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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

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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.

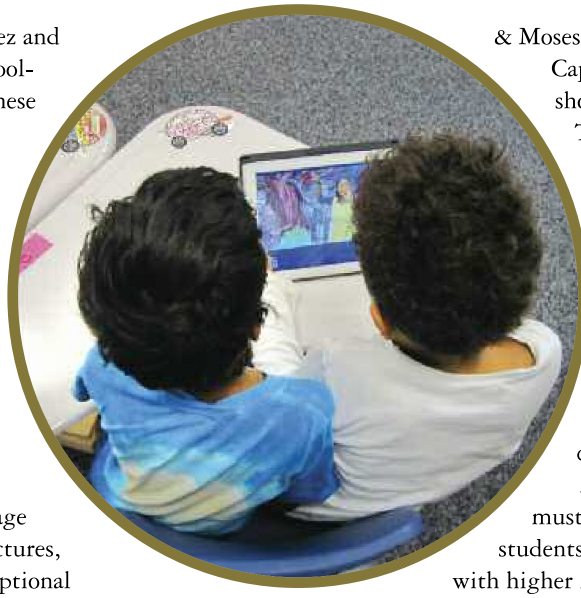
For example, in one study preschool students increased their literacy engagement, including signing and fingerspelling vocabulary, after repeated viewings of stories presented in sign language. The videos embedded a narrator who prompted students to sign along and provided wait time for students to do 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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