Digital Technology, Learning, and Postsecondary Students with Disabilities: Where We've Been and Where We're Going

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Abstract

This article briefly reviews the history of assistive technologies in American and Canadian postsecondary education starting in the 1990s, discusses the accessibility of e-learning and information and communication technologies (ICTs) currently popular in postsecondary education, and highlights emerging trends. Increasing use of universal design principles - in particular, ensuring the accessibility of digital technologies in the emerging stages, at the inception of development - continues to be recommended.

Keywords: Assistive technologies, postsecondary education, college, university, accessibility, e-learning, information and communication technologies, ICTs, emerging trends

In the Beginning

The 1990s was the first decade when digital technology took off in postsecondary education in Canada and the United States. It was primarily the "early adopters" who used technology such as course or learning management systems. PowerPoint was the popular in-class tool used by instructors. It was also during this time that instructors began turning to the Web and email as part of their e-learning approach. A positive byproduct of this was that students began submitting assignments in electronic format instead of in hard copy, making evaluating and grading easier for all faculty, including those with disabilities. This was especially true for faculty with disabilities requiring assistive technology to access print material because they were now dealing with assignments in digital copy that could be accessed using screen reading software, for example. This was also the first decade that issues concerning the technological needs of postsecondary students with disabilities started being addressed in a systematic way. Early research at the Trace Research and Development Center, a pioneer in the field of technology and people with disabilities, was focused mainly on individuals with visual impairments (Vanderheiden, Boyd, Mendenhall, & Ford, 1991), while early educational research was focused mainly on the technology related needs of students with learning disabilities (Raskind & Higgins, 1995). For the most part, this left students with all other disabilities/ impairments to advocate for themselves.

Assistive technologies. There were several important developments in the early 1990s. One was Sheryl Burgstahler's seminal doctoral thesis (1992), which dealt with a study of assistive technology and

technology-related services for postsecondary students, and her founding of DO-IT (Disabilities, Opportunities, Internetworking, and Technology). This is an enormously influential organization hosted by the University of Washington that has, since the mid-1990s, produced free publications and videos intended to increase the success of students with disabilities. Another key development was the growth of EASI (Equal Access to Software and Information) under the chairmanship of Norm Coombs. EASI, an early advocate of the use of accessible technology in higher education, provides free and fee-based online courses on topics related to information and communication technologies (ICTs) and accessibility directed at faculty and postsecondary staff. Yet another development was the expanded impact of CSUN (California State University, Northridge -International Technology and Persons with Disabilities Conference), whose dedicated stream on postsecondary education and technology found a worldwide audience. Finally, it was also during this period that the Adaptech Research Network was founded. Its primary focus since its inception in 1996 has been on conducting empirical research into the use and accessibility of technology by postsecondary students with disabilities.

Toward the end of the 1990s there was much concern and discussion about the accessibility of mainstream e-learning technologies and the availability of assistive technologies in postsecondary education. The annual Accessing Higher Ground Conference, for example, was started in 1997, with a focus on these issues. It was also in the late 1990s that the High Tech Center Training Unit of the California Community Colleges (1999) produced an influential and cutting-edge document on accessibility of e-learning technologies in distance education. This document, almost immediately after its publication, became the premier resource on how to make online postsecondary education accessible to all students.

Empirical research. Because there was virtually no empirical research in the 1990s on what technologies postsecondary students with different disabilities/impairments used, the Adaptech Research Network conducted its first study of how almost 800 Canadian college and university students with various disabilities accessed specialized (e.g., software that enlarges what is on the screen) and general-use technology (Fichten, et al., 1999, 2000). What this research found was that virtually all students with disabilities used some form of technology to facilitate their learning and that a key obstacle to doing so was high cost and poor compatibility among different types of technology products.

During this time, campus offices providing disability-related accommodations to students were typically staffed by counselors, social workers, and nurses who were not very knowledgeable about either specialized (e.g., Braille printers, voice recognition software) or general-use technology (Fichten, Asuncion, Barile, Fossey, & Robillard, 2001). While there were many similarities between views of students and campus disability service providers, the discrepancy in perspectives resulted in different technology-related accessibility related priorities for the two groups.

Blurring between assistive and general use ICTs.[1] In a study that is now fifteen years old, close to 800 postsecondary students with disabilities were asked what computer and/or adaptive computer technologies they considered could be useful in getting their academic work done (Fichten et al., 2000). In rank order, the top 10 for students with all types of disabilities combined was: spelling/grammar checker, scanner, portable note-taking device, dictation software, alternate format materials (e.g., books, hand-outs), specialized software for learning disabilities (e.g., word prediction), voice control software (voice commands like "file," "open"), a large screen monitor, text-to-speech software (reads what is on the screen), and mouse adaptations.

The results highlighted that what are generally considered mainstream ICTs were, in fact, used as assistive technologies by students with certain disabilities. For example, the ubiquitous spell checker was used by students with learning disabilities as assistive technology to help compensate for the disability. Dictation (speech-to-text/voice recognition) software, originally intended for professionals and executives, was used as assistive technology by students with a variety of hand/arm impairments and some types of learning disabilities. Text-to-speech screen reading technologies, originally used by people with visual impairments, have crossed over into the mainstream. The same is true for scanners and optical character recognition software, which are used as adaptive technologies by students with visual and other print impairments. Nevertheless, some technologies have remained disability specific: Braille printers and head and foot mice are examples.

Thus, there appear to be three categories of technologies used by students with disabilities: general use ICTs (e.g., word processing), assistive computer technologies (e.g., Braille printer), and those that are "adaptable" (e.g., dictation and screen reading software).

1 This section is heavily adapted from Fichten et al. (2000)

Turn of the Century to Date

Specialized assistive technology. In the 2000s, the medical model began losing ground. In this framework the emphasis was on managing the student's disability and on providing accommodations, including assistive technologies, for each student based on diagnosis and needs (National Educational Association of Disabled Students, 2012). The social model of disability, where the focus is on making changes to the environment to be more accommodating to all people (McGuire, 2011), has been gaining strength in Canadian and American postsecondary education (Thornton, & Downs, 2010). This includes the migration of universal design concepts, which include responding to the diversity of users from the outset, from the realm of products and buildings (Connell, et al., 1995; Vanderheiden, 1993) to e-learning and postsecondary education (McGuire, Scott, & Shaw, 2003).

Another key development was enforcement of the "Section 508" legislation which, while not specifically relevant to postsecondary education per se, became a point of reference, requiring U.S. federal government agencies to acquire or develop only accessible ICTs (http://www.section508.gov/). It made no sense for mainstream software and hardware developers to produce two versions – an accessible version for the government and an inaccessible version for everyone else. So all benefitted.

A key finding of a recent Adaptech Research Network study is that mainstream information technology (IT) specialists on campus knew very little about the technological needs of students with disabilities, underscoring the need for both access technologists and some level of training on accessibility to front-line IT staff (Fichten, et al., 2009). Subsequent research also showed that while many students' access needs are being reasonably well met, there is one key exception – training on how to use needed specialized/assistive technologies (e.g., screen reading software) (Fichten, et al., 2012). Typically, training is one of the responsibilities taken on or given to those whose role involves supporting access technology on college and university campuses. It was also during the 2000s that ATHEN (Access Technology Higher Education Network [www.athenpro.org]), along with the IT Accessibility Constituent Group of EDUCAUSE (2014) came into being, further raising the profile of those who support technology accessibility in higher education.

In all investigations carried out by the Adaptech Research Network, students noted the high cost of specialized assistive technologies (e.g., screen reading software, specialized multipurpose software for students with learning disabilities). Students also shared low-cost alternatives. This would result in the compilation, starting in 1999, of a listing of free and/or inexpensive hardware and software alternatives that might be useful for students with diverse disabilities (see www.adaptech.org/downloads). This listing continues to grow, including the addition of Windows and Mac products, as well as Apple and Android apps (Adaptech Research Network, 2014). The listing is in no way meant to replace high-end assistive technologies. Rather, the software compiled there is meant to fill the gaps caused by cost and complexity of what is currently available for students with disabilities. Today, and for the last number of years, Apple's smartphones and tablets "out-of-the-box" come bundled with built-in accessibility support for people with different disabilities. Given the role of mobile technologies in current and future e-learning, the accessibility, usability, and affordability of mobile devices and apps is an exciting development.

E-learning. Most instructors use some form of e-learning in their courses (Schmid, et al., 2014). This includes PowerPoint and Prezi, podcasts, videos, clickers (hand-held hardware or mobile device to respond to multiple choice questions in class, which are then tallied in real time), simulations, blogs, digital textbooks, and Web conferencing (Tarawneh, Tarawneh, & Alzboun, 2011). However, unless the course is held in a computer lab, many students with disabilities cannot use needed specialized technologies (e.g., screen reading software, an adapted mouse) to access these. Students can experience difficulties even in classrooms equipped with a computer for each student (or, more recently, a tablet) because the specialized hardware/software they need is located on computers in specialized adaptive technology labs, rather than in the locations where students need these. Although site licenses are usually available, it is only when specialized technologies began being available on USB flash drives that some students were able to take their technologies to class. Wi-Fi, portable, and mobile computing have also been helpful, but only if instructors upload their teaching materials in accessible formats and allow students to access these on their own devices.

Faculty often make online materials available on a course web site or a course/learning management system that allows students to interact with learning materials outside of the classroom (Lombardi, Murray, & Gerdes, 2011). Although online content can be inaccessible (e.g., no captioning of videos, PDF image files), it is material used "on-the-fly" inside the classroom that can pose the most serious access challenges. For example, if the professor uses a video clip in class, this may not be available to the student who requires

video description or subtitles. Or if he or she uses a simulation or digital polling in class, students may not be able to download the results onto their devices to make it accessible. It is important to remember that just because it is digital does not mean that it is usable or accessible to all (Berkowitz, 2008).

College libraries with paper journals are quickly becoming extinct as libraries increasingly move toward digital journals and e-books that can be read online or downloaded and borrowed for the usual number of days. These are often in locked Adobe PDF (DRM) or epub formats. The accessibility of these e-books varies. This trend notwithstanding, unless or until paper-based publications disappear completely from library shelves, colleges and universities must continue seeking ways to address the need for timely access to print material. This was recently demonstrated by the 2013 settlement agreement involving UC Berkeley's library (Schwartz, 2013), which underscored that this need is still very much a reality. Fortunately, technology exists to convert most print material into electronic formats.

"Active learning" has also become popular (Lasry, Dugdale, & Charles, 2014). This can include interactive white boards (e.g., SMART board) and study pods where students teach each other. A challenge when it comes to interactive white boards is how to make both the content and the ability to use them accessible to students with visual or hearing impairments and to students with attention deficit issues who have difficulty in noisy "team" environments and can get lost in the multiplicity of activities. Nevertheless, efforts are ongoing to make active learning accessible (e.g., Illinois State University Media Relations, 2012; Summers & Brauner, 2012).

While some of the larger companies that support and promote e-learning in higher education, such as Desire2Learn and Blackboard, as well as open source organizations, such as Moodle, have been putting efforts toward making their learning platforms accessible, much work still remains. WebAIM's Cyndi Rowland (2012) highlights legal action taken against a number of U.S. colleges and universities between 2009 and 2012 concerning the inaccessibility of their learning technology. Likely as a reaction to such complaints, the United States Departments of Education and Justice jointly issued a "Dear Colleague Letter" in 2010 to presidents of colleges and universities expressing concern over the use of emerging technologies, specifically electronic book readers that are inaccessible to students who are blind or have low vision (U.S. Department of Justice and U.S. Department of Education, 2010). This was followed by a supplement that provided guidance on the use of emerging technology and institutions' obligations to students with a broad range of disabilities (U.S. Department of Education 2011).

In 2014, universal design is a mainstream concept championed by offices that provide disability-related supports on campus (Burgstahler, 2008; CAST, 2011). Universal design concepts are starting to emerge – although slowly – out of the disability arena (Davies, Schelly, & Spooner, 2013). For example, text-to-speech software has excellent potential for proofreading papers (Greenbaum, 2014). Captioned videos are helpful to all students to help with spelling of technical terms or unfamiliar names or words. The use of universal design in e-learning, however, is usually more by happenstance than intention (e.g., PowerPoint and course notes on web sites are available to all, but can be considered an access accommodation for students with certain disabilities/impairments). Social media are also increasingly used in academe (Selwyn, 2012). How accessible these are to students with different disabilities varies (Asuncion, et al., 2012). For example, YouTube captioning is still not as widely used as it can be and Google Drive documents can pose access challenges for students who are blind who are using older versions of screen readers.

The largest proportion of postsecondary students own a smartphone or a tablet (Johnson, et al., 2013). For example, two years ago 74% of students at one university owned a smartphone and 30% a tablet (Hanley, 2013). These have different levels of built-in features meant to provide access to people with disabilities. There is also the growing number of free or inexpensive software solutions available to support persons with disabilities (Adaptech Research Network, 2014). These developments, along with the trend toward universal design, hold promise for meeting the future technology and e-learning accessibility needs of students with diverse disabilities.

Future Trends In E-Learning and Accessibility

Many of the current approaches to e-learning will continue into the next decade. This includes the use of tablets and other mobile technologies, digital textbooks, and active learning applications as well as the use of videos, clickers, etc. There are also many relatively new exciting technologies and approaches on the horizon that need consideration.

Mobile learning (M-learning) and cloud computing. The traditional model of using software installed on one computer is rapidly changing with the advent of cloud computing and "apps." These allow the use of software "in the cloud" (essentially a metaphor for the Internet) anywhere, anytime, so long as the student has Internet access. A good example is Google Drive

(http://drive.google.com), which allows use of a Microsoft Office-like suite in a totally online environment. No need to install software. Mobile devices, including laptops, will benefit from this new trend.

Due to the Web's high penetration in Canada and the United States, mobile devices are a natural platform for Web-based e-learning. M-learning devices include laptops, notebooks, smartphones and tablets. M-learning allows sharing learning content in social networks, such as Facebook and Twitter. The ability to share content in many different platforms and social networks make portable devices a very powerful e-learning platform. The concern for students with disabilities with M-learning relates to the accessibility of the course/learning management systems used to deliver the learning materials as well as the accessibility of the software, of social media networks, and the learning materials themselves. Nevertheless, M-learning allows students to replace printed materials with digital content delivered on students' own portable devices that are, presumably, accessible to them.

MOOCs (Massive Open Online Courses). MOOCs are online courses aimed to reach a great number (usually thousands) of students via the web. Most are free courses provided by either individual universities or a consortium of universities (e.g. eDX, a MOOC consortium created by MIT and Harvard, http://www.edx.org). There are also private MOOC providers, such as Coursera (http://www.coursera.com) and Udacity (http://www.udacity.com). MOOCs are generally non-credit, although some offer a certificate upon successful completion of the course. An issue with MOOCs is low completion rate, reportedly as low as 5% to 7% (Lewis, 2014; Parr, 2013).

At the time this article is being written, conversation around accessibility of MOOCs is nascent. According to Butler (2012), "The responsibility to ensure MOOC content is accessible will likely be divided between the platform providers and the partner institutions." Not an auspicious state of affairs.

Gamification of learning materials. "Gamification is an informal umbrella term for the use of video game elements in non-gaming systems to improve user experience… and user engagement" (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). A good example is Duolingo (http://www.duolingo.com), an online collaboration website for language learning. Real examples from the Web are used. The best translations for each sentence are shared and other students can give their feedback. Several colleges are exploring using gamification in education (e.g., Schaffhauser, 2014).

How accessible will gamified courses be? A good question. Given how new the approach is, universal design, whereby designers incorporate accessibility from the beginning, has terrific potential.

Wearable technologies. Wearable devices are clothing and accessories that incorporate information and communication technologies. The purpose is to create constant, portable, and mainly hands-free digital access (Wearable Devices, 2014). An example of wearable technologies that could benefit people with disabilities includes smartwatches. Another example is Google Glass (http://www.google.com/glass/start). This eyeglass-like wearable computer displays information in a smartphone-like hands-free format and allows wearers to communicate with the Internet using voice commands (Newman, 2012). While Google Glass already has several features that will benefit people with disabilities, these are still limited. Its hands-free form and voice-activated command features establish a solid step in the right direction for an accessible device. Google Glass already incorporates elements of eye control (wink to take photos) and it detects head movements. Google Glass could, in the future, be useful for people with limited or no motor control because of apps using voice commands (Ehrenkranz, 2014) as well as those with low vision due to the use of navigation and other apps (Consumer Reports Staff Writers, 2014). In the future, it could possibly deliver captioning to Deaf users and facial and object recognition to users with visual impairments.

Digital textbooks. Digital textbooks (e-textbooks or e-texts) often serve as the main text for a class, be it traditional or online. The biggest advantage of these is their convenience, as many can be used with multiple portable devices such as laptops, notebooks, tablets, e-readers (dedicated devices for text reading) and smartphones. Other advantages include cost. In addition, if these are not simply electronic versions of the paper product, digital textbooks can provide more up-to-date material than paper books, which can take a year or two to get to print.

How digital textbooks are prepared and presented to students determines their accessibility and usability. Epub books are mostly accessible (Kirkpatrick, 2010). However, academic book publishers tend to use their own proprietary formats. Although most of these have at least limited accessibility to students with print and motor impairments, there are important issues related to usability. The biggest concerns include eye strain, cost, and programmed expiration (the digital book expires and becomes unavailable after a pre-defined period of time) (Mann, 2013). A recent survey shows that students without disabilities still prefer paper to digital textbooks (J. Andrews, personal communication, 2014), although once students have experience

with digital textbooks, research shows that they are more likely to use these in the future (Dennis, 2011; Weisberg, 2011).

YouTube as a learning platform. YouTube is a free video-sharing website. Here, users can upload and view mainly brief videos. In recent years it has become a useful e-learning tool, as instructors can create playlists with selected videos on a specific topic and share it with their students. Indeed, according to Google, "Training, certificate, and program-related videos took the lead with 49% growth, and vocational and trade school videos grew by 35%" (Campus Technology, 2014). In addition, students can search YouTube for concepts they did not understand in class. Creatively, YouTube has spawned new genres of video instruction, including Khan Academy, RSA animations, and TED Talks (Clark, 2013).

YouTube videos can be especially helpful to visual learners, including students with learning disabilities. That said, there are issues related to hearing and visual impairments. Students with visual impairments are likely to miss visual elements of the video in the absence of described audio, while those with hearing impairments miss the verbal content. YouTube has a captioning tool, making it relatively easy to add subtitles to the uploaded videos. However, automatic captioning could pose difficulties, as pointed out earlier, and additional time may be required to clean up the text for accuracy. There are also third-party tools to create subtitles (e.g., Subtitle Workshops, http://subworkshop.sourceforge.net). For now, most YouTube videos are neither video described nor captioned. Maybe in the next decade…

Note taking. Assistive technology is available to facilitate note taking for students with disabilities. As important as it is to teach students keyboarding skills to use computers, it is equally important to teach the skills needed to take notes on laptops, tablets and smartphones. For example, a variety of digital pens (TopTenReviews, 2014) can be used to handwrite notes to upload to a computer. Some can also synchronize this with audio from a lecture. Tapping the audio-enabled digital pen anywhere on text written with the pen plays back the audio recorded while the text was being written. Some of these pens can be used with mobile devices; some with paper only (Livescribe, n.d.). An iPad app that costs under $3.00 (Notability) will simply record all activity – be it writing or typing – on the tablet and synchronize it with speech that it also records (Ginger Labs, 2014).

Audio notes can also be taken using the built-in functionality of smartphones and tablets, without the need for a separate recorder. While offices for students with disabilities often require students to sign a form to assure the confidentiality of the lecture, many students without disabilities simply use their portable devices to record both audio and video.

Another form of note taking – and paper writing as well - involves dictation software, both on a regular computer as well as on a mobile device. Using voice recognition software can render these notes into e-text that can be inserted into email or a Word document, for example. Although accuracy is not perfect, it has much improved over the past 20 years and it is expected that accuracy will continue improving, making this a useful productivity tool.

On a related note, the idea that the professor can use voice recognition during a lecture where video, audio, and text are simultaneously recorded and uploaded to a large screen as the professor is speaking has been around for 20 years (Liberated Learning Consortium [http://liberatedlearning.com]). A variety of problems have made this universal design endeavor not yet viable, although it has possibilities for being inclusive of many different types of students, including those with hearing impairments. In such efforts, consideration should be given to developing translation software from English to American Sign Language, so that the professor's lecture is available, in real time, to students who use sign language. Of course, problems encountered with voice recognition and captioned lectures would likely be exacerbated in this context.

Many universities and colleges already provide lecture recording, especially in large classes, including video as well as audio capture, which is stored on the course web site. This, too, illustrates universal design principles and allows students to review material covered in class at their own pace. We suggest that, in the future, such recording be made widely available and that these be enriched with captioning and with automatic generation of sign language animations. We also believe that technology that allows students to view – and save – material presented by the professor in class on a multimedia projector or on an interactive whiteboard, on their own computer or mobile device via Bluetooth, Wi-Fi, or other similar technology, should be made widely available.

Open educational resources are freely available. Openly licensed software documents and media are useful for teaching and learning. These provide an alternate educational paradigm (Kauppinen, 2013). For example, if students are interested in learning about aeronautical engineering from a professor at MIT, they can check out lecture notes and videos from MIT courses (http://ocw.mit.edu/courses). On the website creation side, many web content creation tools (e.g.,

WordPress, Drupal, Joomla) can be used to produce websites for free. The same is true of content and learning management systems, such as Moodle. Open source software makes it simpler to make modifications to be compliant to accessibility standards, as the source code is open and can be modified by any programmer, so long as he or she is aware of relevant accessibility guidelines. Communities of practice comprised of volunteers with expertise are available to help with accessibility issues. But there are no guarantees!

Future Trends in Technology Useful to Students with Disabilities

As we mentioned earlier, built-in features in smartphones and tablets, along with a range of free or inexpensive software solutions, are important and are expected to continue to evolve. YouTube and Vimeo continue to mature their captioning solutions. 3D printing (three dimensional printing) is on the horizon in higher education (Johnson, et al., 2013) and may have potential for producing tactile objects especially useful for students with visual impairments. Finally, work to overhaul the Americans with Disabilities Act ([ADA]; Center for an Accessible Soceity, n.d.) to more explicitly include the Internet will have a significant impact on technology, accessibility and postsecondary students with disabilities.

A trend worth watching is personalizing accessibility via the cloud. Here, the idea is that students with disabilities would gain the ability to use technology, such as a library terminal, that is able to provide accessible features personalized to their individualized needs without having to worry about the availability of specific assistive technologies. Instead, individuals need only carry a card or to log in, and whatever adaptation they might need would become available. The Global Public Inclusive Infrastructure is leading this effort (RtF Consortium, 2011), which holds potential for making technology in postsecondary education more accessible.

Conclusion

We expect that technology in higher education will evolve and increase in its use faster than in years past. What can be done?

1. Include the voice of students with disabilities and campus disability service providers at any table where discussion of new and emerging technology adoption is discussed on campus. These conversations are actively taking place on many campuses. Inviting oneself to such meetings may be necessary. This may be the only opportunity to ask the sometimes tough questions as to how students with disabilities will benefit from - and have access to - what the institution deems to be "the latest and greatest" piece of new technology and to get firm commitments that accessibility will be a requirement.
2. Train faculty how to use technology in an accessible way in their teaching. Since it is impossible to know if a student with a disability might take any particular course, such training should anticipate and assume this reality. An example related to online learning, which provides quality control checks, is described by Bastedo, Sugar, Swenson, and Vargas (2013).
3. Educate on universal design principles and provide ongoing support with a view to adopting these. Workshops on pedagogical practices should include offerings on universal design – and not only for providing accessibility for students with disabilities. Given the diversity of Canadian and American postsecondary student populations, this will benefit all students, including those with disabilities.
4. Require vendors to demonstrate (i.e., "show me how") that their products are accessible - or not - to users with disabilities. A "Voluntary Product Accessibility Template" or other written documentation alone should not be deemed sufficient evidence. In addition, if the institution decides to go forward with the purchase of an inaccessible product, it should require, contractually, that vendors provide a reasonable timeframe (agreed on by both parties) for when an accessible version of a product will be available. Meanwhile, colleges and universities should press vendors to provide accessible alternatives to address accessibility gaps in their products while these are being addressed. Organizations such as The Association on Higher Education And Disability (AHEAD) could take the lead by creating a living resource of vendors' learning technology products that institutions could comment upon based on their experiences. It goes without saying that the same level of rigor and expectation of accessibility should be applied to anything internally developed for student use.
5. Affirm the college or university's commitment to digital inclusion by assuring language that explicitly describes this commitment and how

it will be executed is included in procurement and other campus policies that govern the use of technology in teaching and learning. Without such language in written policy, those who are advocating for equal access to technology on campus have nothing to reference and leverage, especially in situations where there might be internal or external push back.

6. Deliver training on the use of frequently used assistive technology to help desk and other IT staff who interact with the student body and provide them with awareness training on accessibility. By doing this, day-to-day technical trouble-shooting can shift from the access technologists and offices providing disability-related services to the mainstream help desk. This would, hopefully, free up time that could be better used to train students.

Trends such as mobile learning, open educational resources, MOOCs, gamification, and wearable technology offer exciting possibilities. However, lacking are substantive conversations on making learning experiences involving such technologies accessible and inclusive of students with disabilities. We encourage those who champion the use of the latest ICTs in colleges and universities, both on campus and in the education industry, as well as their higher education counterparts who are experts in accessibility, to begin engaging in meaningful dialogue. At the time this article is being written, an example of where dialogue could begin involves the proposed Technology, Equality and Accessibility in College and Higher Education (TEACH) Act in the US (Congress.Gov, 2013), where there clearly exists a difference of opinion among the stakeholders (Hartle & Cummings, 2014; Shachmut, 2014). Failure to begin such conversations and taking action today may well result in introducing a host of new digital barriers to postsecondary education for students with disabilities.

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