Assistive Technology and Computer-based Assessment for Students with Significant Cognitive Disabilities

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Author Note

The present publication was developed under grant 84.373X100001 from the U.S. Department of Education, Office of Special Education Programs. The views expressed herein are solely those of the author(s), and no official endorsement by the U.S. Department should be inferred.

Abstract

The Dynamic Learning Maps™ (DLM®) alternate assessment is an on-line, computer based, assessment for students with the most significant cognitive disabilities who participate in alternate assessment based on alternate achievement standards. This population of students presents with myriad communication, physical, and/or sensory impairments that have historically limited access to most standardized assessments. The DLM consortium is taking multiple steps to address the myriad needs of this population of students including applying principles of Universal Design for Assessment, while creating a system that can interface with a broad range of Assistive Technologies (AT). In order to determine the specific AT needs of the population of students with significant cognitive disabilities, the DLM consortium conducted a large-scale survey of approximately 50,000 students with significant cognitive disabilities. The results of the survey suggest that the majority of the students have access to computers and that a variety of AT is being used. However, it is unclear whether or not all students who may benefit from AT, have access to it.

Keywords: assistive technology, alternate assessment, computer-based assessment, significant cognitive disabilities

Assistive Technology and Computer-based Assessment for Students with Significant Cognitive Disabilities

The Dynamic Learning Maps™ Alternate Assessment System Consortium (DLM®) is one of the six consortia working to develop computer based assessment systems aligned with college and career readiness standards (CCRS). DLM was specifically funded to develop an alternate assessment system based on alternate achievement standards for students with the most significant cognitive disabilities. Students with the most significant cognitive disabilities, who comprise roughly 1% of the school-aged population, are unable to take general assessments, even with modifications and accommodations. Students with the most significant cognitive disabilities require extensive, repeated, individualized instruction and support, as well as, substantially adapted and modified materials and individualized methods of accessing information to acquire, maintain, generalize, demonstrate and transfer skills across settings.

One major step DLM has taken to address the needs of students with the most significant cognitive disabilities is to apply principles of Universal Design for Assessment (UDA) in the development of the assessment system. This work includes building a wide variety of accessibility features and tools into the software. For example, text-to-speech and magnification have been integrated throughout, while white space has been maximized on each screen, and all graphic elements have alt text tags. In addition to building UDA into the assessment software, DLM has worked to ensure that the software has maximum interoperability with assistive technology (AT) devices that support computer access.

DLM determined which UDA features and AT devices to prioritize by conducting a survey, the First Contact Survey. This survey was distributed across DLM consortium member

states to teachers of students with the most significant cognitive disabilities who participate in alternate assessment based on alternate achievement standards in grades 3-12.

The purpose of this paper is to report the results of the First Contact Survey, including responses regarding student demographics, student computer access, and the types of AT currently used by each student. Further discussion will focus on how this information informed the development of the DLM computer based assessment and how the information can inform future research and development efforts in the areas of assessment and instruction.

Assistive Technology

Assistive Technology (AT) as defined by the Individuals with Disabilities Education Act (2004), consists of "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities." The law also defines AT services as "any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device." AT incorporates a variety of mechanisms intended to accommodate the physical, sensory, cognitive, and linguistic abilities of students with disabilities (Light & Drager, 2007). Examples of AT in the school setting range from simple tools, such as pencil grips and note cards for marking reading passages, to more complex examples, such as mobile phone readers, Braille writers, canes, wheelchairs, and Augmentative and Alternative Communication (AAC) devices and supports (Beukelman & Mirenda, 2005; Soto & Zangari, 2009). Here, the discussion of AT is limited to those technologies and supports that are required for access to computers and communicating understandings as these are the two forms of AT most applicable in a computer-based assessment environment.

Augmentative and Alternative Communication

Many students with the most significant cognitive disabilities have complex communication needs that require the use of AAC to replace or augment speech as their primary means of communication (Beukelman & Mirenda, 2005; Light & Drager, 2007; Soto & Zangari, 2009). These means of augmenting or replacing speech include aided systems such as speech-generating devices, low-tech communication boards and symbols, objects, and unaided systems such as American Sign Language and Signing Exact English (Beukelman & Mirenda, 2005; Light & Drager, 2007). AAC can enhance face-to-face communication while supporting language development and educational access for students with complex communication needs (Beukelman & Mirenda, 2005; Light & Drager, 2007; Soto & Zangari, 2009).

The First Contact Survey queried teachers regarding the communication skills and AAC use of students with the most significant cognitive disabilities. The survey began by asking teachers to indicate if students used speech, sign, and/or symbols to communicate. Then it queried the ways that students use each of those means of communication including the characteristics of AAC technologies and supports when applicable. This led to a distinction between students with and without symbolic communication as well as details regarding the level of symbolic communication for each child. This information is critical to the development of an assessment for students with significant cognitive disabilities because many do not understand that a word, symbol, or picture represents a concept (Rowland & Fried-Oken, 2010). As a result, assessment items must be developed that allow teachers to observe non-symbolic responses for these students. Furthermore, information regarding sign and symbol use informs the need to incorporate appropriate accessibility features into the assessment. However, specific information regarding the types of AAC devices students use are not reported here because

students will not use AAC devices to access the DLM assessment system except, when possible, to access the internet using a browser separate from their communication software.

Method

A web-based survey was developed using Qualtrics (2013) online survey software and distributed to teachers of students with the most significant cognitive disabilities who participate in alternate assessment based on alternate achievement standards in 14 member states in the DLM consortia: Iowa, Kansas, Michigan, Mississippi, Missouri, New Jersey, North Carolina, Oklahoma, Utah, Vermont, Virginia, Washington, West Virginia, and Wisconsin. The survey was developed in consultation with content experts and DLM state partners. It contained 56 items that addressed teacher and student demographics, as well as student sensory needs and aids, mobility and mobility needs, computer access, assistive technology, level of communication, health, and personal issues. The survey also addresses student attention, language, reading, writing, and mathematic skills and included a section for open-ended comments. The survey was completed for each student who was slated to or had already participated in an alternate assessment with alternate achievement standards in each state. The survey used skip logic, so teachers did not answer all 56 questions, but only answered questions that were pertinent to their students. In this paper, the focus is the items that dealt with the need for and use of AT.

The survey was distributed via state level members of the DLM consortium to all educators with students who were slated to or had already participated in an alternate assessment with alternate achievement standards in their state. Approximately 50,000 surveys were returned. Not all educators completed the entire survey and the skip logic led to different numbers of

responses for each item. As such, the total number of responses for each item included in each analysis is reported below.

The analysis that follows was conducted to address one primary research question: what types of assistive technologies are students with significant cognitive disabilities using?

Student Demographics

As reported in Table 1, the majority of the students are male (n=28,835; 64.6%) and White (n= 29,371; 58.5%). All students are in third through twelfth grades. Cumulatively the majority of the students are in third to eighth grade, with a smaller portion being in ninth to twelfth grades. Grade levels are reported as uncertain for about 1% of the students. Table 2 describes the grade distribution.

<Insert Table 1>

<Insert Table 2>

Educators were asked to report the primary category of disability for each student. The majority of the students are diagnosed with Intellectual Disability (n= 19,571; 43.8%), which is not surprising given that students who participate in an alternate assessment based on alternate achievement standards must have a significant cognitive disability. Table 3 reports the primary category of disability for each student as reported by educators.

<Insert Table 3>

As reported in Table 4, the majority of the students are educated primarily in separate classroom settings (n=29,844; 66.9 %) spending less than 40% of the time in the general education classroom. An additional 16.6 % (n=7,425) spend 60-80% of the time in the general education classroom. Only 3.7% (n=1,635) of the students spend at least 80% of the time in the general education classroom.

<Insert Table 4>

Finally, educators were asked to report on student communication modes. Table 5 reports the distribution of students who use speech, signs, or symbols to communicate.

<Insert Table 5>

Results

The DLM Alternate Assessment will be delivered via computer. Therefore, knowing that 89.4% (n=44,588) of the students whose teachers completed the survey have regular access to computers is important. However, it is equally important to understand how they access the computer and why slightly more than 10% do not have regular access.

Computer Access and AT

Students who can independently access a computer are not a major concern in trying to develop a computer-based assessment; however, the needs of students who require support from a human or some form of AT are a particular concern if computer-delivery is going to be a viable option. Of the students reported to have access to a computer, 56.3% (n=25,012) are able to access a computer independently. Another 40.3% (n=17,889) of the students use a computer with support from another human or some form of AT, while 3.5% (n=1,538) of the students do not use a computer even though one is available. Of those students who do not use the computer; 1.7% (n=851) have disabilities which prevented them from accessing the computer, 0.2 % (n=118) do not have the equipment they need to access a computer at the school, 0.5% (n=267) refuse to use a computer, and 0.6% (n=295) could potentially use a computer but have not received instruction on how to use one.

To ensure that the DLM Alternate Assessment is accessible to the broadest possible range of students with significant cognitive disabilities, the survey queried the forms of AT that students specifically use to access the computer. In addition, information about symbolic communication was querried to determine what symbolic representations could be offered as response options in the DLM alernate assessment system.

In completing this portion of the First Contact Survey, teachers were asked to indicate the types of AT each student uses. They were asked to mark all that apply. Given that students who require AT often use more than one type of AT, only frequency data is reported in table 6.

<insert Table 6>

AT for Students with Visual Impairments and Low Vision

Assistive technology also provides students with sensory impairments with access to the general education curriculum and assessment. A total of 1,566 out of 49,878 students (.03% of the sample) have visual impairments with reported use of AT. The specific types of AT used included: magnifiers (n=602), computer screen magnifiers (n=292), screen magnification software (n=211), screen readers (n=201), and scanners with talking word processors (n=104). Importantly, only 18 students are reported to have the skills to use a refreshable braille display. This is important because refreshable braille is the obvious solution for the delivery of a computer-based, dynamic assessment to students who are blind, but very few (.6% of students with visual impairments in this sample) students were reported to have the skills to use this technology.

Communication

The majority of students in this sample use speech to communicate (68.1%, n=33,811); however, within this group, 29% (n=9835) only use 1 or 2 words at a time for a restricted range of purposes. Most students who do not use expressive speech to communicate use sign language (n= 3,435) and/or symbols (n=8,438) with 78.97% of the sign language users (n=2,703) and 69.3% (n=5,683) of the symbol users regularly using only single signs or symbols for a restricted range of purposes. Despite variations in how these students use speech, signs, or symbols to communicate and interact with others, all of these students have at least some form of symbolic communication to employ when interacting with the computer in the DLM Alternate Assessment. Importantly, 4004 students (8%) were reportedly unable to use speech, signs, or symbols to communicate with others. These students do not have the symbolic skills required to communicate their skills and understandings in a computer-based assessment and will have to be supported by educators to complete the DLM Alternate Assessment.

Discussion

Increasingly, students will be required to use the computer to take mandated assessments (Stone & Davey, 2011). While many students with disabilities demonstrate a preference for computers (Croft, Danson, Dawson, &Ward, 2001), not all students have access to a computer or have the symbolic communication skills to understand the information displayed on the computer. As reported herein, many students with the most significant cognitive disabilities can potentially use computers to demonstrate what they know and can do, as long as the assessment system is built to address their specific access needs. The First Contact Survey suggests that the majority of students with the most significant cognitive disabilities have access to computers, but many require support from others or some form of AT to interact with computers. Identifying

these specific needs of human or AT support was critical to the development of the DLM Alternate Assessment System.

DLM's computer based alternate assessment will enable students to use familiar AT, so they can demonstrate their academic knowledge without struggling to first learn alternate means of access. It also allows students who require human support to indicate responses to a test administrator who will then enter the response for the student. Using information gathered from this survey, DLM developed and incorporated additional profiles, accessibility options, and accommodation features that are defined by educational teams to address individual access needs for students. In this manner, students will be able to access needed assessment accessibility options and accommodation requirements, including interfaces for AT the student already uses in the classroom.

Whether or not students actually have access to the appropriate AT or all of the AT they require was not within the purview of this survey. However, examining the utilization of AT suggests that there may be some areas of underutilization within this sample. For example, in this survey there was a group of students who used speech, but were only able to use 1 or 2 words at time to meet a restricted range of communicative functions. These students may benefit from the use AAC systems and supports to augment their speech and allow them to meet a broader range of communicative purposes. As the expectations for academic performance and college and career readiness increase for all students, improved communication skills must be addressed. The First Contact Survey suggests that increasing access to AAC may be one way to address these skills for a broader range of students. In order for students to develop language, they need a functional communication system, which offers a much broader range of symbolically

represented vocabulary that can be combined and recombined for a variety of purposes (Romski & Sevcik, 2005).

The DLM Alternate Assessment was developed to maximize the accessibility of the interface with many access features available to all users. For example, read-aloud and magnification are accessibility features that are built into the software. As such, students do not need to use additional software to enable these features. At the same time, the results of the First Contact Survey made it clear that the DLM Alternate Assessment system had to work with alternate input devices such as a switch (both single switch automatic scanning and two-switch step scanning are available), alternate keyboards (keystroke equivalents are available for all clickable items on the screen), and eye-gaze technologies. This combination of built in accessibility features and interoperability with the assistive technologies that students use as part of their daily instruction is especially important for students with the most significant cognitive disabilities who often lack the cognitive flexibility to shift from one system to another.

Limitations

The results reported herein are not without limitations. For example, the survey instrument had some limitations. Firstly, although teachers identified specific AT being used by each student, they were not asked how often the AT was used or how well the students used the AT. If AT is going to help students successfully access the DLM Alternate Assessment, students must use the AT in their daily instruction and must learn to use it well. If this is not the case, using AT during the assessment might increase the difficulty of the assessment and prevent students from demonstrating what they know and can do. Future surveys could gauge how often AT is used in instruction and how well the student uses it to interact with academic content on the computer.

Another limitation of the First Contact Survey was the use of skip logic. It was utilized to minimize the time an educator had to spend to complete a survey, but it often resulted in missing information. This is especially true with regards to AT. For example, if the teacher indicated that a student used expressive speech, they did not answer questions regarding sing or symbol use. However, students using only one or two words at a time do not have adequate speech to meet all of their communication needs, and, as a result, may augment their speech with signs or symbols. Whether or not these students with minimal speech used signs or symbols was not queried in the First Contact Survey. Given the importance of signs and symbols as means of augmenting speech, this information would have been important to gather.

Lastly, the categories used to describe a student's primary disability are based on the federal definition of disability categories; however, these categories vary by state. This variance often results in students' primary disability category changing if they move between states, and may result in a change when they move from one school system to another. Future surveys might use the definitions and category labels employed by each state. Furthermore many students also had secondary diagnoses, which were not identified. These secondary disabilities might also impact the types of AT used and could inform ongoing development of the DLM Alternate Assessment system.

Future Research

Continued research on the impact of AT on computer based assessment systems is warranted. Currently, there are efforts to build accessibility features into computer-based assessments, but some students will require AT that cannot be built into the system itself. In the DLM Alternate Assessment students are able to use their current AT to interface with the

assessment system and test administrators are always allowed to enter responses that have been clearly indicated by the student. The impact of all of this is currently under investigation.

Although, AT increases students' access to education, whether or not a student has access to the appropriate AT needs to be considered. If students do not have access to appropriate AT, this may affect their ability to demonstrate what they know and can do in any assessment environment: especially when that environment is computer-based. There are many questions that must still be addressed regarding the systems we employ to provide students with appropriate AT, the ways that we incorporate AT into every day instruction, and the ways that AT allows students to more effectively demonstrate what they know and can do on a computer-based assessment. The First Contact Survey provides critical information that has already been translated into the delivery of the DLM Alternate Assessment system, but it is only a starting place.

Conclusion

For students with significant cognitive disabilities to successfully demonstrate their knowledge on an assessment they need access to appropriate AT. At the same time, assessment systems must be built to work with appropriate AT. The literature base has demonstrated that students can succeed academically when provided with appropriate AT systems and supports (see Calculator, 2009; Millar, Light & S Schlosser, 2006; Zascavage & Keefe, 2004). Still, whether or not the lack of an appropriate AT systems will affect the validity and reliability of computer based assessments, including the one developed by DLM, has yet to be determined.

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