

Integrating Evidence-Based Practices and Instructional Design Principles: Introducing Content Acquisition Podcasts

In this new and recurring feature within the members-only side of www.TeachingLD.org, we (Anya Evmenova from George Mason University and Michael Kennedy from The University of Virginia) introduce, review, and highlight evidence-based, and promising interventions that use multimedia to support outcomes for students with specific learning disabilities (LD). In this space, we aim to continue the conceptual argument forwarded by Kennedy in the Fall 2013 edition of the *DLD New Times* Newsletter (Volume 31, Issue 3). To sum up, our guiding compass is technology-driven interventions and products that have at least some evidence to suggest they ‘work’ for students with LD. In this first installment, we introduce an emerging practice for teaching students with LD called Content Acquisition Podcasts (CAPs) (Kennedy, Deshler, & Lloyd, 2013; Kennedy, Thomas, Meyer, Alves, & Lloyd, 2013). In addition, we provide embedded links to resources and specific production steps that can help practitioners create and use this instructional tool in their practice.

Producing CAPs

CAPs are short, multimedia-based instructional vignettes that can package and deliver any content (e.g., vocabulary terms/concepts). The term podcast is a bit misleading, because we do use the best features of podcasting in our work (e.g., ease of creation, dissemination, and use), but more accurately, CAPs reflect a combination of validated design principles and evidence-based instructional practices known to be effective for students with LD. Generic podcasts, whether audio-only or enhanced (visuals in time with audio), have no such features. Before continuing, please [click here](#) and watch a sample CAP that teaches a middle school audience about the term photosynthesis.

After watching, what's your guess for how it was produced? Yes! We use PowerPoint to produce CAPs. You might ask why we use PowerPoint when there are 'fancier' options for creating enhanced podcasts (e.g., Camtasia, ProfCast). The answer comes down to preference, and our desire to provide a set of production steps that any teacher should be able to use given existing technology on any computer. You can access the [written version of our production steps here](#). We also have a two-part CAP on how to create CAPs, which can be accessed at: [Part 1](#) and [Part 2](#). If you are comfortable with Apple's Keynote, Camtasia, or some other product for recording podcasts, by all means, do so with our best wishes. However, while we aren't particularly interested in the software being used, we are consumed with ensuring any multimedia being used to teach students with LD meets standards for valid instructional design principles, and also embeds evidence-based practices for content being taught.

Using Validated Instructional Design Principles to Evaluate and Create Multimedia

As you looked at the sample CAP on photosynthesis, what did you notice about its looks and sounds? Specifically, what did you notice about the images and the pacing of narration? How much on-screen text did you note, and when was it used? We hope you noted and agree that the images shown on screen are vivid and clear, centrally located on the screen, and explicitly connect with the content being presented. The rate of speech is deliberate, and clear. Use of text is at a minimum, other than to highlight essential points. None of these instructional design decisions are accidental. Our design team uses the work of Richard Mayer, whose *Cognitive Theory of Multimedia Learning* (2009) and *accompanying design principles* (2008) give teachers and other instructional designers explicit guidance for multimedia creation and use. Mayer's instructional design principles are supported by numerous experiments detailing their

effectiveness for promoting learning. Figure 1 lists these principles, and gives a short explanation of how they are infused within CAPs.

Figure 1.

Linkage of CAP production steps to Mayer’s CTML and instructional design principles.

Triarchic Model of Cognitive Load (DeLeeuw & Mayer, 2008)	Research-Based Instructional Design Principles and effect sizes* (Mayer, 2009)	Brief Description of Mayer’s Instructional Design Principles (Mayer, 2009)
Limit Extraneous Processing	Coherence Principle <i>ES = .97, 14 Studies</i>	Each CAP only contains information relevant to the content being presented
	Signaling Principle <i>ES = .52, 6 Studies</i>	Each CAP contains recurring explicit cues to signal the beginning of a new section
	Redundancy Principle <i>ES = .72, 5 Studies</i>	Each CAP only contains carefully selected key text
	Spatial Contiguity Principle <i>ES = 1.12, 5 Studies</i>	The on-screen text and pictures in each CAP are presented in close proximity to one another
	Temporal Contiguity Principle <i>ES = 1.31, 8 Studies</i>	Pictures and text within each CAP correspond to the audio presentation
Manage Essential Processing	Modality Principle <i>ES = 1.02, 17 Studies</i>	CAPs are multimedia; therefore this principle is addressed
	Segmenting Principle <i>ES = .98, 3 Studies</i>	Each CAP is broken either into segments as noted by instructions to pause the video, or main ideas are separated into separate CAPs
	Pretraining Principle <i>ES = .85, 5 Studies</i>	Each CAP begins with an explicit statement of purpose and an advance organizer for the term
Foster Generative Processing	Multimedia Principle <i>ES = 1.39, 11 Studies</i>	The CAPs are multimedia; therefore this principle is addressed
	Personalization, Voice, and Image Principles <i>ES = 1.11, 11 Studies</i>	The narration in each CAP is presented in a conversational style and by a human voice. The speaker’s image is not on the screen. Images are non-abstract and easily recognizable by viewers

* Note: Effect sizes are summaries of empirical research conducted by Mayer and his colleagues and are reported in Mayer (2008).

Figure 2

Mayer's 12 Instructional Design Principles and Corresponding Evaluation of Sample Video from the Khan Academy

Research-Based Instructional Design Principles (Mayer, 2008; 2009)	Sample Khan Academy Video	Principle Met?
Coherence - Instructional materials are enhanced when irrelevant or extraneous information is excluded	There is no obvious attempt to constrain narration to essential content	No
Signaling - Learning is enhanced when explicit cues are provided that signal the beginning of major elements	There are not explicit signals to cue the viewer's attention to key segments or points	No
Redundancy - Inclusion of extensive text (transcription) on screen along with spoken words and pictures hinders learning. Carefully selected words or short phrases, however, augment retention	Redundant, on-screen text is used throughout the video	No
Spatial Contiguity - On screen text and pictures should be presented in close proximity to limit eye shifting	On-screen text and images are continuously spread across the screen	No
Temporal Contiguity - Pictures and text should shown on screen should correspond to the audio presentation	The same images remain on the screen for the duration of the video. Once on-screen text is added, it is not removed	No
Modality - People learn better from spoken words and pictures than they do from pictures and text alone	Pictures and narration are used	Yes
Segmenting - People learn better when multimedia presentations are divided into short bursts as opposed to longer modules	The video is not broken into segments, its running time is 17:04	No
Pretraining - People learn better when given an advance organizer or preliminary instruction for the content being introduced	The video begins with a statement of introduction but there is no further orientation to its structure	No
Multimedia - People learn better from pictures and spoken words than from words alone	The video contains pictures and narration	Yes
Personalization - Narration presented in a conversational style results in better engagement and learning than more formal audio presentations	The narrator uses a conversational tone throughout the video	Yes
Voice - People learn better when narration is clearly spoken with respect to rate and accent	The narration is not unusual with respect to rate or accent	Yes
Image - People learn better when images are non-abstract, and clearly represent the content being presented	The pictures shown on screen are not abstract, and represent the core content	Yes

Using a validated instructional design framework like Mayer's to evaluate and/or guide multimedia production that will be used for teaching students with LD is extremely important. In a recent article, Kennedy, Deshler, and Lloyd (2013) deconstructed a sample video from the popular website, the Khan Academy (<http://www.khanacademy.org/humanities/history/euro-hist/v/french-revolution--part-1>), in part to evaluate the extent to which it adheres to Mayer's model. Figure 2 presents the results of our analysis. While deconstruction of videos on the Internet (e.g., the Khan Academy or You Tube) is to some extent unfair because of their original purpose, as special educators it is our job to help shed light on potential mismatches between student learning needs and instructional materials potentially being used to teach them. In summary, trading the convenience of multimedia for quality design principles and pedagogy is not a good match for the learning needs of many students.

Selecting and Embedding Evidence-Based Instructional Practices in Multimedia

Making decisions regarding the looks and sounds of multimedia is important. However, when teaching students with LD and other disabilities, the instructional priority should always be evidence-based practices that can help students improve in specified areas of need. This leads to our second major criticism of 'off the rack' multimedia that is usually freely available on the Internet. When a teacher or other educator does a fast search for a video to show in class or assign as homework, they may not expend energy and time evaluating the technical and pedagogical characteristics of videos they find. Technical characteristics refer to the looks and sounds noted in the previous section. Pedagogical characteristics are evidence-based practices used within the multimedia to deliver instruction.

If a teacher is looking to help improve student comprehension or vocabulary knowledge via a video or other multimedia, the multimedia should embed evidence-based practices in that

vein. To illustrate, take another look at the sample video from the Khan Academy with the express purpose of noting any evidence-based pedagogical practices being used: (<http://www.khanacademy.org/humanities/history/euro-hist/v/french-revolution--part-1>). Given your training and professional judgment, is Mr. Khan using any instructional practices you might consider to be evidence-based? I do think his voice is pleasant and easy to listen to, and as an adult, expert learner (who happened to major in social studies), I can follow along with his pace of instruction and successfully pick up new pieces of information. For many students with LD, however, I have serious reservations about the extent to which they could successfully watch that video and walk away with the ability to discuss or answer critical questions. Regardless of whether I assigned students with LD to watch the video multiple times, the pedagogy of telling being used by the narrator without concern for level of vocabulary and complexity of ideas is not likely to achieve its intended purpose. Students with LD need multimedia that is more considerate and explicitly conscious of their cognitive learning needs.

To address this concern, CAPs can be built using a menu of evidence-based practices that are appropriate for the content being taught. To illustrate, six specific instructional practices, grounded in the empirical literature on vocabulary instruction (e.g., Bryant et al., 2003; Ebbers & Denton, 2008; Jitendra et al., 2004), constitute a menu of practices embedded into the instructional routine used within CAPs. These include (a) promoting word consciousness (e.g., pronunciation, spelling, syllables, prefix, suffix, root words) (Reed, 2008), (b) providing direct instruction of word meanings (Archer & Hughes, 2011), (c) providing guided practice and scaffolding (Dexter et al., 2011), (d) providing instruction that promotes awareness of closely related terms (Graves, 2006), (e) using the keyword mnemonic strategy (Mastropieri, Scruggs, & Levin, 1987), and (f) providing a statement of purpose/rationale for why the student needs to

learn a given term or concept (Deshler & Shumaker, 2006). These six elements of effective vocabulary instruction are represented within a checklist called the Vocabulary Planning Framework Checklist (see Figure 3). Depending on your needs, you should select practices from the VPF Checklist, or substitute others that are appropriate.

One guideline after selecting appropriate instructional practices is to consider how they will interact with Mayer's principles within the CAP. An example is the keyword mnemonic strategy ([see a CAP explaining how here](#)). Because the keyword mnemonic strategy is driven by a combination of explicit instruction and visuals, capturing this instructional approach within a CAP makes particular sense. Another example is using word-learning strategies ([see a CAP explaining how here](#)). The visual-driven format of CAPs lends itself to showing learners how words can be broken into component parts, and then use visuals to demonstrate what the word parts mean.

Another option is to embed practice questions within CAPs. We know our students with LD often demonstrate learning via oral responses, and on other tasks that do not have intentionally confusing questions or require combinations of higher order thinking skills. I often hear from teachers that their students do not pass high-stakes assessments because the questions contain that one word or phrase that is unknown to the student, and causes them to choose the incorrect answer, even when they know the material. This is frustrating, and many schools choose to address this issue by giving students frequent practice assessments. By embedding both simple recall and end-of-course type questions within CAPs, you can give students opportunities to practice and immediate feedback. You can make decisions regarding accommodations within the CAP, for example, you could opt to read the sample question aloud within the CAP, or, simply instruct the student to read it silently and choose the best answer.

The narrator could also opt to model the type of thinking needed to answer challenging multiple-choice questions by doing a think aloud. Like the menu of evidence-based practices noted above, embedding questions within CAPs has numerous options that might make sense for your students.

Conclusion

The defining feature of CAPs is that they are designed using Mayer's validated instructional design principles, and also include embedded evidence-based practices for the content being taught. Students can watch CAPs during class as part of the traditional lecture, be assigned to watch them during study skills time, and have access to the videos at home. Giving students access to CAPs at home can help bring the parents up to speed on what the students are learning, and also see the types of instruction they can hopefully replicate when working on homework and other assignments. Some teachers might opt to have students create their own CAPs. This is an exciting next step in our program of research, to see the extent to which students can create CAPs, and if there is a corresponding impact on learning. Teachers who are interested in creating CAPs, but might need a hand getting started are invited to email Michael Kennedy (MKennedy@Virginia.edu) to get additional pointers. I am happy to help in any way I can!

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Figure 3

Vocabulary Planning Framework Checklist (Kennedy, Lloyd, Ely, & Cole, 2012)

Step 1: Look for and Teach Morphemes or Other Semantic Clues <i>When planning for instruction, ask yourself the following questions regarding essential vocabulary terms in the various content areas in which you teach and support students with exceptionalities.</i>		
Questions to ask	Yes	No
Does the term have a prefix?		
Does the prefix have a special meaning in this content area?		
Have I explicitly taught the prefix's meaning(s)? <i>If no, teach the prefix's meaning.</i>		
Does the term have a suffix?		
Does the suffix have a special meaning in this content area?		
Have I taught the suffix's meaning(s) to students? <i>If no, teach the suffix's meaning.</i>		
Can this term's meaning change based on various endings (e.g., -s, -es, -ing)?		
Have I explicitly taught students how different word endings can change this term's meanings? <i>If no, explicitly teach tenses.</i>		
Does the term have a root word that helps define the term?		
Is the root's meaning obvious? <i>If not, explicitly teach it.</i>		
Have I explicitly taught a strategy or strategies for identifying morphemes in unknown words?		
Can students use the strategy appropriately without prompting?		
Have I set aside and made appropriate use of instructional time to support students who have not yet mastered any word-learning strategies? <i>If no, review teaching routines and priorities.</i>		
Have I used semantic maps to help students visualize interconnections among common word parts? <i>If no, introduce this strategy using explicit instructional methods.</i>		

Step 2: Define the Term in and Out of Context

Use the information you generated in Step 1 to create student-friendly definitions for the key vocabulary terms and concepts that your students are likely to struggle with. Remember that students with LD and other learning challenges are likely to be confused when a term has one meaning in “the real world,” and means something else entirely in a content area.

Questions to ask	Yes	No
Are the morphemes and other semantic parts of the word useful in defining this term?		
Did students use a generative word-learning strategy to define the term (e.g., breaking the word into parts)?		
Does this term have a “real-world” meaning that is different than the content-specific definition?		
Did I explicitly teach and/or review the “real-world” meaning of the term using student-friendly language?		
Did I explain how and why this term means something different in this content area?		
Did I explicitly teach a student-friendly but content-specific meaning of the term?		
Did I use examples and non-examples in my explanation?		
Were my examples and non-examples content-specific?		
Did I explicitly teach closely related terms in the context of this content area?		
Did I explicitly teach any synonyms?		
Did I explicitly teach any antonyms?		

Step 3: Review and Select Relevant Evidence-Based Practices (EBPs)

Choose from this menu of vocabulary instruction EBPs that make sense for the term being taught, given its content-specific meaning and students’ learning needs. (Note: This list is not exhaustive.)

	Evidence-based practices
	Semantic feature analysis and mapping (Ebbers & Denton, 2008)
	Explicit instruction (Archer & Hughes, 2011)
	Keyword mnemonic strategy (Mastropieri, Berkeley, & Graetz, 2010)
	Word ID strategy (Lenz & Hughes, 1990)
	Morphemic analysis (Reed, 2008)
	Using instructional technology (Xin & Rieth, 2001)

	Graphic organizers (Dexter Park, & Hughes, 2011)
	Content enhancements (Deshler & Shumaker, 2006)
	Anchored instruction (Cognition and Technology Group at Vanderbilt, 1990)
	Bringing words to life (Beck et al., 2002)
<p>Step 4: Individualize Instruction to Ensure EBPs and the Term’s Characteristics Match</p> <p><i>Individualize instruction by carefully considering the learning needs of the student, the content-specific demands of the vocabulary term/concept, and the selection of an appropriate EBP (or practices) to help the student construct a meaningful cognitive representation of the term’s meaning.</i></p>	
What is the term?	
What makes the term easy, typical or hard to teach and learn?	
Be specific: What is the definition of this term that ALL students need to know?	
What are supporting details that would help ALL students understand more about this term?	
<p>What additional background knowledge is necessary for students to really understand this term? Example: Is the term a recurring concept in history/science/ELA/Math? Is there a modern connection? What other terms/concepts are related to this one?</p>	
What does the student’s IEP say about his or her strengths for learning?	
Which EBPs have been effective in the past for helping the student successfully learn the meaning of vocabulary terms in this content area?	
Which EBPs have been effective in the past for helping other students successfully learn the meaning of vocabulary terms in this content area?	