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FEATURE ARTICLE

Educational Technology for Diverse Learners

By Tara L. Kaczorowski, Illinois State University

Educational Technology (EdTech) is undoubtedly a topic of interest in schools today. The U.S. Department of Education (2016) published a national technology plan that emphasizes how technology can transform learning experiences in terms of equity, accessibility, and individualization. (U.S. Department of Education, Office of Educational Technology, 2016). EdTech is found in federal law as well. The reauthorization of the Elementary and Secondary Education Act known as the *Every Student Succeeds Act* (ESSA, 2015) defines terms such as *blended learning, technology,* and *digital learning* to help facilitate the incorporation of EdTech as a means of transforming teaching and learning (Mesecar, 2015). Schools have followed suit with this federal initiative to push learning to the 21st century, as demonstrated by their investment in EdTech. Public schools have, on average, one computer for every five students and spend more than $3 billion each year on digital content (Editorial Projects in Education Research Center, 2016). However, more access to technology does not necessarily equate to effective technology implementation. Teachers need support to select EdTech that complements evidence-based instruction, particularly for students with the most substantial learning needs.

Students with Learning Disabilities

Today's classrooms are more diverse than ever; one classroom can be filled with students with a wide range of strengths, interests, and needs due to their cultural, linguistic, and socio-economic backgrounds as well as their disability status. One population of students with some of the most intensive instructional needs are students with learning disabilities (LD), who make up about 42% of all students with disabilities in public schools today. Learning disabilities are often categorized based on their specific impact on reading, mathematics, and/or written expression (Cortiella & Horowitz, 2014). Students may have distinct areas of need related to just one of these areas, or they may have needs in multiple areas. In addition to academic difficulties, researchers have found some common characteristics of students with LD include difficulties with memory, information processing, attention, and metacognitive strategy (National Association of Special Education Teachers, 2007). Teachers must select instructional practices and tools that have been evidenced to support these needs.

Largely due to the federal mandate to educate students in their *Least Restrictive Environment* (LRE; Individuals With Disabilities Education Act, 2004), about two-thirds of students with LD spend 80% or more of the school day in a general education setting with some instructional supports (Cortiella & Horowitz, 2014). Students with LD who receive core instruction in a general education environment are

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Editor:
Sarah J. Watt, *Miami University of Ohio*
Co-Editor:
Shaqwana Freeman-Green, *Illinois State University*
newsletter@TeachingLD.org

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likely to encounter collaborative, inquiry or problem-based lessons that will require them to co-construct knowledge with the teacher acting as a facilitator or supporter rather than as a traditional instructor. Despite this common practice, researchers have found the use of specialized intervention using explicit instruction (EI) promotes stronger academic outcomes for this population (Fuchs et al., 2015). Fortunately, EI principles and elements *(see Figure 1, below)* can be embedded into a variety of instructional methods to scaffold the learning process for those with LD and for those students who need extra support.

There are six main teaching functions of explicit instruction: review, presentation, guided practice, corrections and feedback, independent practice, and weekly/monthly cumulative review (Archer & Hughes, 2011). According to Archer and Hughes (2011), the principles of explicit instruction are the foundational underpinnings of EI, and the elements are the specific methods used to ensure the principles are addressed. Strategic use of specialized instruction within the EI lesson structure should still be an educational support for students with LD, however, when students engage in inclusive activities that may involve

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Explicit Instruction
(Archer & Hughes, 2011)

Principles of Effective Instruction

Optimize engaged time/time on task

The more time students are actively participating in instructional activities, the more they learn

Promote high levels of success

The more successful (i.e., correct/accurate) students are when they engage in an academic task, the more they achieve

Increase content coverage

The more academic content covered effectively and efficiently, the greater potential for student learning

Have students spend more time in instructional groups

The more time students participate in teacher-led, skill-level groups versus one-to-one teaching or seatwork activities, the more instruction they receive, and the more they learn

Scaffold instruction

Providing support, structure, and guidance during instruction promotes academic success, and systematic fading of this support encourages students to become more independent learners

Address different forms of knowledge

The ability to strategically use academic skills and knowledge often requires students to know different sorts of information at different levels: the declarative level (what something is, factual information), the procedural level (how something is done or performed), and the conditional level (when and where to use the skill)

Elements of Explicit Instruction

- **Focus instruction on critical content**
- **Sequence skills logically**
- **Break down complex skills and strategies into smaller instructional units**
- **Design organized and focused lessons**
- **Begin lessons with a clear statement of the lesson's goals and your expectations**
- **Review prior skills and knowledge before beginning instruction**
- **Provide step by step demonstrations**
- **Use clear and concise language**
- **Provide an adequate range of examples and non-examples**
- **Provide guided and supported practice**
- **Require frequent responses**
- **Monitor student performance closely**
- **Provide immediate corrective and affirmative feedback**
- **Deliver the lesson at a brisk pace**
- **Help students organize knowledge**
- **Provide distributed and cumulative practice**

Figure 1. Explicit instruction principles and elements. From Explicit Instruction: Effective and Efficient Teaching by Anita L. Archer and Charles A. Hughes, chapter 1. Copyright 2011 by The Guilford Press.

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more knowledge construction rather than modeling and practice, it is vital the elements of explicit instruction are embedded as much as possible. Given the increasing presence of EdTech in today's classrooms, the ability to select and implement technology that enhances elements of EI is a critical skill for teachers to develop.

Effective Technology Integration

Technology integration for learners with disabilities is often incorporated as an accommodation to provide access to the curriculum that might have been hindered by the student's disability. For students with LD, this kind of Assistive Technology (AT) might include supports like use of digital text with text-to-speech capabilities to read questions or directions aloud. It might also include the use of calculators or reference tables to offload lower-order tasks involving memory and attention while working on higher-order skills like problem solving or composition. In the past, these tools were provided with specialized AT, but, as technology becomes more universal, many AT features are built right into the devices our students use on a regular basis. This means, when implemented effectively, EdTech can enhance learning content and evidence-based teaching practices while also providing AT supports for access.

Universal Design for Learning

The National Technology Plan (2016) and ESSA (2015) both refer to the Universal Design for Learning (UDL) framework for EdTech implementation. The UDL framework is a proactive approach that assumes learner differences are the norm and instructional practices must be flexible enough to reach the widest range of learners' strengths, interests, and needs. The three foundational principles include providing (a) multiple means of representing content to give learners more than one way to acquire knowledge; (b) multiple means of expression to give learners options in how they demonstrate what they know; and (c) multiple means of engagement to motivate learners by capitalizing on interests, strengths, and promoting self-regulation skills (Rose & Meyer, 2002). While the use of EdTech is not a requirement for implementing these UDL principles, new technologies can offer opportunities to enhance them. Beginning with a universal design to incorporate technology is a great foundation for planning instruction, but for learners with the most intensive academic needs like those with LD, there are additional considerations for teaching and learning with multimedia.

Multimedia Learning

While every learner certainly has unique qualities, all people need to process and apply information as part of the learning process. Mayer's (2009) Cognitive Theory of Multimedia Learning specifies recommendations for teaching with multimedia that are based on scientific evidence regarding how the human brain processes images, text, and auditory information to build understanding *(See Figure 2, on page 4)*. These directives for multimedia learning are most pertinent to the UDL principle of multiple means of representation. The way we present information to students using technology can either help or hinder student ability to develop mental constructs, integrate these new constructs with prior knowledge, and generalize it to other contexts. The role of the teacher is vital in the selection and/or creation of multimedia representations.

The Role of the Teacher in Effective Educational Technology Integration

In describing EdTech, ESSA (2015) defines the term *digital learning* as any instructional practice that effectively uses technology to strengthen a student's learning experience. Thus, when teachers select a tool for representation, expression, or engagement, particularly to meet the needs of students with LD, they need to ensure they are considering how the tools support evidence-based instructional practices for specific content areas. Researchers define this understanding as a specific domain of knowledge called *Technological Pedagogical Content Knowledge* (TPACK; Koehler & Mishra, 2009). Simply put, TPACK is knowledge of how technology can be integrated with purpose to enhance content and teaching practices while helping mitigate the barriers learners face. Though we are still discovering how to efficiently increase teachers' TPACK, researchers suggest targeting teacher attitude/beliefs and general knowledge of technology (Hew & Brush, 2006; Kim, Kim, Lee, Spector, & DeMeester, 2013) as well as participating in active experiences that reflect on the instructional purpose behind various technologies (Ersanli, 2016) are ways to help develop this knowledge base. In the upcoming section, I present a sampling of technologies organized by purpose to help teachers navigate these frameworks and the myriad of EdTech tools on the market *(see Figure 3, on page 5, for a summary)*.

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Multimedia Learning people learn better from words and pictures than from words alone	
Reduce Extraneous Cognitive Processing	
Principle	**Recommendations**
Coherence Principle *people learn better when extraneous words, pictures, and sounds are excluded*	✓ Only include key words, pictures and sounds – get rid of anything "extra"
Signaling Principle *people learn better with added cues to highlight essential material*	✓ Provide use a clear cue (e.g., arrow, highlighting, bolded font) to highlight essential words and images.
Redundancy Principle *people learn better from graphics and narrative rather than from graphics, narration, and on-screen text*	✓ Limit the modalities included to just a clear visual with audio commentary instead of including a lot of text on the screen
Spatial Contiguity Principle *people learn better when corresponding words and pictures are presented near to one another*	✓ When using key words, place them near the image or animation rather than at the top or bottom of the page
Temporal Contiguity Principle *people learn better when words and pictures are presented simultaneously rather than successively*	✓ When using key words with images, present them at the same time
Manage Essential Cognitive Processing	
Principle	**Recommendations**
Segmenting Principle *people learn better when multimedia is presented in user-paced segments*	✓ Keep videos and representations short and focused ✓ Include options for the user to repeat short sections as needed
Pre-training Principle *people learn better from multimedia when they already know the names and characteristics of the main concepts*	✓ Introduce key vocabulary and critical background knowledge before presenting the multimedia
Modality Principle *people learn better from graphics and narrations rather than from animation and on-screen text*	✓ Use auditory narration rather than lengthy text as an explanation for your graphics or animations to avoid visual overload
Increase Generative Cognitive Processing	
Principle	**Recommendations**
Voice Principle *people learn better when narration is spoken in a friendly human voice rather than a machine voice*	✓ Record your own audio instead of using computerized voices
Personalization Principle *people learn better when words are in conversational rather than formal style*	✓ Keep your tone conversational and animated just like you would in person
Image Principle *people do not necessarily learn better when the speaker's image is added to the screen.*	✓ Keep images to those related to the content; your photo or "talking head" on the screen will not help your students learn more

Figure 2. Recommendations for multimedia creation using Multimedia Learning Theory (Mayer, 2009).

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	EdTech Tool	Primary UDL Enhancements			Effective Instruction Enhancements						Platform					Cost			
		Representation	Expression	Engagement	Scaffold or Individualize	Monitor/assess progress	Immediate Feedback	Collaboration	Active Responding	Pre-teaching/Review	iOS mobile device	Google Play mobile device	Mac OS Computer	Windows Computer	Web-Based	Free Trial	Free *may have limitations	One-time cost	Paid subscription model
Multimedia Images	Meme Generator	✔	✔							✔	✔	✔			✔		✔		
	Bitmoji	✔	✔							✔	✔	✔			✔		✔		
	Giphy	✔	✔							✔	✔	✔			✔		✔		
Recorded Lectures	PowerPoint	✔								✔	✔	✔	✔	✔	✔			✔	
	Keynote	✔								✔	✔		✔					✔	
Annotated Tutorials	Educreations	✔	✔		✔					✔	✔				✔		✔		✔
	Show Me	✔	✔		✔					✔	✔				✔		✔		✔
	Explain Everything	✔	✔		✔					✔	✔	✔			✔			✔	✔
Screencasts	Quicktime	✔								✔			✔				✔		
	Screencast-o-matic	✔								✔			✔	✔	✔		✔		✔
	Camtasia	✔								✔			✔	✔		✔		✔	
Multimodal Composing	iMovie		✔		✔						✔		✔				✔	✔	
	Write About This		✔		✔						✔				✔		✔	✔	
	Seesaw		✔		✔	✔					✔	✔			✔		✔		✔
	Google Docs		✔		✔	✔		✔	✔		✔	✔			✔		✔		
Group Brainstorming	Padlet		✔	✔	✔	✔		✔	✔	✔	✔	✔			✔		✔		✔
	Groupboard		✔	✔		✔		✔	✔	✔	✔	✔			✔	✔	✔	✔	✔
	Baiboard		✔	✔		✔		✔	✔	✔	✔				✔		✔		
Polling/ Clickers	Socrative		✔	✔		✔	✔		✔	✔	✔	✔			✔		✔		✔
	Plickers		✔	✔		✔	✔		✔	✔	✔	✔			✔		✔		
Comprehensive Tools	EdPuzzle	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔			✔		✔		✔
	Nearpod	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔			✔		✔		✔
	iBooks Author	✔	✔	✔	✔	✔	✔		✔	✔	✔		✔				✔		

Figure 3. Purpose-driven EdTech summary.

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Purposeful Technology Integration

So far, we have discussed explicit instruction (EI), Universal Design for Learning (UDL), and Technological Pedagogical Content Knowledge (TPACK) as they relate to supporting the needs of students with LD in inclusive environments. It would behoove teachers not to think of these as separate, competing ideas, but rather as complementary components of good teaching. The teacher must plan lessons that provide multiple means for representation, expression, and engagement using flexible tools that allow for the embedding of more individualized supports including AT and elements of explicit instruction. When selecting tools specifically for representation, such as video, audio, images, and text, teachers need to consider how multimedia interacts to help students process, connect, and generalize new information. All the while, the teacher needs to continually engage in active and reflective exploration of technologies to develop TPACK that can help them select tools for the task.

Tools for Multimedia Creation

There is no single form of representation or expression that will be optimal for all learners and all content. Learners have different ways of approaching learning tasks as they process and express their knowledge differently. When multiple modalities are combined, students are better able to make connections within and between concepts (CAST, 2011). Some of these modalities include images, text, audio, animation, and video.

Multimedia images. The combination of multimedia to represent concepts is commonplace within social media today. Our students regularly interact with multimedia like videos, memes, comics, and GIFs. Why not leverage UDL and multimedia learning principles while making connections to your students based on their interests? Try explaining a concept with a GIF or presenting a writing/discussion prompt using a meme. You can even ask your students to create their own multimedia as a means of expressing their knowledge using free tools like **Meme Generator**, **Bitmoji**, or **Giphy**. Keep in mind, while our "digital native" students regularly interact with technology, it does not mean they will automatically leverage these technologies to enhance their learning (Thompson, 2013). Teachers should model how to use these tools to enhance understanding or expression, particularly for students with LD who are less likely to strategically utilize multimedia features for enhancing learning without explicit instruction (Kaczorowski, 2015).

Recorded lectures. A growing movement in schools today is to flip learning (e.g., Flipped Learning Network, 2014) so teacher-led instruction is completed at home and class time is used for active practice facilitated and supported by the teacher. Many teachers may already have existing **PowerPoint** or **Keynote** presentations they have used for in-class presentations. These programs make it easy to turn your presentation into a narrated video. Remember, when creating video content for independent student acquisition, you should consider the aforementioned principles of Multimedia Learning (Mayer, 2009) to help reduce extraneous processing and manage essential processing. One example of short videos designed with these tenets, are Content Acquisition Podcasts (CAPs). Researchers found these brief videos are an effective way for students with and without LD to learn from multimedia (e.g., Kennedy, Aronin, O'Neal, Newton, & Thomas, 2014). If you want to make your own recorded lectures based on evidence-based multimedia principles, I recommend viewing **this video** posted on creator, Michael Kennedy's (2011) Vimeo site: **https://vimeo.com/24179998**. This video is a CAP that teaches you how to make your own CAP for your students.

Annotated tutorials. Another type of video you may want to create is an annotated tutorial. For example, in class you modeled an example math problem on the board, or you drew a diagram on the board to explain a concept to your students. By combining verbal explanation with an active visual, you provided your students with multiple means of representation. But what if one of your students was absent, was not paying attention, or just needs to see the explanation more than once? With some inexpensive (or even free) apps for your tablet, you can quickly create a video annotation by adding images, text, and drawings while recording your verbal explanation. Free tools like **Educreations** and **Show Me** allow you to share a limited number of these videos by posting them to your online account. Another inexpensive option called **Explain Everything** has a one-time purchase price and will allow you to export unlimited movie files to be posted anywhere instead of within a specific application. Researchers have demonstrated that video modeling can be an effective way for students with LD to learn and practice academic skills, particularly those involving procedural knowledge (Cihak, 2009; Kaczorowski, 2015). Another potential use for annotated tutorials are as a resource for parents to help support their children when they practice at home.

Screencasting tools. The more you choose to integrate technology into your instruction, the more you might need to model how to use the tools for your students or for their parents who often are trying to keep up with all the new tools their children are using. Creating a computer screencast is a

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great way to make an EdTech tutorial. **Quicktime**, which is free for Mac OS users, makes screencasting easy. Other cross-platform tools include **Screencast-o-matic** (free, with some limitations) and **Camtasia** (free trial with built-in editing capabilities). Creating reference videos for the EdTech you use. You may be surprised by the number of screencast tutorials available online already without having to make them yourself. If you want a customized tutorial, consider having some of your students create these screencasts to save you time and to give them more ownership of their learning.

Tools for Student Composition

If multiple modes are used for presenting content, it is only logical that students should be able to express and demonstrate what they know using those same modalities.

Multimodal Composing. Composition using multiple means of expression can be very powerful for students. Di Cesare (2015) taught students with LD to respond to literature-based writing prompts using Digital Video (DV) composition. This kind of multimodal composition allows students to organize and edit images and video clips to respond to a writing prompt using multimodal conventions like video and sound editing, cropping, and filtering to engage in a recursive composition process. The students in this study, who were not motivated to write traditionally, were excited to share their ideas through DV and were even able to use their multimodal compositions to translate organizational skills back to print writing. Simple video editing software that could be used for DV composition is available on multiple operating systems and mobile devices. One such tool is an iOS version of **iMovie** that provides movie trailer templates that make great scaffolds for beginners trying DV composition.

Journaling tools. Teachers across grades and subject areas use journals as one way for students to express themselves. Some practices to improve written expression for students with LD that could be linked to journaling include interactive dialogue between students and teachers (Mason & Graham, 2008) and promoting creativity through visual imagery (Graham, McKeown, Kiuhara, & Harris, 2012). EdTech makes journaling more interactive and multimodal with apps and web-based platforms that allow for easy sharing, commenting, and collaborating. One app called **Write About This** includes the ability for teachers to offer varied levels of writing prompts using images, text and audio, and allows students to respond to the prompts using those same modalities. **Seesaw** is a student-driven learning portfolio that allows students to use mobile devices to take photos, and add text and audio commentary before sharing them with the teacher. This free app also allows the teacher to automatically share student journals with parents or to pull up work samples at IEP meetings. Another universal web-based tool that makes for a great dialogue journal is **Google docs**. I have my pre-service teachers share google doc journals with me so I can read and comment on their reflections to in-class writing prompts. This universal, collaborative document extends to a variety of composition-based tasks as an alternative to a paper-pencil worksheet. Students are able to add text, images, videos, and hyperlinks onto a blank canvas or even on a "worksheet" template I create for them. As their instructor, I can monitor their work and offer feedback both during class or from a distance.

Tools for Active Engagement

The Center for Applied Special Technologies (CAST, 2011) asserts to keep students motivated and engaged, teachers must optimize individual choice and provide relevant and valuable experiences while minimizing distractions and fostering self-regulation skills. To accomplish this, teachers must acknowledge that not everyone is motivated by the same kinds of tasks and activities. Students with LD benefit from systematic, explicit instruction, while other learners may prefer and excel with problem-based learning activities. Some of the most powerful EdTech tools on the market can help a teacher embed elements of explicit instruction like requiring frequent responses, scaffolding, providing meaningful practice opportunities, and monitoring of student work with immediate feedback into a variety of active learning activities.

Collaboration. Building skills for working with and learning from others is valuable both in and out of school. Norris and Soloway (2015) explain that to harness the full potential of mobile learning, teachers must make a pedagogical shift away from direct (i.e., explicit) instruction toward more collaborative, inquiry-based learning. For students with LD, and other at-risk students, this kind of learning does not typically come automatically. EdTech options for collaboration should be flexible enough for the teacher to provide immediate feedback with varied levels of support. **Padlet** is an easy-to-use online collaborative bulletin board that allows students and teachers to post, sort, and comment each other's ideas. Posts can include text, audio, video, images, and hyperlinks, and students can access this collaborative board from anywhere with internet connection. If students want to brainstorm by drawing as an additional modality and they have computers or tablets, collaborative whiteboards like **Groupboard** or **Baiboard** are a great way

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for them to draw on the same whiteboards to share ideas. As a teacher, you can be part of all collaborative groups to monitor work and offer ideas and feedback with varying levels of support.

Active Response for formative assessment. Increasing the number of opportunities to respond improves students' attention and behavior (Partin, Robertson, Maggin, Oliver, & Wehby, 2010), so when posing questions to your students, consider how you will ensure everyone has opportunities to engage in active response. One way EdTech can help teachers increase active response is by incorporating "clicker" or polling technologies. If you have 1:1 technology in your classroom, try using a free, cross-platform clicker tool like **Socrative**. Your students can login on their devices and respond to multiple choice or open answer questions and their response data will be stored so you can use it for formative assessment. If you do not have 1:1 technology for your students, but you have a mobile device as the teacher, you can use an active response application called **Plickers**. Students respond using unique printed codes and the teacher uses a mobile device to quickly scan student responses. Both of these free options are easy to implement and have a plethora of online tutorials to help you get started. Similar active response options are also built into some more comprehensive EdTech that foster all three UDL principles.

Comprehensive tools for UDL. Some EdTech tools allow for multiple means of representation, expression, and engagement within the same program with embedded EI elements. For teaching with video, you may consider **EdPuzzle**, a free online system that is great for engaging and assessing students while watching videos. Teachers can embed comments or questions (using text, images, or audio) throughout the video as scaffolds or checks for understanding. Additionally, teachers can embed immediate feedback for their closed-answer responses, check to see who did and did not watch the videos, and provide comments as feedback for their open-answer responses. For in-class engagement, teachers could use **Nearpod**, which takes presentation from the front of the room to individual student devices, giving the instructor the freedom to walk around the room and provide individualized support as needed. This tool allows for the embedding of images, videos, response questions, collaborative brainstorms, documents, and websites to keep students actively engaged. If the classroom is equipped with Mac OS computers and iPads, free software like **iBooks Author** can be used to create multimedia-enhanced "ebooks" to provide a space for presenting content and for student responses within the same ebook by incorporating customizable interactive widgets. Research supporting the use of some specific EdTech programs is largely focused on learning theories and perception, however, the research base is rapidly growing. The potential of these tools to enhance practices we know to be evidence-based for students with (and without) LD warrants strategic implementation in classrooms today, especially when teachers use formative assessment throughout the process to document student growth.

Transforming Pedagogy with EdTech

The EdTech described above represents just a small sample of tools to enhance teaching available on the market today. The process of sorting through your options can be overwhelming without a good strategy. If you are ready to transform your pedagogy with EdTech, here are some tips:

1. **Focus on Purpose –** When searching for EdTech, focus on the purpose of the tool rather than specific devices or applications. What needs do your students have? What do you want to fix or enhance about your instruction? Utilize existing resources like **EdShelf** that are designed to help you filter results based on purpose and logistical needs.

2. **Explore Regularly –** Carve out regular time to explore and create using technologies by making it a part of your routine. I like to take 15-20 minutes in the morning to grab a cup of coffee and spend some time exploring and organizing what I have found.

3. **Consider Stakeholders and the Environment –** When you explore tools, try them out from both the teacher and the student viewpoints. What are the logistics involved with implementation? How much time would it take to teach students to use the tool?

4. **Start with Baby Steps –** Try not to incorporate too many new tools all at once. Begin with tools you feel comfortable with and implement one tool well before adding another new tool to your practice.

5. **Let Go –** Technology does not need to be teacher controlled and operated. Technology should be in the hands of the students for both input and expression. Allow your students to help you create content too; it can save you time and give them some ownership in their learning.

6. **Start with What Works –** Choose tools that will enhance the evidence-based practices you already incorporate from your instruction. Technology is not a replacement for good teaching.

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7. Provide Strategy Instruction – Students need less explicit instruction in how a tool works, and more instruction in how to leverage built-in supports for improving learning (Kaczorowski, 2014, 2015). Allow students to freely explore functionality of tools until they are comfortable with them. Provide explicit instruction in strategies to help them use the multimedia representations and supports appropriately for the task.

8. Reflect Regularly – Technology integration is a recursive process. Observe and monitor your students, ask for their feedback, assess their learning, and make changes as needed.

Conclusion

In order to transform learning with EdTech, teachers must allow technology to change their teaching. Effective technology integration requires a paradigm shift. The work for technology integration typically comes up front, particularly when considering the flexibility of the tools you select from a UDL perspective. Create materials accessible enough to be used by diverse learners with varied levels of support. When selected with purpose, technology can enhance evidence-based practices in a way that couldn't be done without it. EdTech can offer access and equity, opportunities to actively engage with content, flexible learning spaces that allow for scaffolding and review, and freedom for students to drive their own learning.

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Do Research Findings Apply to My Students? Examining Study Samples and Sampling

By Bryan G. Cook & Lysandra Cook, University of Hawaii

Special educators are encouraged to use research to inform their instruction. However, it can be difficult to tell whether and how research findings apply to one's own students. In the current issue of *Learning Disabilities Research & Practice*, Cook and Cook (2017; http://onlinelibrary.wiley.com/doi/10.1111/ldrp.12132/full) discussed two approaches for examining the degree to which research findings apply to one's students: the classical generalization model and the case-to-case transferability model.

In the **classical generalization model**, *generalization* refers to the degree to which research findings derived from a sample of research participants can be extended or applied to the broader population. Generalizability depends on how *representative* a study sample is of a larger population. Representativeness refers to study participants accurately reflecting the population. For example, assume a state-level administrator needs to select a practice shown by research to improve reading outcomes for students with LD in her state. She should not choose a practice shown to be effective in a study that (a) was conducted in one affluent school and (b) included only students with LD with only reading comprehension difficulties (i.e., without problems in reading fluency) because this study sample is not representative of all students with LD in the state. Even though the practice worked for study participants, it might not be similarly effective for the larger population of students with LD in the state. Researchers can use *probability sampling methods* such as random selection to maximize the probability that their study sample is representative of a larger population. For example, if researchers randomly selected one out of every 50 students with LD in the state to participate in their study, it is highly probable that the study sample would be representative of students with LD in the state, and that study findings would therefore generalize to this population. Although examining whether study samples are representative of the population is a valid approach for identifying whether study findings apply to one's own students, very few studies in special education use probability sampling.

The **case-to-case transferability model** is an alternative approach for examining the relevance of research findings to one's own students that originated in qualitative research. In this approach, educators examine the *match* between their students and the participants in the research. The more research participants match one's students on relevant characteristics (e.g., age, disability area, cultural and linguistic status), the more research findings are likely to *transfer* or apply to those students. For example, findings from a research study conducted with participants who were CLD fourth graders with LD are more likely to transfer or apply to other CLD fourth graders with LD than to non-CLD high school students with intellectual disabilities. It is important to note that (a) the match between study participants and one's own students does not need to be exact for study findings to transfer and (b) that match and transferability exist on continuums. For example, although the match between (a) fourth-grade students with LD and (b) study participants who are fifth graders at risk for reading failure is not perfect, it is a much closer match (and, therefore, study results are much more likely to transfer) than for a study involving gifted high school students.

Among other considerations and caveats to bear in mind when examining the likelihood of research findings applying to one's own students are:

- All other things being equal, the larger the number of participants in the study(ies), they greater the likelihood that research findings will generalize or transfer.
- Even if (a) a study sample is representative of the population to which one's students belong or (b) the match between study participants and one's students is very strong, there is no guarantee that results from research will apply to any particular student. Therefore, it is important to collect progress-monitoring data to examine the impact of any new interventions on individual learners.
- Examining the sample and sampling in research studies is just one consideration when deciding whether to adopt a practice. It is also important to consider factors such as the degree to which a practice addresses learner needs and goals, acceptability of the practice for the instructor and learner, and resource demands of the practice.

In conclusion, it is easy to overgeneralize research findings and for educators to inappropriately apply study results to their students. Special educators should examine the sample and the sampling method in studies to determine whether and the degree to which research findings are likely to generalize or transfer to their own students.

DLD Shares Evidence-Based Practices in Cuba

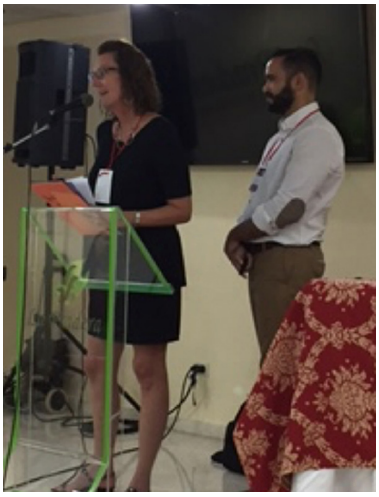
Diane Rodriquez, Associate Professor at Fordham University, meeting with students in Cuba.

Board member **Diane Rodriguez**, who chairs the Cultural and Linguistic Diversity subcommittee, invited the DLD board to get involved in Havana at the International Congress on Teacher Training and Education Research Docencia Conference held from the 25th through the 29th of October. Hosted for the first time ever in Cuba, the conference included 29 Americans joining over 400 scholars from across Latin America. Coincidentally this occurred shortly before Fidel Castro passed away. During our brief visit, Cuba noted anniversary of Columbus' arrival (October 28), participated in Cuba's ongoing celebration of Fidel's 90th birthday, and witnessed the first ever US abstention from a UN vote condemning the Cuba Embargo. This was an international event organized by the Pedagogical Science University **Enrique José Varona** from Cuba. Then-DLD president **Linda Mason** was interviewed by the Cuban print media and she highlighted the importance of supporting individuals with disabilities and international collaboration.

Michael Faggella-Luby presenting on evidence-based practices.

Several of the board presented evidence-based practices. We joined to create and translate into Spanish two presentations and we invited doctoral students and colleagues to help us. One panel presented Self-Regulated Learning for Students with Disabilities (Mason, deBettencourt, Lavin, Faggella-Luby, and Mamlin.) This panel described direct and explicit instruction principles, including the changing responsibilities of teacher and student during mediated learning. The presentation highlighted two evidence-based interventions (Self-Regulated Strategy Development and the Strategic Instruction Model). The panel concluded with handouts for practitioners on the roles of general and special educators during explicit instruction of students with disabilities.

The second explained Data-based Individualization for Reading Intervention for Students with or at Risk for Learning and Intellectual Disabilities (Al Otaiba, Lemons, McMaster, Pappamihiel, & Polanco). This panel described response to intervention, or multi-tiered systems of supports, for struggling readers, characteristics of students who have not adequately responded to intervention, small group or peer-assisted intensive interventions, and what special educators need to know about data-based tertiary intervention, or special education. The panel concluded with a set of 10 evidence-based tips that are helpful for training educators who teach reading to students with disabilities.



Stephanie Al Otaiba, professor at Southern Methodist University, presenting in Cuba this summer.

As teachers across the US plan for the start of the new school year, we hope you will find information about these and other evidence-based practices on our website. We also hope you will enjoy the DLD session at the CEC in Tampa conference and that you join us in our commitment to improving the lives of all individual with learning disabilities here and across the globe!

Subdivision Contact Info

FLORIDA – Diana Morales
Florida@TeachingLD.org

IDAHO – Margaret Gross
Idaho@TeachingLD.org

ILLINOIS – Elizabeth Mackie
Illinois@TeachingLD.org

KANSAS – Irma Brasseur
Kansas@TeachingLD.org

MISSOURI – Sarah Bates
Missouri@TeachingLD.org

NEW JERSEY – Marie Segal
NewJersey@TeachingLD.org

NEW YORK – Dee Berlinghoff
NewYork@TeachingLD.org

NORTH CAROLINA – Debbie Holzberg
NorthCarolina@TeachingLD.org

OHIO – Janice Kelley-Stafford
Ohio@TeachingLD.org

ONTARIO – Amy Shannon
Ontario@TeachingLD.org

PENNSYLVANIA – Carolyn Berenato
Pennsylvania@TeachingLD.org

SOUTH CAROLINA – Susan Thomas
SouthCarolina@TeachingLD.org

UTAH – Dan Elbert
Utah@TeachingLD.org

WISCONSIN – Jackie Blumberg
Wisconsin@TeachingLD.org

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