National Center on
Accessible Educational Materials

Connecting Accessible Educational Materials (AEM) and Learning

Prepared for the National Center on Accessible Educational Materials
By the AEM Center Staff

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Abstract

Provisions introduced to the Individuals with Disabilities Education Act (IDEA) in 2004 help to improve the delivery of accessible instructional materials (AIM) to students with print-related disabilities. It is important to recognize, however, that access to content does not, by itself, guarantee a quality learning experience. Paying closer attention to the ways in which students interact with AIM and to insights from the learning sciences can inform efforts to improve the quality of learning experiences for all learners, including students with print-related disabilities. This paper also pertains to the more general accessible educational materials (AEM) which includes print sourced materials, those which are born digital and the technology used to deliver them to the learner.

Five concepts from the learning sciences are highlighted—purpose, demand, control, challenge, and context—that can be leveraged to amplify the impact of AEM to support greater self-directed learning and to improve educational outcomes for all learners.

Introduction

The 2004 reauthorization of the Individuals with Disabilities Education Act (IDEA) introduced provisions designed to help schools provide timely access to accessible instructional materials (AIM) for students who need them. The U.S. Department of Education and U.S. Department of Justice (2010) have re-stated the importance of providing access to educational content in the digital age. This guidance has reaffirmed the responsibility of schools to ensure equal access to the educational benefits and opportunities afforded by emerging technology and equal treatment in the use of the technology for all students, including students with disabilities. While these requirements focus on improving students' access to content—both print-based materials and those created digitally—it is equally important for teachers to utilize effective teaching strategies that support their students in the use of AEM.

Over the past fifteen years the learning sciences (e.g., cognitive science, neuroscience, education, and developmental psychology) have undergone a conceptual shift—away from static perspectives and toward a more dynamic and contextualized view of the learning process (Bransford, Brown, & Cocking, 2000; Fischer & Bidell, 2006; Sawyer, 2006; Thelen & Smith, 1996). At the heart of this approach is the idea that learning emerges from interactions between students and their learning environment (Hattie, 2009; Hattie & Timperley, 2007; Karabenick & Newman, 2006; Rose & Fischer, 2009; van Geert, 1998). This emphasis makes clear the need for increased collaboration between AEM and the learning sciences.

This paper introduces five "high-leverage" insights from the learning sciences—purpose, demand, control, challenge, and context—and discusses ways to develop a closer integration between AEM and learning. These insights—while not exhaustive by any means—were chosen because they are robust findings within the field of learning science, they interrelate with each other in critical ways, and they are immediately actionable within the existing AEM context.

(1) Purpose

One of the most significant insights to come out of the learning sciences in recent years is the importance of making the purpose of learning clear to students (Anderman & Wolters, 2006; Boekaerts & Pintrich, 2005; Zimmerman & Schunk, 2011).

Purpose, as defined here, requires that two things occur together: students must know what they are learning (goal) and they must know why they are learning it (relevance).

Goals

In a sense, the importance of goals is at once the easiest point to understand and yet the easiest to forget. Educators intuitively know the importance of having a goal in order to teach, yet sometimes forget to make goals explicit to students (Danielsen, Wilhelmsen & Wold, 2010; Garner, 2009; Linnerbrink-Garcia, Tyson & Patall, 2008); Rose & Meyer, 2002).

AEM can help students attain overall lesson goals

When designing lessons, educators start by deciding on a goal for the lesson and then create a set of learning experiences to help students reach that goal. Because educational materials are a fundamental component of the curriculum, when students struggle with inaccessible curriculum materials, they expend a great deal of working memory in these intermediate efforts—often losing the overall goal of a lesson in the process. Therefore, ensuring that educational materials are perceivable by students—i.e., available in formats such as braille, audio, digital text, or large print—is a necessary step to help students attain overall goals. In particular, when such goals involve the acquisition of content knowledge, the availability of AEM removes the barrier of print and helps optimize the possibility of perception.

Goals need to be explicit, available at all times, and presented in an accessible format

For all students—those with and those without disabilities—it is important to understand the goal of the learning event. From the perspective of the modern learning sciences, there are at least three steps that educators can take to increase the chance that students will adopt the lesson goal: (1) make the goal explicit, (2) make the goal available in the environment all of the time, and (3) make the goal available in a format and media appropriate to students' learning needs.

When a lesson goal is not explicit, a student may be left making sense of the learning experience and using an irrelevant goal. If this happens, learning suffers. Similarly, when a goal is not available in the learning environment, the impact can be taxing on students' working memory. Each of us has a limited mental capacity for holding things in mind while doing other things. Finally, and perhaps most importantly in the context of AEM, when a goal is not made available to students because it is not provided in an accessible format, students with print-based disabilities will struggle to keep it in focus, using precious working memory that is needed for learning (Pickering, 2006).

Students need explicit and clear goals in their use of AEM

It is also important for educators to make goals explicit to students in their use of AEM. For example, in the case of a student using digital text, the introduction of guiding questions by the teacher can help the student use the text in a more meaningful way to set a goal for the reading, to skim irrelevant information, and to focus on the purpose of the reading. Given how much learning depends on the extent to which students understand the goal of what they are learning, educators can help student users of AEM to become more independent and effective learners by making sure that they understand the underlying goal. This can be done any number of ways, including by drawing students' attention to the goal initially as well as during the learning experience.

Relevance

For a lesson to have purpose, students not only need to know what they are learning, they also need to know *why* they are learning it. In other words, purpose requires *relevance*. From a learning sciences perspective, relevance is recognized as fundamental to learning: it not only plays a role in the brain's ability to filter out irrelevant information, it also influences students' motivation to persist in the learning process (Kember, Ho, & Hong, 2008).

AEM can help students focus on what is relevant in a lesson

When students with print-related disabilities are forced to spend a significant portion of time and working memory trying to decipher print, it becomes harder for them to focus on what is relevant in the lesson. A similar situation can occur in the context of assessment. When an item inadvertently measures construct-irrelevant information, some students may be unable to demonstrate their true ability with respect to the intended construct or skill. For example, requiring a student with a print disability to decode a math word problem will mean that the student is being assessed on his/her performance with respect to a skill outside of math computation. In contrast, allowing the student to hear the word problem read aloud through synthetic or human speech will enable the assessment to measure the student's true performance more accurately.

AEM can help make learning more relevant to students

The concept of relevance is closely connected to that of student engagement. Educators can play a role in supporting relevance in at least three ways: (1) ensuring multiple representations and multiple examples of concepts being taught (e.g., using accessible materials that allow for text-to-speech, synchronized visual highlighting,

magnification, etc.); (2) allowing students, when it is reasonable, to contribute to the setting of goals; and (3) promoting discussions that cue personal experiences before a learning period.

With regard to AEM, the use of accessible, multimedia materials can help to make a lesson more engaging for students. Students who are drawn into a learning environment are more likely to persist when encountering challenge. Students with print, sensory, physical, or learning disabilities are more likely to be drawn to media and materials that are accessible to them, while students without disabilities can also be engaged by the multimedia aspects of, for example, digital learning environments.

Having students set their own goals for AEM can make learning even more relevant

It is possible to make a lesson even more relevant for student users of AEM by helping them to set their own goals with respect to their use of AEM. Such a task is especially important for students who are going through the transition planning process and are getting ready to move on to post-secondary life experiences. In the context of higher education or employment, young adults with print disabilities must be able to advocate for their own needs in relation to AEM. Consequently, having students set their own goals in relation to AEM can support them in becoming more independent. Similarly, having students personalize their experiences with respect to their use of AEM can also help to increase its relevance for them.

(2) Demand

Students today face the daunting task of navigating learning environments that place incredible demands on their ability to process information (Goldberg, 2009). For example, technologies provide students with a continuous stream of information unprecedented in its diversity, volume, and the speed with which it is delivered. Importantly, these demands are not only coming from informal, technology-based environments; they are also coming from the classroom (St. Clair-Thompson & Botton, 2009).

AEM can help reduce the demands posed by traditional learning environments

Traditional learning environments, with an over-reliance on print-based materials, place unnecessary demands on students with print-related disabilities. These demands are an

issue because our biological capacity for processing information—what scientists call working memory—is limited (Baddeley, 2007). Providing a student with a print-related disability with a digital talking book that includes text-to-speech functionality can help minimize the demands posed by printed text and can enable the student to participate more effectively in the learning environment.

Separating goals from means is important for students who use AEM

While there are many opportunities to address working memory demands in the classroom, educators have the most leverage in lesson planning: demands are easiest to deal with *by design* and difficult to address on an *ad hoc* basis during instructional periods. As most educators know, lesson plans begin with a learning goal. In terms of addressing working memory demands, a clear goal is essential as a starting point because without it, educators cannot differentiate relevant from irrelevant demands.

A second leverage point for educators (once a learning goal has been clarified) is to separate the goal and the means of achieving that goal whenever possible. Of course, there are times when pairing a goal and its means is intentional (e.g., wanting students to show their understanding by writing a paper in the format of a scientific publication). However, often it is unintentional (e.g., wanting students to understand the factors precipitating the Civil War, but requiring students with print-based disabilities to struggle through a printed textbook rather than having access to the content in an alternate format such as digital text). In this example, constraining the means of comprehension to decoding is problematic in that it is not part of the learning goal and therefore adds irrelevant demands that make it difficult for students with print-based disabilities acquire the information that is necessary to achieve the lesson goal.

(3) Control

Another recent advancement from the learning sciences is a better understanding of the ways in which students' perception of *control* influences how well they learn in classrooms (Stipek, 2002). From a learning sciences perspective, control is about the fact that volition depends on having choices, and, importantly, about learning how to make good choices given one's goals (Ames, 1992).

It is important to provide student users of AEM with choices so they can develop an internal sense of control

For students who use AEM, a mistake is often made in thinking that by addressing the main barrier—inaccessible materials—the problem has been solved. If a student is always offered only one choice (e.g., a screen reader), or only one way to use that choice, then the student would recognize control as residing in the technology and not himself/herself. Therefore, the starting point for promoting a greater internal locus of control in students who use AEM is to make sure, whenever possible, to provide choices with regard to how technologies and media are used. In order for choices to generate a sense of control, students need to be aware that choices are available to them and receive support for developing strategies for making appropriate choices.

Not allowing choice takes away students' perception of control. This is not surprising—most of us at some point have had a frustrating educational experience; even something as simple as watching a video online that provides no indication of how long it is can be frustrating. Frustration or a sense of lack of control can easily arise for a student using AEM when s/he is given only one option for reading, set up in one way, at one speed. Clearly, that is better than nothing, but it is far from an ideal situation for developing a sense of internal control.

It is important to give student users of AEM the opportunity to learn how to use various options

Simply having choices does not necessarily translate into control for a student. In order to develop an internal sense of control, students need to be taught about options available, but they also need the chance to learn how to use them in the service of their own learning and to do so in a way that gives them a chance to experience success—success they can clearly attribute to their own volition (Ames, 1992). In other words, aside from teaching students basic affordances of their AEM-related materials and tools and the ways in which they can be used, teachers can have a big impact by creating a classroom culture that is conducive to trying and failing. This kind of environment is particularly beneficial for students using AEM because it can allow them to develop a sense of confidence in their own choices regarding the use of AEM.

(4) Context

In recent years, there has been a realization that learner variability is the rule and not the exception (e.g., Rose & Fischer, 2009; van Geert, 1998). Research has found that the “best” approach to learning for a student is situational: it changes in response to factors such as development, information that has already been presented in that particular modality, level of background knowledge, and information to be learned (Fischer & Bidell, 2006).

Student use of AEM varies by context

The role of *context* in determining the best way to learn has important implications for teaching students via AEM. Take, for example, the issue of reading comprehension for a student with impaired vision. There are several options available (e.g., having the words read aloud or reading via braille). Both options are viable, and most teachers would recognize that a student might do better using braille for some purposes and text-to-speech for others. As with any other student, the “best” way to read for a visually impaired student is more situational than might be assumed. Sometimes braille is best, sometimes having text read aloud is best, and sometimes both together are best. It would be a mistake to think that it is only a matter of teaching a student to read braille or providing them with AEM to read text aloud. Providing these students with the same options as other students and providing ways for them to learn what works best for them personally and under different conditions creates the best opportunity to help students reach their full potential.

(5) Challenge

One potential misunderstanding arising from the science of learning is that approaches that deal directly with student variability do so by making things easier for students. Making things easy, however, does not facilitate learning. In fact, it is the opposite. Research suggests that things that are not challenging to learn are often less likely to be transformed to memories and that having to work to understand helps facilitate the kind of robust memories that are the foundation for deep learning (e.g., Bjork, 1994; Bjork, 1999).

Providing AEM is not a substitute for high-quality and challenging reading instruction

The provision of AEM has the potential to increase challenge by minimizing the demands of traditional learning environments, which often have an over-reliance on print materials. The goal is not to water down the curriculum for students with print-related disabilities but, rather, to provide these students with access to higher-level, more challenging content. Similarly, it is important to point out that providing students with AEM should not replace high-quality reading instruction. These two tasks are not mutually exclusive. Students can be provided appropriate AEM that supports their learning of higher-level content while also being taught to read. To deny students with print-related disabilities the opportunity to learn to read under the guise of AEM would violate their rights under disability civil rights law.

Student users of AEM need relevant learning challenges

There are many ways to make things challenging, but it is critical to emphasize that it is not simply the act of making learning challenging that improves learning—what matters is the right *kind* of challenge. Increasing demands in a learning environment is not by itself usually enough to facilitate learning. Proper challenge requires that a student have a reason to persist with the experience. This usually means a learning challenge must be *relevant* to a student. This makes intuitive sense—students are willing to work harder to understand things they want to know.

Conclusion

Modern learning sciences, with a focus on variability and on interactions between students and their learning environments, have radically changed thinking about learning and, in doing so, have opened up unique opportunities for closer coordination between the use of AEM and the learning sciences. In this paper, the focus has been on five high-leverage insights from the learning sciences—purpose, demand, control, challenge, and context—that represent fruitful starting points for this important work. Taken together, these ideas, along with existing gains made by the increased use of AEM, will help educators move beyond access to content toward access to learning for all students.

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Note Regarding the Use of AIM and AEM

AIM [emphasis on INSTRUCTIONAL] is defined under IDEA, section 612(a)(23) and pertains to print sourced textbooks, core related instructional materials and accessible materials that are produced from those sources. SEAs/LEAs are required to comply with provisions related AIM.

The term AEM [emphasis on EDUCATIONAL] as authorized under 34 CFR 75.105(b)(2)(v) and sections 674 and 681(d) of the IDEA (20 U.S.C. 1400 et seq.) means print- and technology-based educational materials, including printed and electronic textbooks and related core materials that are required by SEAs and LEAs for use by all students, produced or rendered in accessible media, written and published primarily for use in early learning programs, elementary, or secondary schools to support teaching and learning. AEM also includes the technologies used to deliver educational materials and activities.