

Is Information Technology a New Barrier for Students with Disabilities?

Introduction

Success in today's world is measured, or even sometimes granted, by our ability to function in a technology based information society. Education systems are charged with giving students the necessary tools and knowledge to succeed, but communication technology continues to develop at a dizzying speed, making it difficult for educational institutions, faculty and students to keep up in knowledge and finances. Students entering university are on a steep learning curve that includes new courses and material, but also a new educational culture, administrative system and very often new technology. Students with disabilities must learn all of these pieces as well, but it often does not stop there. There is also a growing market of assistive technology and software that many students now need to keep up with the demands of higher education. To add to the fray, sometimes before they have entered their final year of studies, technology has changed and new programs must be learned.

Based in disability theory and theories of learning, this paper explores the disconnect between information communication technology used in the classroom and the technology needs of students with disabilities. The foundation for this discussion is an overview of typical disabilities and their associated challenges, as well as an overview of current technology used in university settings. In several cases the two are not compatible. In order to reconnect students with disabilities and technology, there are two main areas that universities must address: institutional planning and anticipatory planning. The institutions as a whole and individual faculty must reconsider their role in teaching and as players in these barriers. As the culture of online learning begins to

flourish, students with disabilities can be the starting point for improving the learning environment for all students.

Disability Theory

Disability has been traditionally defined in terms of negatives, such as what an individual cannot do or is not able to do well (cannot walk, cannot see, cannot hear, cannot read). A person is considered normal by what functions they are able to perform, and then it is assumed that all avenues in society are open to them. To have a disability means that an individual's ability to function in society is abnormal (Oliver, 1990). Since disability has been defined as outside of the norm, services have individualized and medicalized, usually by able-bodied people (Oliver, 1990). This mentality has led to services and accommodations being put into place to compensate for an individual's abnormality in function. While some accommodations are being made system-wide, like accessible entrances and classrooms, many universities still operate on an 'accommodate when needed' policy.

Michael Oliver has challenged this locus of control on the individual and developed an alternative to this individualized model of disability. Oliver (1990) suggests rather than disability having an individual, medicalized cause to be remedied, there are more likely societal causes that must be remedied. For example, if we did not build curbs on our roadways, we would not require curb cuts to allow for wheelchairs (interestingly, this has also been helpful for able-bodied parents with strollers or people with shopping carts). From this perspective, institutions within society must address its role in producing barriers to all citizens, and then accommodate when needed.

Learning

The primary goal of an educational institution is of course learning, which is a multi-modal process. Yet when we think of higher education we often think of a very limited type of learning – auditory (lectures) and verbal (reading and writing). This one-dimensional vision of learning, even at the lofty levels necessary in higher education, is not supported by traditional or newer intelligence theories. When diagnosing learning disabilities, for example, a psychologist measures both verbal intelligence (the ability to interpret and manipulate words) and non-verbal intelligence (the ability to interpret and manipulate pictures, diagrams, etc.), which when combined with processing speed and working memory constitute full scale intelligence. The ability to read, write, perform math problems and process auditory information are separate evaluations. The diagnosis of a learning disability will occur if the individual scores significantly lower on these tests than expected based on their full scale intelligence.

When it comes to learning, Howard Gardner's theory of multiple intelligences expands this understanding of the processes taking place in our classrooms. Gardner (2006) states that an intelligence is a "computational capacity – a capacity to process a certain kind of information – that originates in human biology and human psychology" (p.6). Currently, Gardner acknowledges 8 ½ intelligences: musical, bodily-kinaesthetic, linguistic, logical-mathematical, visual-spatial, intrapersonal, interpersonal, naturalistic and existential (this is the half intelligence, due to current lack of evidence in brain research). People will generally demonstrate strengths in some of these capacities and weaknesses in others. Teachers can use this knowledge to use student strengths to enhance learning or support areas of weakness. For example, we can teach the multiplication tables to a child using music, or use a student's linguistic strength to help

them solve calculus problems. Classrooms that use a variety of modalities to teach the material, ask students to apply the material using a variety of intelligences and techniques, and evaluate students using multiple assessments are classrooms that allow all types of learners to succeed.

Assumptions we have of users

We tend to assume in this age of information overload that our students are familiar with computers, software and online environments. There are two issues to consider here. First, many mature students are returning to post-secondary education after years of being out of school. The pace of technology development has been so fast that their knowledge is outdated or in some cases relatively non-existent. Many students may have with little or no experience with computers beyond email and basic internet services, or some may not have acquired the skills to perform basic tasks on the computer. We can also not assume that mature students were exposed to technology in the workplace. If they have not progressed past the knowledge stage, these students will not be able to effectively problem solve and manipulate the programs (Braddlee, & Matthews-DeNatale, 2006).

Second, students coming directly from high school may know how to text message, navigate MySpace and download music, but they may not know how to use other software. They may possess the basic skill set of technology use but not the problem solving skills or understand the underlying structure of the program enough to manipulate it (Braddlee, & Matthews-DeNatale, 2006). In addition, we even expect that they know how to conduct proper searches, yet they may never have been given proper instruction on focusing and narrowing searches.

Types of Disability

Visual

A visual impairment refers to any condition that affects a person's ability to see. These disabilities range in severity from an impairment (10% of normal vision remains) to the complete lack of vision. Other visual impairments might include colour blindness, sensitivity to light or eye strain. Traditional lectures are often a good format for these students, as are multi-media presentations. The challenge for these students is that online environments tend to be visual rather than auditory. For those with some vision, software can be inflexible with regards to colour, contrast and font size.

Students with visual disabilities might also be disadvantaged if they are expected to contribute postings to online forums. For this, students often use a voice-to-text software and are not always able to catch spelling mistakes such as homonyms. Also, issues of visual fatigue and eye strain are very real for these students. Those without a visual impairment may be able to visually scan and reject material in just a few seconds, but a student with a visual impairment may have to read large parts before determining to reject an article. What may take an hour for the average student will often take several times longer for these students.

Auditory

There are various levels of hearing impairment that range in scope from hard of hearing to a profound hearing loss such as deafness. If there is no visual impairment, most online environments are well suited to these students. The challenges for these students are any auditory feature of the software, such as sound files, films or radio programs. Those who are hard of hearing will often be able to follow a conversation as

long as they are able to see the face and mouth of the speaker, but a sound file only does not allow for this.

Motor control

There are many conditions that may affect motor control for students. Medical conditions such as rheumatoid arthritis, paralysis, cerebral palsy and muscular dystrophy can impede motor control, as can the learning disability dysgraphia, which can result in impaired fine or gross motor control. The challenge for these students is moving their mouse on a computer screen with accuracy or slowness in typing. They may not be able to keep up with real-time chats or respond quickly enough for online tests. Online searches, especially in the library, may prove fatiguing, or even next to impossible if proper pointing cannot occur with the mouse.

Processing speed/Working memory

Processing speed and working memory fall under the category of learning disabilities. A basic requirement for the diagnosis of any learning disability is average to above average intelligence with an impairment in one or more processes related to learning. A student with slow processing speed will take longer to process all types of information, whether it be reading, listening, writing, problem solving or remembering. Provided with extra time, they can find the correct information and demonstrate their knowledge and understanding. Working memory is the ability to process and manipulate two different pieces of information at the same time. For example, a student with an LD in working memory may not be able to listen and understand a lecture at the same time as deciding what notes should be recorded. The challenge for these students is time and clear information that is free from distractions. Material should be presented and

considered one at a time, allowing the cognitive functions to take place. What may take some students two hours to complete online may take twice as long for these students. These students may not be able to adequately contribute to real-time online discussions, or effectively and quickly navigate software such as WebCT.

Reading/ writing

Due to a learning disability, or possibly a medical source such as an acquired brain injury, some students will have difficulty reading or writing. The challenge for those with a reading disability (e.g. dyslexia) will be keeping up with the amount of reading since it generally takes them longer. If a student has difficulty with written expression, they sometimes have difficulty with organization and flow, spelling and grammar. They may require a voice-to-text software such as Dragon Naturally Speaking plus sometimes a text reader so they can hear their mistakes. Due to the nature of the disability, students with either of these difficulties may prefer face-to-face meetings where they have to opportunity to attend to non-verbal clues, such as voice, intonation, body language and facial expressions.

Verbal/non-verbal

With some learning disabilities, students will have either a verbal disability (the ability to manipulate and work with language) or a non-verbal disability (the ability to manipulate and work with non-verbal communication, such as pictures, graphs and diagrams). These students will work better when information is presented to their strength. For example, those with a learning disability may have difficulty following the different strands of an online discussion, and a student with a non-verbal learning

disability will have difficulty navigating the links and new message boxes of an online discussion.

Information Technology

Learning Management Systems

WebCT and Blackboard are the most widely used learning management systems that are currently in use by universities, colleges and other institutions to facilitate e-learning. The goal of these online learning environments is to enhance opportunities for learning beyond 'in-class' time. Instructors are able to customize the use of the system by adding tools such as discussion boards, mail systems, synchronous and asynchronous chat options, as well as adding materials such as downloadable documents and links to web pages (WebCT, 2007).

The adoption of e-learning platforms has added a much desired collaborative element to the post-secondary environment. Unfortunately, the array of materials and resources available through the online environment create new accessibility issues for students with disabilities. The lack of compatibility with common assistive technology renders adaptation difficult for learners using such programs as screen readers, text-to-voice and voice-to-text software. Secondly, the flexibility of use for instructors (other systems offer a single way of structuring resources) makes it difficult for students to navigate when using assistive technology or if a student has processing difficulties. Finally, the ability for the instructor to add their own elements (e.g. web page links, multimedia) or by allowing students to upload information and add to the e-learning environment opens up the possibility of further inaccessibility.

In order to enhance the learning environment, some educators have begun to experiment with other online tools that may or may not be compatible with established learning management software. Many forms of social software provide optimal conditions for maximal learning. Furthermore, although these technologies benefit all learners, they increase the accessibility of online learning for students with disabilities due to their adaptive, evolutionary and collaborative nature.

What is Social Software?

Social software is technology used to mediate social rituals such as the sharing of opinions, experiences, insight and perspectives between groups or peer-to-peer. The software typically allows users to produce, share and/or receive various media, including text, audio, images, and video. Popular methods of message transmission and reception are blogs, message boards, podcasts and wikis.

Blogs: Short for web log, a blog is “is a user-generated website where entries are made in journal style and displayed in a reverse chronological order” (Blog, 2007). Users utilize website based software, such as Blogger or LiveJournal, to publish thoughts, get feedback, or stay connected. Although blogs are primarily text-based, they have the ability to combine text with images, links to other blogs, webpages and other media of related interests. Blogs are typically authored (the blogger) by a single person but have the option of adding multiple authors; however, the ability for readers to leave comments and interact with the blog is of primary interest to the blogger allowing for two-way communication between the author(s) and reader(s).

How blogs can be incorporated into curriculum: As implied by the description above, a blog can be used as an interactive journal. Each student can author their own blog

to reflect on personal experiences, course readings, and major course issues. A professor can leave comments for the student regarding entries facilitating timely feedback on the student's progress. An alternative use is an instructor-authored blog. The exercise can be collaborative in nature where learners are presented a weekly topic by the instructor and asked to connect course work to wider implications outside of the classroom.

Bryant (2006) presents other engaging and interesting uses for blogs. Partnering with sister courses or institutions in other countries, language students can use group-blogs to post and receive comments from their language partners on their writing and speaking. Finally, instructors can exploit previously created blogs the following year by using them as an overview, orientation or introduction for incoming or prospective students.

Podcasts: Podcasts are a very efficient and useful tool for online learning, and still maintain a relative novelty. A podcast "is a digital media file, or a series of such files, that is distributed over the Internet using syndication feeds, for playback on portable media players and personal computers" (Podcasts, 2007). Users have the ability to receive subscription services that are downloaded automatically using media management software such as iTunes.

How podcasts can be incorporated into curriculum: Podcasting is becoming increasingly popular for its use in educational contexts. Podcasts allow instructors and learners to share information with one another at anytime throughout the duration of the course. The most popular use is the recording and publishing of lectures; however, other uses are gaining in popularity. Instructors can incorporate external podcasts that reinforce or present new points of view to core course concepts. For example, an instructor of

Politics and The Environment can source a recording of a recent presentation by Dr. David Suzuki discussing the Canadian implications of the Kyoto Protocol (in addition to or in substitution of a weekly reading). An instructor can also point to a Wikipedia article with an accompanying podcast that will provide background information or common reference point for what will be further discussed in lecture. Other uses of podcasts include instructor recorded vocabulary or foreign language lessons, musical performances, interviews or debates. A podcast can also be utilized as a publishing tool for learners' oral presentations.

Video podcasts can be used in all the above ways with an added visual element. In particular, instructors can have students prepare and record presentations outside of class. Once published, all learners in the course will have access to the presentations. Instructors can also enable peer feedback elements to the assignment.

Social Bookmarking: Social bookmarking allows groups of users to work together to create a database of relevant web pages. Like bookmarking a website using a browser on a personal computer, users save website addresses to online accounts and categorize (tag) sites with keywords and descriptions in order to make them searchable (Bryant, 2006).

How to incorporate social bookmarking into curriculum: Instructors can begin the collaboration by setting up an account for their particular course. Key words and their accompanying descriptions should be outlined by the instructor or agreed upon by the group. Learners can browse through the accumulated database of web sites and make connections with other learners in the course that share similar interests. Burke (2006) advises that bookmarking programs vary in their complexity, including some programs

that incorporate user information (e.g., media, background, and interests). Furthermore, several bookmarking programs allow for descriptors to be organized into concept maps called “tag clouds” which allows for a visualization of available resources, or the ability to spot the lack of information in certain areas.

Once established, social bookmarking can continue to be built upon from year to year by the instructor or by students as they move through their program. The benefit of the continuous evolution allows learners to identify likeminded people, establish partnerships or develop peer groups and engage in more productive, collaborative, self-directed learning in the future.

Wiki: A wiki is a website that allows for the mass collaboration in the creation of a database for creating, browsing and searching information. Users are able to interact with the web-based software by adding, removing and editing content. Every article links users to associated articles, additional information, and identifies cross-references. More developed wikis include multiple modality elements including audio, video, pictures, etc. One of the most well-known wikis is Wikipedia.

How to incorporate wikis into curriculum: Perhaps in part to the ongoing, active debate on the use of Wikipedia as an academic source for information, the use of wikis as an instructional tool is relatively new. A wiki is best suited to collaborative writing or group projects that may or may not involve multimedia. For example, an instructor for Introduction to Psychology can break a large class into groups and assign each group a distinct subtopic or school of thought. A wiki can act as an asynchronous meeting place for the groups. As learners source information (preferably over an extended period of time to allow for adequate compilation) they can add it to their group’s wiki. The wiki in

its entirety can be submitted at the end of the term and be graded based on its scope of information, accuracy, employment of multiple modality elements, etc. Built-in history or tracking abilities aid instructors in monitoring information gathering, provide timely feedback and assess individual members contributions. At the end of the term all of the group assignments can be linked together and be used as a reference tool, orientation or introduction for incoming students.

What's next

Web 2.0: Web 2.0 is a phrase that connotes the coming together of social software and web-based communities in order to foster a new learning landscape. The focus is on multiple modality of information, collaborative learning, as well the ability to pursue self-directed learning by connecting to others with similar interests. The term does not refer to a new version or an update of the internet or World Wide Web technical specifications, but implies a shift in the way the platform is used. Learners will make use of wikis that will be combined the ability to blog commentary, search tags and interact within a social network, all by employing a single platform.

Interface problems

Many students with visual impairments require text-to-voice software such as Kurzweil 1000 (which is not as powerful as Kurzweil 3000), ReadPlease, Zoomtext, audiotapes, and less frequently, Braille. For students with a learning disability in reading, psychologists usually recommend Kurzweil 3000. Unfortunately, these programs are not compatible with all of the above programs, including WebCT, and other online programs such as library databases, eBooks, or university registration systems. As well, visual images such as graphs, diagrams, mind maps or pictures cannot be read by text-to-voice

software. Students with no vision may need voice-to-text software or even a scribe to enter a posting to a discussion. If they are not compatible, text-to-voice software requires students to convert information from one program to another, which adds a great deal of time in addition to the extra time needed to co-ordinate two programs.

Students experiencing difficulties with motor control or written expression may be using voice-to-text software. These programs are independent, and students must cut and paste their writings each time they submit a posting. Other problems inherent in these programs are incorrect transcription and difficulty with homonyms.

Institutional Planning & Responsibilities

In Canada, the rights of persons with disabilities are protected in the Charter of Rights and Freedoms. Section 15(1) declares that every individual is equal and has the right to equal protection without discrimination based on mental or physical disability. The preamble to the Ontario Human Rights Code (1990) states that it is public policy in Ontario to recognize the dignity and worth of every person and to provide for equal rights and opportunities without discrimination that is contrary to law. The Code aims for the creation of a climate of understanding and mutual respect for the dignity and worth of each person so that each person feels a part of the community. The Code recognizes a person's ability to contribute fully to the development and well-being of the community and the Province, which will be made possible through the elimination of all barriers for persons with disabilities.

At this point in time, many disability services in Ontario post-secondary institutions are maintained by a separate office for students with disabilities. Students who self-identify as a person with a permanent disability request specific

accommodations in their classes, such as extra time on tests, text-to-voice scanning and software, voice-to-text software, exams on tape or audio systems for lectures. The emphasis is upon the student to advocate for themselves within the disabilities office and within their departments and faculties. This is an individualized model of disability, with the university making accommodations where needed, and does not adhere to the social model of disability by actively reducing barriers for all students.

In terms of information technology, this plays out in two ways: availability to accessible software and technology; and technology not designed for accessibility. Software sometimes required by students with disabilities are text-to-voice, voice-to-text, alternate screen formats (enlargers, reduced visuals, high contrast) and visual organizers. Many institutions have an independent accessible computer lab, but other labs across campus often only have a few accessible computers. The irony is that some of this software would help all learners, not just the ones with identified learning disabilities. For example, Inspiration is a popular visual organizer that is used by elementary and secondary students, as well as post-secondary (Kidspiration is the version for younger children). This software allows users to brainstorm, link ideas, make notes and organize their material for exams, essays or any project. The resulting concept maps are a very powerful tool for retention and transfer of material, even better than summary notes (Nesbit & Adesope, 2006). Inspiration can also be used to create self-quizzing tools. Although relatively inexpensive and easy to download, Inspiration is not standard in most computer labs.

The second challenge is with software used in the institution, but was originally developed for the workplace. Most faculties use software that is specific to their fields,

such as the statistics package, SPSS. This software is generally out of the control of the faculty or the IT department of the university, who cannot manipulate or alter the functions to make them accessible. This software is usually available in departmental specific labs, however, these labs are not usually equipped with accessible software, so even if they were compatible, students are unable to use their accommodations.

Lack of institutional planning often means that faculty must search for and acquire their own information technology for their classes. This could mean that a student must learn and adapt to several sets of technology being used by different faculty. What becomes intuitive in one program is often very different in another (or in the case of WebCT, the same links could be used for different purposes). For students with a disability in executive planning, this can result in constant difficulties as each must be reconsidered and relearned throughout the term.

Anticipatory Planning

When designing any course, instructors must anticipate their students' needs as well as the learning objectives and curriculum of the course. Anticipatory planning for technology and students with disabilities is very much the same. Faculty members might ask themselves these typical questions when considering a student with a disability: What difficulties does this student with a disability have in my course? What do I need to change to accommodate this student (e.g. presentation of material, testing)? How do I still make the accommodations equitable for the other students in the class? Michael Oliver (1990) suggests changing our questions from the individual model (the student as cause) to the social model (the course design as cause). The above questions then become: What difficulties might all learners have in my course? How do I change my class so it is

accessible to a variety of students' learning styles (e.g. multi-modal presentations, authentic assessment)? How do I provide each student with the best opportunity to succeed?

This makes sense not only in terms of philosophy of disability, but in terms of best teaching and practicality. Faculty often ask for advice in accommodating a student with a disability only after they are made aware of their presence in the classroom. Considering the overall growth in demand for higher education, it is best for faculty to assume they will have students with disabilities in their classes, whether they have identified themselves or not. Consider this example. An instructor has decided to use WebCT in a class and has determined that students should post a comment every week, in keeping with the readings. The instructor has also determined that to best keep up with the material and ongoing discussion, students should be online at least three times per week (synchronous design). However, it may not be feasible for a student with a motor skills disability to post messages three times per week due to difficulties with typing. For this student, once a week is difficult enough. While still in the planning stage, the instructor decides to use asynchronous design, allowing not just this one potential student to participate in a manner s/he is able to, but all students now have the same flexibility.

Anticipatory planning will also solve some very practical issues. For example, an instructor plans a course in a particular format, but suddenly finds that accommodations must be made for one student. Sometimes confidentiality can be compromised when accommodations are granted to students with disabilities after the class rules have been established. In some ways, faceless interactions encourage privacy, especially with a visible disability. A controversial example is the use of laptops in the classroom. Many

faculty members have found laptops to be very distracting to themselves and other students, especially if the laptop is being used to surf the internet, send email, or play games. Laptops are essential to some students, especially those who require text-to-voice software (typed notes can be read, handwritten notes cannot). If faculty members only allow students with disabilities to use a laptop in class, these students have essentially been 'outed'. Instead, faculty members could find ways to incorporate the laptops in class by asking students to conduct online searches and share the information with the class.

The Next Step

Technology does not need to be a barrier to students with disabilities. If institutions and faculty plan for learning with all students in mind, then all students will benefit. The institutions need to work closely with staff members who know what assistive technology students are using in order to properly equip computer labs across the campus and purchase compatible software. The information technology specialists must continually ensure that university websites, registration systems and other student (and staff) software meets accessibility requirements (such as Bobby approved). Institutions may have to bear the financial cost, but they need not do it alone. The Ontario Ministry of Education has purchased licences for information and learning technology to be used by all students and teachers in Ontario school boards, as well as faculties of education and pre-service teachers (go to OSAPAC.org). Ontario post-secondary institutions could encourage the Ontario Ministry of Training, Colleges and Universities to do the same. Time and money are saved for individual universities, as all will share in the cost of access made possible through MTCU.

When designing a course with information technology, faculty should meet with the developer before classes to problem solve in advance. Talking with the office for students with disabilities can provide the instructor with information and help to identify potential problem areas. Faculty may also want to acquaint themselves with the principles of Universal Instructional Design, which takes a diversity of learners and learning styles into account and strives to maintain academic rigour while increasing the effectiveness of teaching for all learners by reducing barriers.

Much of the responsibility for accessible technology based classrooms is borne by those that work directly with students – faculty members. This paper starts with the sentence: Success in today's world is measured, or even sometimes granted, by our ability to function in a technology based information society. Faculty are no longer exempt from this measure. When we ask faculty to integrate information technology with the needs of students with disabilities, or even to use information technology alone, we are asking faculty to change. When we are asking faculty to consider disability as a social cause rather than an individual cause, we are asking them to change. Institutions must provide incentives for these necessary changes to take place. Good teachers care about their students and want to improve all aspects of their art; caring is not the barrier to this change. An inability to change is often the result of fear of the unknown, the unfamiliar. If accessible information technology and multi-modal learning is made known and familiar, change will be less frightening. After being provided with training and support, faculty can then be rewarded with promotion, tenure, and most importantly, successful students.

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