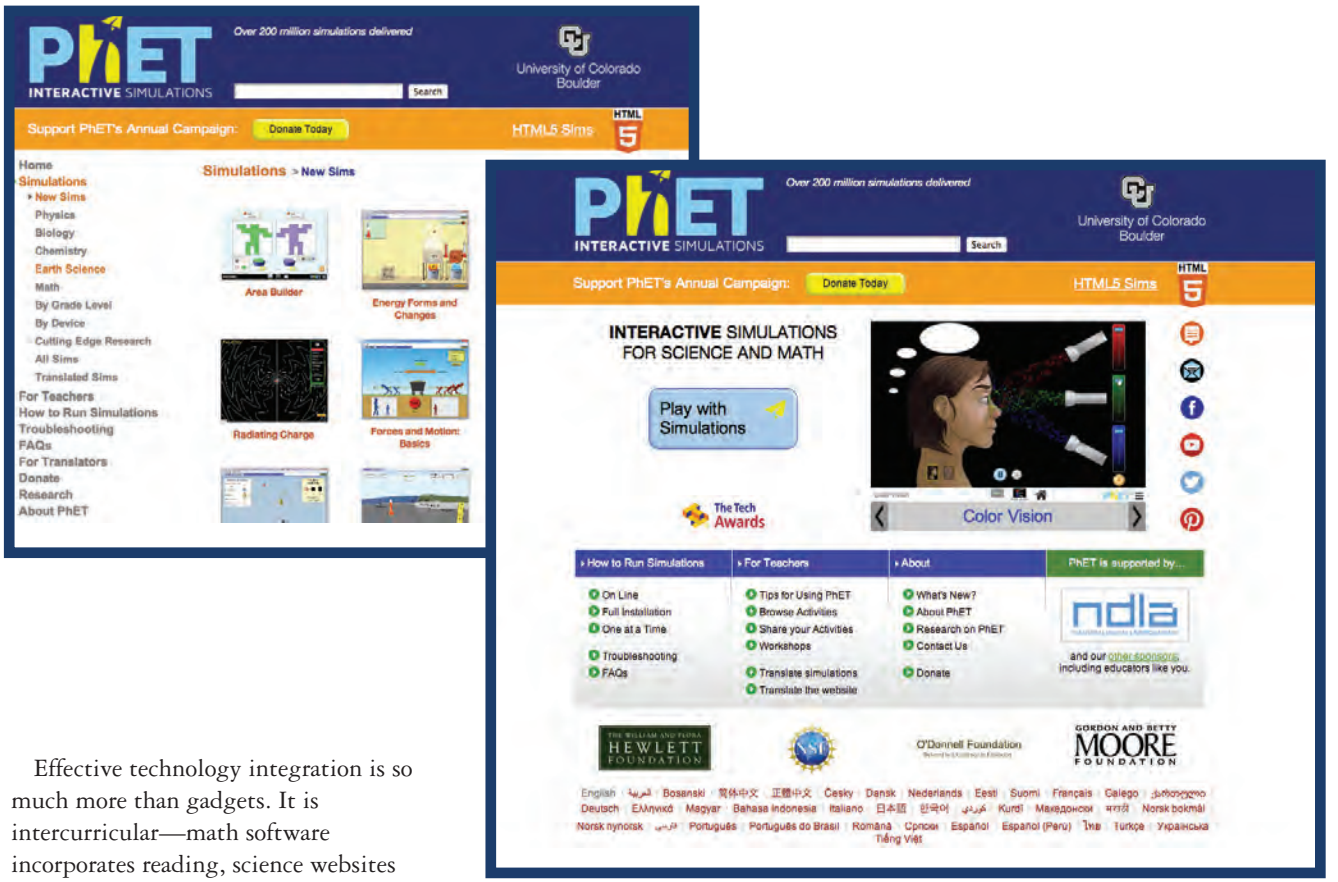
Now 15 years into the 21st century, our community is global—and a lot more accessible to all. Alpha-numeric pagers, captions, the Internet, and videophones have, in the most general sense, connected—or potentially connected—all of us. The call for technology to provide "access" has become myopic at best. Once the wave of the future, technology is now standard in most classrooms.

We need to raise the bar. *Access* means merely putting students in the presence of technology. *Action* means students and educators working with technology and making the technology work for them. We are moving from *access* provided through *incorporation of technology* to *action* inherent in the *integration of technology*. This is the framework we must claim for 2015 and beyond.

Incorporation to Integration

In a superficial sense incorporation and integration are synonymous, but the dictionary tells us differently. *To incorporate* is to include a thing, an individual, or an event as part of something else. *To integrate*, however, is to combine whole systems into an existing system that then becomes so changed in the combination that it becomes something new (*www.merriam-webster.com*). Today it is taken for granted that students use a computer to type a paper or use a website to watch a video. These activities are technology incorporation—but they are just the beginning. The electronic device is part of the learning process, but it does not affect the outcome. A computer may be easier to work with, but it makes no more impact on the students' learning than a typewriter would have 40 years ago. It may be cool to have the latest iDevice in the classroom, but a worksheet on an iPad is still just a worksheet.

Illustrations courtesy of Shay Taylor



Effective technology integration is so much more than gadgets. It is intercurricular—math software incorporates reading, science websites support language skills. It is multimodal—requiring not just clicking and reading but filled with visual, kinetic, and interactive information. It requires students to think more critically, not only to connect to content but to get more from the content than they would if they didn't have technology.

It's important to remember: The *how* of educational technology should be peripheral to the *why*. The key is integrating technology that supports and enhances learning goals and follows the four key components of learning (adapted from *www.edutopia.org*, 2015):

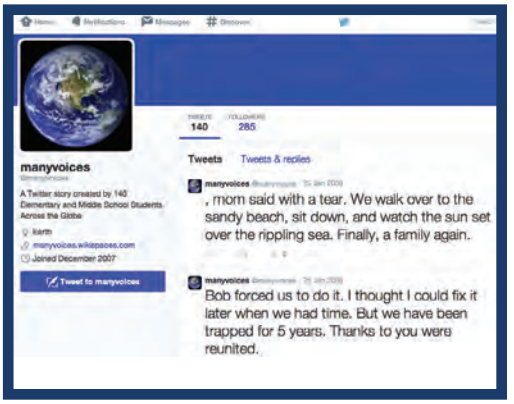
- **ACTIVE ENGAGEMENT—**Students retain more information and process it better when they are actively involved with their learning.
- **PARTICIPATION IN GROUPS—**Students work together, fostering collaboration and teamwork.
- **FREQUENT INTERACTION AND FEEDBACK—**This allows for independent self-monitoring and increases active engagement.
- **REAL-WORLD CONNECTIONS—**How can students apply their new knowledge to something they know/use/do?

At the Model Secondary School for the Deaf in Washington, D.C., for example, high school students use the discussion board feature of the Blackboard Learning Management System to develop critical commentary on historical and political issues and current events. Students share their own thoughts and questions and respond to those of their peers, posting their commentary in English and American Sign Language (ASL). Themes of social justice, oppression, and the American political system are contextualized historically but applied to modern-day events and situations.

As they pursue their discussions, students use technology not for technology's sake but as a tool to develop a sense of understanding of the world around them. Through discussions in English and ASL, they develop empathetic approaches to social groups and discuss critical readings about social systems. Further, by presenting information through writing and video using the tools in Blackboard, they develop skills for blogging and vlogging.

Each of these activities fosters critical thinking and allows students to express themselves in expository and persuasive ways. Technology integration also allows teachers and students to extend their conversations beyond the context of the classroom. Students are expected to provide real-world examples to clarify a point or direct a discussion; they are encouraged to connect images, videos, and websites to their text.

In mainstream classrooms, students



use class-specific Twitter accounts to backchannel their reading experiences with peers. Through Twitter, they question content, raise issues, and make connections. Reading their students' commentary, teachers are able to provide clarifications and passage-specific prompts, often in real time. Students can reply to each other, too, and re-tweet comments they find meaningful.

For example, the National Education Association's magazine, *NEA Today*, explained how George Mayo, a teacher in Montgomery County, Maryland, integrated Twitter into his class by using it as a platform for collaborative story writing. Through an account he called "Many Voices," Mayo and his students crafted an ongoing story through tweets. The project began with one line in 2007 and grew 140 characters at a time as his students and students from other states and six countries around the world added their thoughts (National Education Association, 2015). The project that Mayo and his students developed allowed them to increase their sense of global belonging, develop creative thoughts, exercise narrative writing skills, and connect with others.

For instructors who are wary of on-line technology or who don't have the district-wide or school-wide infrastructure to integrate technology in class, Edmodo (*www.edmodo.com*) is a solid option. This on-line system has the look and feel of Facebook but is fully secured to prevent unauthorized access. Edmodo allows students to post comments to the class but not directly to each other, and class discussion can be teacher moderated. This maintains transparency and minimizes possibilities of on-line bullying or harassment. A free program, Edmodo does not require software downloads or personal information to be shared.

Another great program is Fakebook (*www.classtools.net/fakebook*). Young children can demonstrate their knowledge of characters in an assigned reading, use critical thinking and integrate language art skills by capturing the actions, personality, and motivations of a character in creating a fun profile. This website, modeled on that of Facebook, is not publically shared. Fakebook is ASL-friendly; it allows posting of videos. Consider assigning students to record a short introduction of themselves portraying characters from a book as part of their "on-line" profile project.

Teachers can also integrate digital recording technology and editing software to develop visual storytelling skills. Everything within the video frame has meaning for the viewer, and students can learn to create and analyze video, then apply those literacy skills to other forms of media. As teachers integrate social networking programs, either through on-line programs that are publicly available or through off-line programs where access is limited to those in the classroom, they can teach appropriate digital citizenship skills.

Math and science classrooms have a wealth of on-line resources available to support deaf and hard of hearing students, including free access to science experiments. Among the best: The PhET Interactive Simulation Project of the University of Colorado (*www.phet.colorado.edu*), which is highly visual and interactive and not dependent on sound. Several math and science textbook publishers offer on-line components of the textbook chapters with supporting text, extension activities, and visual glossaries. This kind of tool allows deaf and hard of hearing students to extend learning, and it supports them in making clear, visual connections with the discussion seen and heard in class. At their own pace, students can explore topics further, see videos that demonstrate complex processes, and explore unknown words—all in one seamless experience.

It's important to understand that deaf and hard of hearing students who find themselves in classrooms without integrated technology experience a double whammy. They lose access to requisite information and the global connections and discourse that technology provides. They also lose opportunities to develop their skills in both technology and critical thinking that will shape how they connect with the world as adults, learn new information, figure out how to solve problems, and develop new ideas.

All students, regardless of hearing ability, should have full access to the technology available today—just like they have access to pencils and paper. Integrating educational technology allows students to construct their own learning from where they are and with what they have. However, access alone is not sufficient. The goal of access is action. Moving beyond technology incorporation to technology integration ensures deaf and hard of hearing students are getting every opportunity to flourish as young people in the 21st century.

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Yes, You Can!

10 THINGS YOU CAN DO NOW TO GROW YOUR TECH-SAVVY SELF

By Shay Taylor

1. Learn to love Twitter. With a Twitter (*www.twitter.com*) account, your professional learning network will grow exponentially. Follow people and groups: @*NAME*. Follow topics of discussion: #TOPIC. Check out an #*EdTechChat* in your state or someone else's state. Also try: @*Edutopia*, @*justforDeaf*, @*ASCD*, and @*JDSDE1*. Throw out a thought or a question, mark it with a matching hashtag (#)—the marker that connects related ideas to each other—and see all the responses you get! Search hashtags already on Twitter and follow the people whose hashtags interest you. Hashtags are a great way to be part of conferences when you can't be there in person. Great starters include: #*notatISTE,* #*FETCsummit,* #*edtech,* and #*deafed*.

2. Embrace Evernote. Evernote (*www.evernote.com*) is a curating tool for all your newly found information. It allows you to file websites, blogs, and newsfeeds, together with tags, and annotate and save screenshots and webpages. Keep these online as well as on your computer. This tool is available as an app and in the Chrome browser, and it can be downloaded to your mobile device from Google Play (Android) or from the App store (Mac/iOS).

3. Taste Feedly. Feedly (*www.feedly.com*) allows you to collect blogs, websites, and even on-line magazines and put the sites together in one place. You save time and ensure your privacy by avoiding signing up to individual sites or e-mail newsletters. Read what others are saying about technology integration, best practices in deaf education, and much more. You can also do similar things with other programs found at LinkedIn's *www.pulse.me*, *www.Digg.com*, and *www.NewsBlur.com*.

4. Create a Google forms station. If you have a Google account, you have access to Google forms, a free on-line tool that can be used for surveys, tests, and evaluations. From your Google account, open Google Drive and select the "forms" option. The Google form allows you to construct questionnaires and will fill out spreadsheets with the results for easy evaluation and tracking. Students can complete "checks for understanding" after individual reading time. This is a powerful, versatile tool. Start simple and then build as you go! Log in at *www.drive.google.com*.

5. Attend a local EdTech conference. The International Standards of Technology Education conference is held annually and has local chapters in several states that also hold annual conferences. Attendance will allow you to connect in person with those who are tech savvy as well as with others who are just learning. Check out *www.isteconference.org* or do a Google search for "educational technology conferences 2015" for a great list of upcoming conferences.

6. Take students on a virtual field trip. From history, to science, to math, to media—whatever your field of study—a virtual field trip can enhance your students' learning, allowing exploration of on-line primary sources and virtual artifacts. Most museums offer video clips of interviews, animals, and events; 3-D tours of buildings; and viewings of paintings and other art closer than you can get in real life. Many, but not all, have captions. These tours support in-class literature and social studies units. Check out *www.newseum.org/education/*, *www.educatevia360.com*, and *http://googlelittrips.com/GoogleLit/Home.html*.

7. Learn from Lynda. This on-line learning website, *www.lynda.com*, is designed for older students and adults who want to learn a specific program, software, or technical skill. While a paid membership is necessary for full access, many tutorials are free. The tutorials cover everything from shooting digital video to learning how to use Excel. The captioned video modules are comprehensive, covering basic to advanced skills. The website also has a channel dedicated to K-12 educators, with topics like "classroom management" and "flipping the classroom." It is great for personal enrichment, summer projects, and ongoing professional development opportunities.

8. Be a student again. Many opportunities exist to learn online. For example, Blackboard K-12, Edmodo, Simplek12 and SharemyLesson all sponsor on-line webinars—and they are free! Khan academy (*www.khanacademy.org*) offers "learning…free… forever," including channels for parents and teachers. YouTube also has a wealth of educational videos. Don't forget the face-to-face options; consider a technology class at a local community college or joining a workshop at a library or museum. One drawback: captions and interpreters are not guaranteed.

9. Create a visual scavenger hunt. Using a digital camera or web images, collect pictures of a set of people, places, and things that represent a single concept (e.g., obtuse angles, the water cycle, or public spaces that used to be segregated). Present the pictures in PowerPoint as a slideshow. Challenge students to determine the connection, and then let them create their own slide show, or virtual hunt, based on a topic you give them.

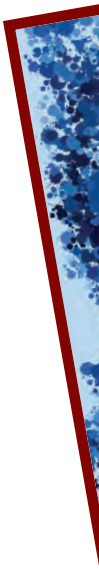
10. Make a tech-smart friend. This doesn't mean inviting your school's instructional technologist to lunch—but it could! Also consider connecting with people who use technology more than you do. Ask for an hour of their time just to show you what they do and how they do it.

Patrick Boudreault, PhD, is an assistant professor and coordinator of the master's program in Sign Language Education in the Department of ASL and Deaf Studies at Gallaudet University. He earned his PhD in educational psychology from the University of Manitoba in Winnipeg, Canada. Boudreault grew up in a quadrilingual and bilingual community in Quebec, where he became a native user of Langue des Signes Québécoise, American Sign Language, French, and English. He has been involved in the field of sign language and deaf studies in Canada and the United States since 2000. His areas of interest include signed language acquisition, assessment, translation, interpreting, and the impact of genetic testing on the Deaf community. Boudreault welcomes questions and comments about this article at *Patrick.Boudreault@gallaudet.edu.*

Bilingual Cancer Information:

Access is the First Line of Defense

By Patrick Boudreault and Christina Palmer



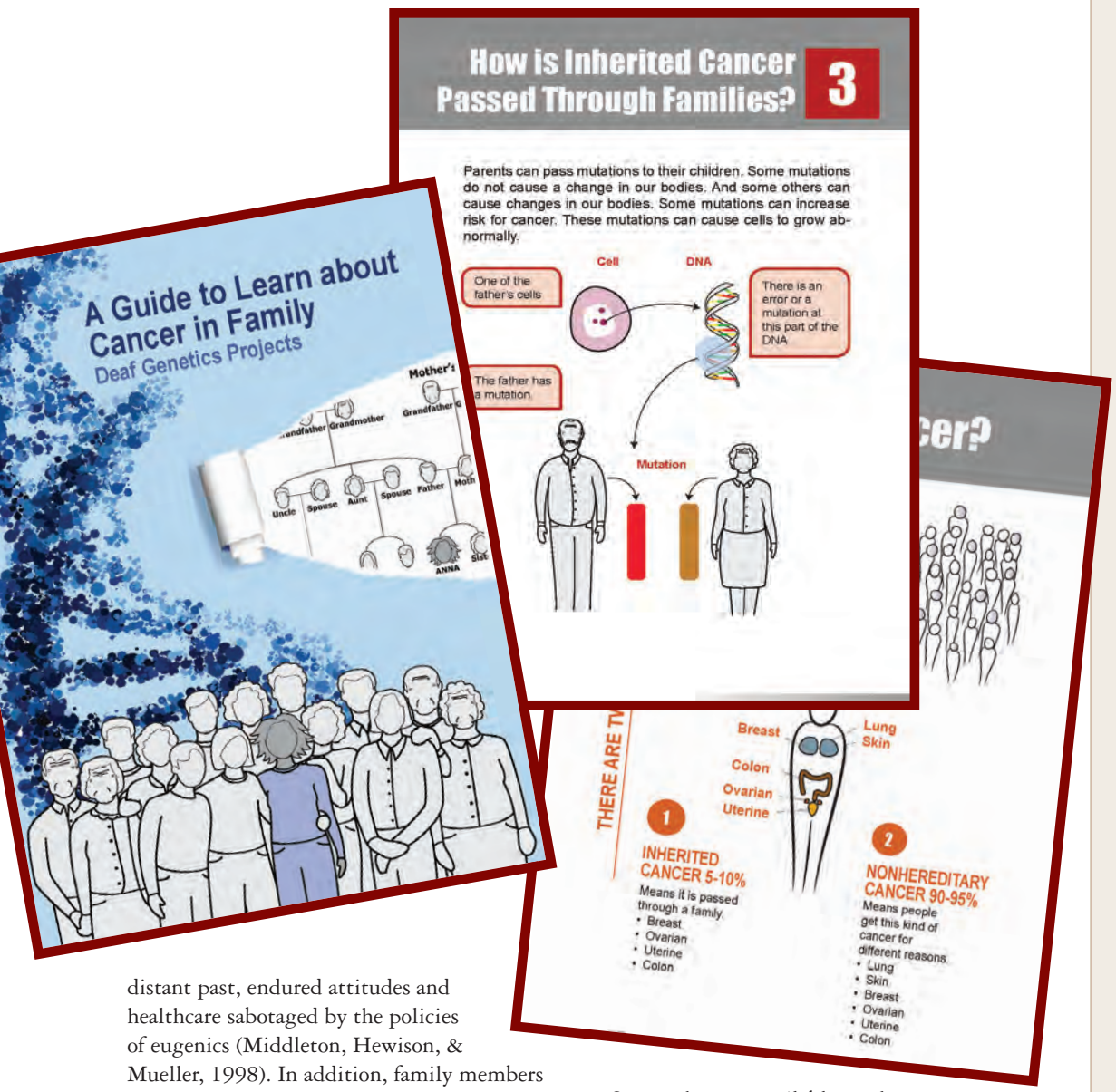
Information about cancer, the disease that kills more Americans than any other except heart disease, is essential. In some ways, information is our first line of defense. It allows us to identify individual risk factors, to note when a problem means we should see a professional, and to avoid activities that might put us at risk. Information allows individuals to use the latest research and to live healthy lives.

However, researchers have found that many people are prohibited from getting information because facts about cancer and other health-related issues are couched in language that is difficult to understand. In fact, though the U.S. Department of Education recommends that educational materials aimed at the public be written at a level no higher than eighth grade, King, Winton, and Adkins (2003) found that the reading levels for health-related materials on the Internet ranged from 11.1 to 14.8 grades.

This prohibits many individuals—young people still in school, adults who never learned to read well, those who learned English as a second language, and some deaf and hard of hearing individuals—from accessing information. Not only are these individuals frustrated in trying to access information through the Internet, McEwen and Anton-Culver (1988) found that deaf individuals may be at great risk for poor provider-patient communication. Further, Harmer (1999) found that deaf individuals have inadequate access to health education through channels such as the media, the Internet, friends, and the community.

Although many deaf individuals are able to read at a high level and deaf academicians use medical terminology and explain complex genetic information in American Sign Language (ASL), this terminology—as well as its spoken counterpart—is not widely understood. Further, many deaf people distrust the medical community due to a long history of not only insensitivity on the part of medical professionals but outright discrimination against deaf individuals. Deaf people have experienced a lack of acceptance of themselves as human beings from medical personnel, and, in the not very

Photos and illustrations used with permission of the Deaf Genetics Projects



distant past, endured attitudes and healthcare sabotaged by the policies of eugenics (Middleton, Hewison, & Mueller, 1998). In addition, family members of deaf adults cannot be relied on to transmit their family health history, especially the risks associated with cancer genetics, due to the complexity of the subject and the stigma that surrounds the disease.

In response, the National Cancer Institute and the Genetic Alliance have funded the Deaf Genetics Projects research team, and the team is developing bilingual materials to help individuals in the Deaf community understand the complex information about cancer. The materials are designed for a wide audience that includes deaf high school students, deaf adults with minimum education, and deaf adults with some college education. The materials may be aligned with established curricula for science, biology, and health classes.

In order to take advantage of today's technology and to make these materials available for people throughout the United States, they are available on the Internet at *http://aslcancergenetics.org*. They open with a presentation by Patrick Boudreault, a professor and researcher who is deaf and who addresses his audience in ASL. In clear signs with supporting visuals, he compares cancer to normal cells, notes the risk factors for developing cancer—those that are inherited and those that are encountered or introduced into our environment—and explains the importance of knowing family medical history.

In a following lesson, Boudreault introduces Anna, a fictitious 28-year-old woman with a family history of breast and ovarian cancer. As the visuals illustrate her relationships—to her mother, father, aunt, uncle, and cousins—he outlines the major questions facing Anna as she evaluates her own risk for cancer. Explaining the importance of genetic counseling and genetic testing, Boudreault

Christina Palmer, PhD, is a board-certified medical geneticist and professor in the Psychiatry and Biobehavioral Sciences, Department of Human Genetics, and Institute for Society and Genetics at the University of California Los Angeles. Palmer specializes in genetic counseling for deafness and for psychiatric conditions. Her research centers on genetics of complex behaviors and the educational, psychological, and behavioral outcomes of genetic counseling and genetic testing. Palmer is presently collaborating with Boudreault and other researchers to examine the individual and societal impact of genetic testing for deafness on the Deaf community, and to increase access to information on genetic counseling and genetic testing in American Sign Language. She can be reached at *cpalmer@mednet.ucla.edu.*

notes that there are three important questions:

1. *Which of Anna's relatives had cancer?*
2. *Which cancer did they have?*
3. *How old were they when they developed cancer?*

This is one of six lessons packaged in 35-minute modules. The modules are:

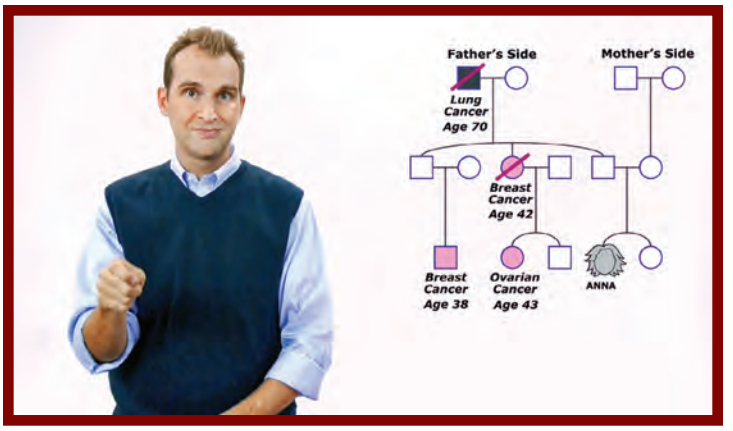
- Introduction
- Family History (and four quizzes)
- Evaluating Risk Factors of Cancer in Family (and two quizzes)
- Understanding Genetics (and four quizzes)
- Genetic Counseling and Genetic Testing (and three quizzes)
- Review

The most effective way to reach the Deaf community is in person by attending various deaf-related events (Kobayashi, Boudreault, Hill, Sinsheimer, & Palmer, 2013) and by working in partnership with Deaf organizations and educational institutions serving deaf and hard of hearing students. Information about the website, along with a supporting booklet, will be distributed during Deaf events and mailed to advocacy and health-related organizations across the United States.

Still under development on the website are the educational components for those who teach deaf and hard of hearing students. The materials will include downloadable lesson plans and existing on-line resources (e.g., videos with captions, websites on how to align materials with curricula in science, biology, and genetics). The unit plans will revolve around the bilingual educational modules that have already been developed. Teachers can also directly use these existing educational modules to develop their own lesson plans or as a way to generate discussion in science class.

Increased understanding of genetics and the increasing availability of personalized medicine—medicine tailored to an individual's genetic composition and lifestyle—have improved the prognosis for many of those who experience cancer. The result is that many more people survive cancer today than at any other time in history. Genetic counseling and testing can help to prevent cancer. Still, individuals have to be able to access this information to benefit from it. This is the goal of our project.

Thanks to technology, full, free, and direct access to health information through sign language is possible. The United Nations (UN) has recognized this access as a human right. The UN Convention on the Rights of Persons with Disabilities (2007) notes in Article 25 that all individuals have a right to the highest standard of care. Developing health information in ASL ensures access to information about health for deaf and hard of hearing people. As a result, they may learn to better understand their family health history, have an opportunity to pursue genetic counseling, become aware of cancer risk factors, and perhaps save their own lives and the lives of those they love.



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Right: The Clerc Center's Deaf Students with Disabilities Network provides parents and professionals with the opportunity to share information and resources.

ONLINE WITH THE CLERC CENTER:

Bringing Resources to Families and Professionals

By Mary Henry Lightfoot and Betsy Meynardie

What does a dad do when he has questions about getting an interpreter for his daughter's high school soccer team?

What do teachers do when they learn that a deaf student has been assigned to their classes?

What does a mom do when she wants more information about her son's newly scheduled hearing test?

What do teachers of deaf students do when they want to share information with parents and general education teachers?

If they are like most people, chances are they will go online.

In today's world, the Internet is a global library, classroom, and town hall—and it is so much more. This is especially true for families and professionals involved with deaf and hard of hearing students. When two to three out of every 1,000 children are deaf or hard of hearing (National Institutes of Health, 2014), and these children are educated in a wide variety of educational settings throughout our large country (GAO, 2011), on-line support becomes critical.

Illustrations courtesy of Mary Henry Lightfoot and Betsy Meynardie

The Laurent Clerc National Deaf Education Center, responding to public input from families and professionals around the country, has implemented the Clerc Center Strategic Plan 2020 (CCSP 2020) which will guide this work. With an expanding on-line presence, the Clerc Center enables individuals, both experienced and new to deaf education, throughout the country to receive information and resources. With a click, scroll, swipe, or tap, parents, teachers, and deaf and hard of hearing students can access information through the use of a desktop computer, laptop, tablet, or smartphone. This ease and freedom benefits busy professionals and families alike. Professionals can pull up information moments before the start of back-to-back meetings; parents can pull up information while waiting in the grocery line.

Today 7.1 million people are learning online (Allen & Seaman, 2014). Further, 38 percent of training is achieved online (Association for Talent Development, 2014). The advantages of on-line learning are multifold (Koller, Harvey, & Magnotta, 2008; Dobrovolny, 2006; Smith, 2014). On-line technology allows learners to:

- progress at their convenience and with flexible scheduling
- experience information in multiple formats in response to individual learning needs
- learn at their own pace
- review content multiple times, in whole or in part

On-line learning has a further advantage in that it allows assessment information to be collected easily (Swan, 2012). This not

Betsy Meynardie, MA, the director of Training, Products, and Dissemination at the Laurent Clerc National Deaf Education Center, coordinates the design, development, and dissemination of national outreach products and programs at the Clerc Center. After receiving her master's degree in school counseling from Gallaudet, Meynardie began her career at the Clerc Center's Model Secondary School for the Deaf, developing and implementing proactive, student-centered programs in the Student Life Department. She also coordinated professional development for Clerc Center teachers and staff before moving to national outreach work, where for 15 years she has designed, developed, and delivered workshops, webinars, on-line learning modules, and on-line networks.

The authors welcome questions and comments about this article at *Mary.Lightfoot@gallaudet.edu* and *Elizabeth.Meynardie@gallaudet.edu*.

Left: All Clerc Center webinars, including Dr. Laura-Ann Petitto's "What the Eyes Reveal About the Brain: Advances in Human Language Acquisition," are archived, free, and available for convenient playback.

only potentially informs the learner about his or her progress but allows course and content developers to use the information to inform practice and increase program effectiveness.

The hallmark of on-line learning is that it typically focuses on the learners' needs more than the instructors' content (Smith, 2014). Instead of having a pre-planned lesson where people must physically come together at a specific time and in a specific place to participate in an activity designed with the instructor at its center, on-line learning allows participants to decide when and where they learn and how much content they want to attend to at a given time. The on-line environment allows the learner to be proactive and seek out understanding rather than passively receive information through an instructor. It is designed to respect the adult's desire to be self-directed and to respond to his or her learning needs (Abdullah, 2001; Morrison, Ross, & Kemp, 2007).

The Clerc Center is harnessing technology to provide different forms of on-line learning for all those involved in the lives of deaf and hard of hearing children. These include:

- **webcasts,** in which subject matter experts—teachers or skilled facilitators—present information
- **learning communities**, in which parents, professionals, and interested individuals can go online, meet each other, and interact
- **training modules**, in which participating individuals can pursue more in-depth learning at their own pace and in their own time
- **books and materials**, through which individuals can procure information with a click that before would have taken weeks to write for and receive

Webcasts—Learning for All

The Clerc Center sponsors webcasts specially selected, designed, and presented to meet the needs of those who work with deaf and hard of hearing students. For example, the webcast "How Early Intervention Can Make a Difference: Research and Trends," by educator Beth Benedict, focused on the importance of immersing infants in language from the moment they are born—especially those who are deaf or hard of hearing. The webcast "What the Eyes Reveal About the Brain: Advances in Human Language Acquisition," by researcher Laura-Ann Petitto, addressed the science behind language development.

Webcasts provide a form of synchronous learning, in which participants and experts come together in real time for a heightened experience. Once archived, webcasts also permit an opportunity for learning at a convenient time (or asynchronous learning), meeting individual needs and allowing individuals to move at their own pace and view the webcasts when their individual schedules allow.

All Clerc Center webcasts are accessible through ASL, spoken English, and captions. All are archived to allow teachers, parents, and other interested parties to access them at their leisure. They can be watched alone or in groups from home or work settings. In addition, taking advantage of the ease with which technology allows

assessment, all webcasts are evaluated. The Clerc Center monitors those who participate and gages their reactions. For example, most of those who watched the Benedict presentation were professionals, 91 percent reported that the webcast met their needs, and 98 percent reported that they planned to pass on the information to other interested individuals. The Petitto workshop, one of the most popular, has experienced 5,409 additional viewings since it was archived.

Learning Communities—The Virtual Clubhouse

The Clerc Center has facilitated the establishment of an on-line learning community as seen in the Deaf Students with Disabilities Network, where professionals and parents of deaf and hard of hearing children with disabilities can share information and resources and find support. Important segments of our audience live in rural areas, where knowledge resources and support are difficult to locate. This on-line communication vehicle allows individuals to connect, share, and learn together as they support these unique students.

This site, as well as the National Outreach Resources network established by the Clerc Center for outreach professionals in deaf education, allows peer-to-peer communication and sharing of perspectives and experience. This, in turn, supports learning and allows knowledge to be translated into everyday problem solving and ongoing practice (Lewis & Allan, 2005). Would you like to join the Clerc Center on-line communities? They provide an opportunity for you to express ideas, questions, and practice; help you develop understanding from a novice level to one that is knowledgeable; and introduce you to others who have the same needs and interests (Gilbert & Silvers, 2014). We invite you to explore the Clerc Center learning communities!

Training Modules—The Self-Paced Classroom

The Clerc Center has developed modular on-line training that puts the learner in the driver's seat. The modules are self-paced, allowing learners to proceed at their own pace and time. Modular training is segmented into micro lessons that have four key on-line learning qualities: chunk-ability, repeatability, pause-ability, and understandability (Smith, 2014). *Setting Language in Motion: Family Supports and Early Intervention for Babies Who are Deaf or Hard of Hearing* is an on-line training chunked into seven video modules. These modules are searchable and vary in length between three and 17 minutes. Professionals and families can view the modules from beginning to end or by topic as the need arises. The short module length and searchability features are in line with the attention span of adults, generally measured at 20 minutes or less (Islam, 2013).

Viewers are able to skip sections that they either already know or do not need to know. Thus learners can self-select information that is pertinent to their individual needs and that fits into their time constraints.

Understandability is created with an American Sign Language version, which has captions, and a spoken English version, which also has captions.

Educating Students Who are Deaf or Hard of Hearing: A Guide for Professionals in General Education Settings is a three-module, on-line training with a multimedia approach to learning. Interest is maintained through a series of interactive screens that can be paused, clicked, or acted upon as needed by the learner. With a tap, learners can stop the training to consider what they have already learned or advance within the training to incorporate still more information. Viewers are able to skip sections that they either already know or do not need to know. Thus learners can self-select information that is pertinent to their individual needs and that fits into their time constraints. Further, they can reflect on what is learned through periodic knowledge checks, self-correcting any erroneous understanding by reviewing the learning experience and going back to key sections to solidify understanding.

The Clerc Center training modules also follow the design specified by Dobrovolny (2006), who showed the need for learners to be able to exercise a high degree of control and freedom within the on-line training, including the ability to return to sections as needed even after completing the training. Dobrovolny supports the need for participants to "manipulate and personalize" learning, customizing it to "their prior experiences, their current responsibilities, and the expectations of further responsibilities." By incorporating these recommended features for on-line learning, the Clerc Center's on-line modules provide the best in technology and pedagogy for each individual user.

Info to Go: Print Goes Virtual

The Clerc Center's Info to Go has a wealth of information and resources on the educational, linguistic, social, and emotional needs of deaf and hard of

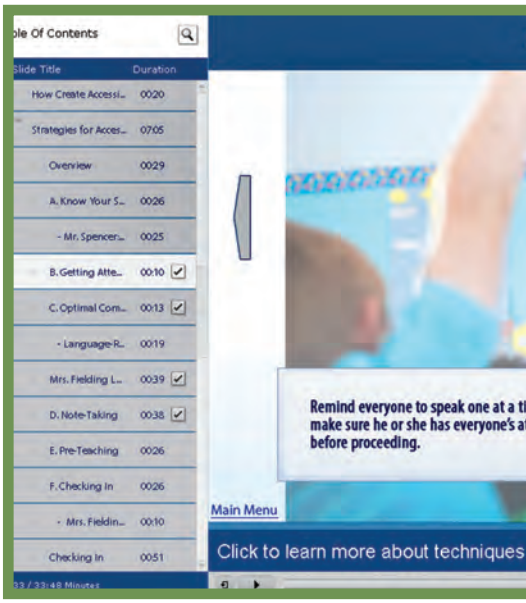
hearing children. In addition, Info to Go accepts questions from families, educators, and the general public related to deaf and hard of hearing children from birth through age 21.

Next Steps

The Clerc Center continues to bring training, research, and research-based practice to urban, suburban, and rural areas, supplying information, training, and community to professionals and families of deaf and hard of hearing children. At the same time, we recognize that access to technology is not universal and remain committed to delivering technology-based resources to those who need them.

Technology-based on-line learning reaches a wide range of users, from professionals who may be working with deaf or hard of hearing students for the first time to experienced teachers who need to access information during a busy day. From parents and families who are facing many questions regarding their recently diagnosed deaf child, to parents who are working with school professionals to make the best decisions for their child, technology creates paths for disseminating research-based information to professionals and families across the country. It connects professionals and families by allowing them to share ideas and receive information from subject matter experts and each other.

With the CCSP 2020 as our guide,



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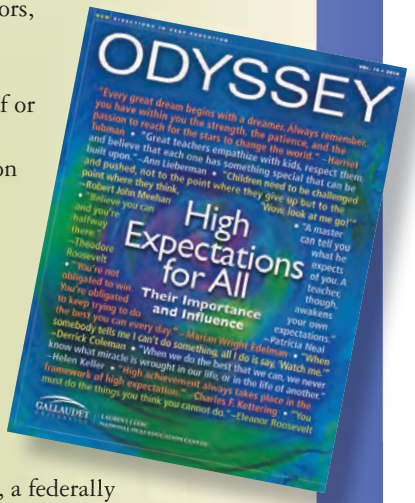
the Clerc Center will continue to explore technology to give professionals and families an opportunity to build knowledge and apply resources to everyday problem solving. Evolving technology allows greater reach through virtual instruction, peer-to-peer interaction, and formal and informal learning. As technology continues to advance in perhaps unimaginable ways, the "magic" will always be in the learning. This is at the heart of our resources for professionals and families of deaf and hard of hearing children, and it is made increasingly promising through technology and on-line initiatives.

Experience the magic of learning by using the Clerc Center's technology-based resources. These resources will support you, taking into account your role and level of experience. They will address your specific responsibilities or needs. We look forward to meeting you online at *http://clerccenter.gallaudet.edu*!

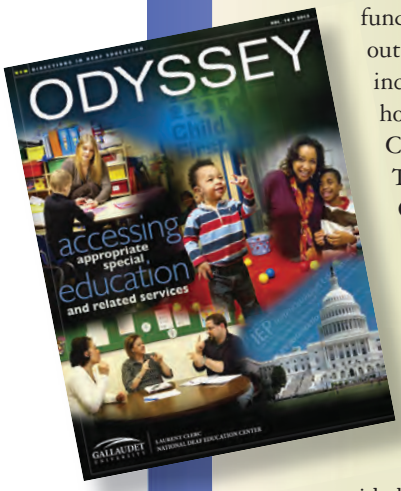
Coming Up in Odyssey's 2016 Issue

THEME: The Importance and Value of Building State-Level Collaborations to Support the Transition of Deaf and Hard of Hearing Students from Secondary Education to Postsecondary Options

The transition from high school to postsecondary education and employment has the potential to alter the future for deaf and hard of hearing students. It is a complex process that begins well before students leave secondary education and benefits from a team approach that includes educators, high school and postsecondary transition professionals, family members, and—most importantly—the student. While each deaf or hard of hearing student's transition plan is specifically created for that student based on his or her Individualized Education Program, the systems within which teams must operate are often rooted at the state and district level. Developing meaningful connections and collaborations at these levels is essential to the effective development and implementation of these large-scale processes.



Recognizing the importance of state-level collaborations, pepnet 2, a federally funded project with the goal "to improve postsecondary outcomes for individuals who are deaf or hard of hearing, including those with co-occurring disabilities," has hosted a Summit Series entitled "Building State Capacity to Address Critical Issues in Deaf Education: Transition from Secondary Education to Postsecondary Options." The goal of this national effort is to provide a framework that enables each state to develop a plan to enhance successful postsecondary education and employment transition outcomes for students leaving high school. As noted on the pepnet 2 Summit Series website, "Young adults who are deaf or hard of hearing face barriers that inhibit these successful outcomes; one way to mitigate these barriers is by effecting positive change in the way current services are provided to deaf and hard of hearing students."



The 2016 issue of *Odyssey* will be a joint publication of the Laurent Clerc National Deaf Education Center and pepnet 2. It will share the work that has occurred through the Summit Series, focusing on the development, implementation, and maintenance of state-level collaborations; the planning processes undertaken by the state teams, including the successes and challenges they experienced; and the outcomes that were achieved.

Technology Resources

Check out these helpful new tools and resources for educators.

CATS Offers On-Line Learning Tools for Deaf and Hard of Hearing Students

The Center for Accessible Technology in Sign (CATS), in Atlanta, Georgia, is a joint project between the Atlanta Area School for the Deaf and the Georgia Institute of Technology.

"CATS is dedicated to providing accessibility to learning via sign language. Its goal is to enhance language, literacy, and general world knowledge for deaf learners, particularly children. CATS has been awarded the American Library Association Grolier Foundation Award, 2004 for its contributions to children's literacy," states the website.

Learning tools included on the site are:

- **SMARTSign Dictionary**
- **SMARTSign Library** (to which students can make contributions)
- **Sign4Good**—Makes stories accessible in American Sign Language (ASL)
- **StAR ASL** (Storybook Augmented Reality ASL)
- **CAT-ASL Comprehension**
- **Sign app for android**
- **Elf** (Electric Language Factory)—Offers games that incorporate signers showing how specific vocabulary is signed
- **BRAVoE and BRAVoEKids** (Basic Reading and Vocabulary Enrichment)—Offers signed stories and games to improve on vocabulary

Also offered are research and publications as well as a Tools & Resources section related to accessibility, accessible technology, ASL, and education. For more information, visit *www.cats.gatech.edu*.

Epic Bookworms: New On-line Resource for Deaf Educators

The Educational Resource Center on Deafness (ERCOD) has introduced a new literature resource called Epic Bookworms. This year-long project, which will encompass four complete units of study related to popular children's and young adult books, is geared to teachers, parents, and students. It endeavors to provide supplementary literacy resources that are accessible to a wide range of deaf and hard of hearing students.

"Though we started with just one book, *Charlotte's Web*, our goal is to add at least four books per year as well as to encourage other master teachers statewide to make contributions. And because our time and resources are always limited, we would love to see similar efforts made by other programs nationwide so we can all share our work via the web" said Twyla Loftin, ERCOD on-line resources teacher.

Each unit of study includes videos in American Sign Language, captions, and text transcripts. Materials include worksheets, vocabulary studies, extension activities, lesson plans coordinated with state standards, and both grade-level and adapted activities.

"Imagine the wealth of supplementary literacy resources we could build over time—and classes in different places and states working on a book together!" said Avonne Brooker-Rutowski, ERCOD program specialist. "We hope you'll take a moment to check out the website and to envision how we can all work together to provide quality literacy support for deaf and hard of hearing students."

For more information, check out *www.epicbookworms.org*.

myASLTech.com: On-Line Suite of Software Provides ASL Support for Instruction

The Institute for Disabilities Research and Training, Inc. (IDRT) has developed a unique on-line suite of eight assistive technology tools entitled *myASL Tech*. These tools enable users to efficiently create and archive American Sign Language (ASL)-supported educational materials and quizzes, support text with sign graphics and video in real time, build and share creations with other *myASL Tech* community members, and play games that reinforce ASL and English literacy.

The site offers low-cost memberships for children as well as individual, small group, and large group memberships. Members gain access to a central database of tens of thousands of words, phrases, symbols, idioms, and numbers and their representative sign language graphics and video clips. As the database expands (weekly), so do the capabilities of each assistive technology tool. The assistive technology tools include:

- ***myASL Dictionary***—View sign graphics and video clips, conceptual graphics, and English and ASL definitions by inputting English text.
- ***mySign Generator***—Translate English words, phrases, symbols, and idioms into ASL graphics and video clips in real time. Right-click to make selections for multiple sign words, hide sign graphics, or fingerspell. Type or paste any amount of text! You can save and print the graphics and play video clips of the sign sequence.
- ***myConcept Generator***—Automatically support English words, phrases, symbols, and idioms with concept graphics. Just right-click to hide concept graphic supports for individual words.
- ***myASL Games***—Play a variety of interactive learning games that can be used to reinforce sign language learning or just have fun. With many of the games, you can play by category or with the entire *myASL Tech* lexicon. Check out *Signing Science for Kids*, a learning module about weather phenomena.
- ***myASL Publisher***—Create instructional materials (e.g., posters, flash cards) using ASL and concept graphic clip art. You can draw, make shapes, and import your own graphics, too.
- ***myASL Templates***—Create templates that automatically generate customizable, printable worksheets (e.g., fingerspelling scrambles, crossword puzzles, word finds).
- ***myASL Quizmaker***—Create quizzes using six question templates with automatic sign graphic and video support. Have students take published quizzes online within prescribed constraints (e.g., due date, length of time). Score the quizzes and send the results back to the students. Generate statistical reports on student performance and quiz results.
- ***myASL Thesaurus***—Identify signs by inputting descriptors (i.e., handshapes, locations, movements, palm orientations). View the resulting sign graphics and videos, corresponding English words, concept graphics, and ASL and English definitions in an expanding lexicon of root words.

When you become a *myASL Tech* community member, you automatically get "banks" into which you can save your products (e.g., quizzes, questions, posters, worksheets) on IDRT's cloud-hosted server. By linking your banks with other members, you can share products with each other. Visit *http://idrt.com/asltech_ home.php* to get started!

Grant support of the National Science Foundation, and the Institute for Educational Sciences and the National Institute on Disability and Rehabilitation Research, U.S. Department of Education contributed to bringing this software suite to life.

Clerc Center Launches Pioneering Study on Parent Advocacy

Recognizing that the role of the parent is also that of an advocate is not new, but the Clerc Center is taking steps to quantify how parents of deaf or hard of hearing children across the country have been advocating for educational accommodations.

"Parent advocacy in deaf education has been scarcely researched," said Dr. Christen Szymanski, director of Research and Evaluation at the Clerc Center. The study is the first of its kind to specifically seek to better understand the experiences of advocacy with parents of deaf or hard of hearing children. "Most previous studies have investigated the advocacy efforts of parents who have children with either learning disabilities or autism, but none have really carefully looked at the unique needs of families of children who are deaf or hard of hearing."

The Clerc Center is seeking participants who are parents or caregivers of children who are deaf or hard of hearing who have advocated for the needs of their children. "All age groups are welcome. We hope to get the entire spectrum of parents who believe themselves to be successful in advocating and those who remain struggling to advocate," said Szymanski.

Parent advocacy has been defined as a parent recommending, arguing, supporting, or defending their child's educational needs. Ideally, a school will provide the necessary program accommodations or modifications requested by the parents for their child. "However, that does not always happen," said Szymanski. "Often parents must continue to advocate for an educational program that maximizes their child's academic and social opportunities. Sometimes parents may not know what their child needs and they may encounter personnel in the general education setting who have no training and only a limited understanding of working with students who are deaf or hard of hearing; that makes joint partnership and advocacy a challenge. What we don't know is what is happening and what is working. Research shows us what is effective for parental advocacy for those students with learning disabilities and other disabilities, but we don't know if that model works for families of children who are deaf or hard of hearing. What we want to learn is if it is and how we can use it to help others."

The Clerc Center hopes that this research can be used to inform future best practices of parent advocacy for children who are deaf or hard of hearing, develop programs that allow for joint partnerships between school and parents to achieve what is best for the child, help future researchers and school professionals design appropriate models, and ultimately help the deaf or hard of hearing child to succeed.

Know someone who should take the survey? Tell them!
bit.ly/ClercCenterParentAdvocacySurvey

Student-Inspired Design for New Dorm

Model Secondary School for the Deaf (MSSD) students played a critical role in the planning of the new state-of-the-art dorm under construction this year. The design competition focused on student-centered charrettes, or formal workshops, intended to elicit students' insight into how a residence hall can enhance the MSSD experience.

As part of the first charrette, students led a tour of the school showing "a day in the life of an MSSD student." Three architectural firms visited MSSD; listened to input, ideas, and needs from the Dorm Design Committee and the students; and then incorporated those ideas into their design proposals. The architectural firm Dangermond Keane Architecture/Gadureau, Inc. was awarded the contract. "Their proposal had everything we wanted for MSSD. The design was functional and also beautiful," said principal Mindi Failing. "The team was very receptive to the students' feedback."

The new residence will incorporate Deafspace design principles for enhanced communication access and green environmental concepts such as rooftop gardens. The dorm will feature four floors, an activity center, rooms to accommodate 160 students, and apartments for staff-in-residence. Move-in is scheduled for 2016.

KDES Students and First Lady Michelle Obama

KDES second grader Tristan Macfadden introduced the First Lady to the audience at a "Let's Read! Let's Move!" event hosted by the U.S. Department of Education at the White House. As Obama strode into the center of the room, she stopped to sign "thank you" to Tristan for his introduction. She then read aloud to the students a book based on Dr. Seuss's classic character, Cat in the Hat, and his helpers, Thing One and Thing Two.

KDES Parent-Infant Program Serves as a Model in Mongolia

Gallaudet graduate Namiraa Baljinnyam recently established an early intervention program in her home country of Mongolia that is modeled on the Parent-Infant Program (PIP) at Kendall Demonstration Elementary School (KDES).

After graduating from Mongolian State University, Baljinnyam received a Nippon Scholarship to attend Gallaudet University where she studied for her master's degree in deaf education and a graduate certificate from the Deaf and Hard of Hearing Infants, Toddlers and Their Families: Collaboration and Leadership Program. While studying for her master's degree, she interned at KDES.

Baljinnyam returned to Mongolia and, with a USAID grant, established an early intervention program and an elementary school program, sign language instruction, public training on deaf education, and visual aid productions. She modeled the early intervention program on the PIP at KDES.

"Brenda Perrodin, one of our most experienced teachers, mentored Namiraa and gave her many wonderful opportunities to observe and work with infants and toddlers and their parents during the two years she interned with us," said Debra Cushner, KDES Early Childhood Education lead teacher. "Our mission is to be a demonstration program and showcase best practices in bilingual/bicultural learning."

Baljinnyam set up the early intervention program in the capital city of Ulaanbaatar. Students from birth until age 3 are taught in a bilingual/bicultural environment with creative curriculum that is based on the visual environment and family involvement just as she had experienced at KDES. It is her vision to expand the program in Mongolia to every one of the country's 21 provinces.

SETTING LANGUAGE IN MOTION: FAMILY SUPPORTS AND EARLY INTERVENTION FOR BABIES WHO ARE DEAF OR HARD OF HEARING

A new on-line video resource, *Setting Language in Motion: Family Supports and Early Intervention for Babies Who are Deaf or Hard of Hearing*, comprises an overview and seven web-based video modules with critical information that families and early intervention specialists need to know about language acquisition in infants and toddlers.

The modules were developed in a collaboration between the Clerc Center and Boston Children's Hospital's Department of Otolaryngology and Communication Enhancement's Deaf and Hard of Hearing Program.

The modules are online, free, and with open captioned versions in American Sign Language and in Spoken English. The site also offers downloadable resources.

CLASSROOM INTERPRETING FOR STUDENTS WHO ARE DEAF OR HARD OF HEARING

In a series of new guides published by the Clerc Center entitled *Classroom Interpreting for Students Who are Deaf or Hard of Hearing*, Dr. Brenda Schick, a professor at the University of Colorado-Bolder and a former certified interpreter, takes on questions related to the role of the interpreter in the classroom.

Schick compiled the information in the guides from the website she created in collaboration with the Center for Childhood Deafness at Boys Town National Research Hospital.

Each guide is targeted specifically to one audience—teachers, parents, administrators, students, or interpreters—and gives practical information and strategies. The guides are available online from the Clerc Center as downloadable PDFs as well as in print.

NATIONAL K-12 ASL CONTENT STANDARDS

The Clerc Center is pleased to partner with the California School for the Deaf, Fremont (CSD) in the next phase of its work in developing national K-12 American Sign Language (ASL) Content Standards that will be made available for use in

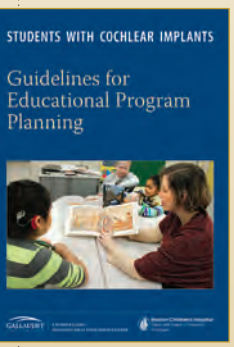
New Resources and Updates

any educational setting.

These research-based benchmarks will describe the breadth, depth, and range of complexity of language skills that students who are deaf or hard of hearing will need in order to meet the academic expectations of their grade. These standards and benchmarks will guide teachers in planning instruction by comparing student skills against these milestones and will be aligned with the Common Core State Standards.

In this phase, CSD will develop the standards and benchmarks for all grades K-12. The Clerc Center will oversee the development of the rationale; feedback, review, and validation processes to ensure that the standards are usable and aligned with the rationale; and the final design of the curriculum standards. Afterwards, the standards will be made available to the public.

STUDENTS WITH COCHLEAR IMPLANTS: GUIDELINES FOR EDUCATIONAL PROGRAM PLANNING



Professionals and families will find the Clerc Center's *Students with Cochlear Implants: Guidelines for Educational Program Planning* invaluable when developing a student's Individualized Family Service Plan (ISFP), Individualized Education Program (IEP), 504 plan, or any other educational planning document.

Developed in partnership with Boston Children's Hospital with a total of 40 contributors, this resource provides comprehensive checklists to assess a student's ability to access the general education curriculum. Taken into consideration is the language of instruction used with each student, whether it be American Sign Language, Spoken English, Spoken English with Sign Support, or some other type of communication such as Cued Speech or Picture Exchange.

Students with Cochlear Implants: Guidelines for Educational Program Planning is available online and in print. The publication and the appendices offer reference guides for general education teachers, guidance counselors, administrators, special education teachers, and allied professionals.

EDUCATING STUDENTS WHO ARE DEAF OR HARD OF HEARING: A GUIDE FOR PROFESSIONALS IN GENERAL EDUCATION SETTINGS

This on-line resource is specifically designed to equip general education professionals with the knowledge and skills they need for instruction considerations and lesson planning. Self-paced training is set up in three modules: Introduction to Students Who are Deaf or Hard of Hearing; Instructional Considerations; and Educational Planning. In the third module, the authors discuss laws that apply to these students.

Each module has stand-alone content. Viewers can use single modules, a combination of modules, or all three. Knowledge checks are built into the modules to aid user understanding, along with a resource listing.

Contributors to the modules include Clerc Center authors; Dr. Peter Hauser, clinical neuropsychologist and associate professor at the National Technical Institute for the Deaf; Barbara Hunt, itinerant teacher in Loudon County, Virginia; Gina Oliva, retired professor, Gallaudet University; Barbara Raimondo, Esq., advocate for the rights of deaf and hard of hearing individuals and their families; and Miako Rankin, Department of Linguistics, Gallaudet University.

EARLY INTERVENTION NETWORK: A RESOURCE FOR PROFESSIONALS

Now professionals and administrators can go to one centralized site for evidence-based practices on how to help deaf and hard of hearing children think critically, problem solve, read, write, and communicate. This free, on-line network highlights five factors in early intervention research that facilitate linguistic competence and showcases national programs that demonstrate these practices.

The network is a place where early intervention professionals across the country can discuss how to develop programs and supports. In addition, the network maintains a national directory of resources in one annotated database.

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Leveling the Playing Field Through Technology

By Philip W. Bravin

Philip W. Bravin is the vice-president of business development at ZVRS. He stepped away from Communication Service for the Deaf (CSD) in July 2005. At CSD, he held a variety of executive positions in corporate research and development, marketing, broadcasting, and business development in addition to helping pioneer the development of CSD's video relay service. Prior to joining CSD, in 1999, Bravin was president of Yes You Can, Inc., an organization specializing in enabling people with the latest technological advancements. He is currently president of the board of the Lexington School/Center for the Deaf in New York. He served 20 years on the board of trustees at Gallaudet University and was its chairman from 1988-1993; he is a trustee emeritus there and the recipient of a doctor of humane letters. Bravin is a member of the National Association of the Deaf. He is also a co-patent holder for Patent No. 7333507 for a multi-modal communications system, which was awarded in 2008. He and his wife, Judith, currently reside in Chester, Vermont. He is the father of three grown deaf children and 12 grandchildren.

Many people might not realize how technology in general has leveled the playing field for deaf and hard of hearing children. Before attempting to define this, let us take a historical journey with respect to technology back to when I was a little boy in the late 1940s before we look at the landscape today.

When we speak of technology, we refer to devices or services that adapt the environment around a deaf or hard of hearing child to make communication accessible. As a young child, I had access to two-pound bilateral hearing aids that required a harness to hold them. In my classroom, I had to suffer the weight of earphones that made my ears very red due to heat and lack of circulation. When watching movies at my deaf school, my classmates and I had access to about 10 captioned movies that were recycled over and over to the point that I still remember the storyline of those movies to this day. There was no captioned television, no access to radio, no access to telephones, and very limited availability of interpreters (they were usually offered at deaf schools but not in the community).

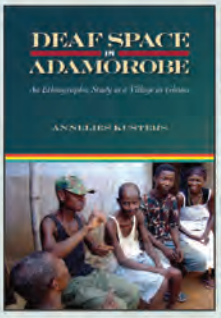
One interesting effect of technology is the fact that some of the things developed for deaf and hard of hearing people are now enjoyed by the general hearing population.

Fast forward to 2015. We have captioned television, access to radio via Twitter (which I consider "visual radio"), access to telephones via a videophone, and access to interpreters in almost every place in the United States. How did all of this happen? We needed two things: 1) technology, which made it possible to adapt the environment around us, and 2) the force of laws such as the Americans with Disabilities Act, the Television Decoder Circuitry Act, the Telecommunications Act of 1996, and, recently, the 21st Century Communications and Video Accessibility Act and a few others.

Leveling the playing field is an important concept. No deaf or hard of hearing person has the same degree of hearing loss nor the same degree of speaking ability—even with such things as hearing aids or cochlear implants, the range of comprehension varies. With those environmental adaptions, along with the use of sign language, the playing field becomes level as the use of technology fills those gaps each individual has. One interesting effect of technology is the fact that some of the things developed for deaf and hard of hearing people are now enjoyed by the general hearing population. We often see hearing people watching captioned television in restaurants; children and families with limited English proficiency learning English through captioning; and hearing people using programs like Skype, Hangouts, and FaceTime to communicate via video.

What does the future hold for us? Being a geek for 50 years myself (and proud of it!), I happen to fully appreciate the potential of technology and how it can further level the playing field down the road. While most of the laws written today take into account the possibility of changes in technology, we must be ever vigilant that the laws which protect our access are not weakened or diminished in any manner. However, one thing is for certain: when the playing field becomes level, the deaf or hard of hearing child, in the words of I. King Jordan, "can do anything … except hear."

Explore Sign Languages in Africa, a Novel of a Deaf Boy's Checkered Life, and Deaf Legal Rights



Deaf Space in Adamorobe

An Ethnographic Study in a Village in Ghana

Annelies Kusters

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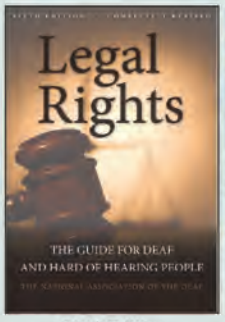

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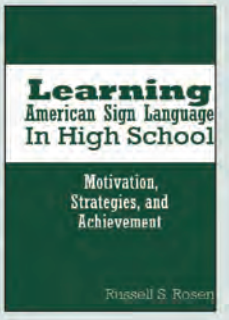

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