Are You Considering All Students, Including Those with Disabilities, When Planning for Technology Integration?

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Introduction

This article is based, in part, on a series of empirical studies involving more than one thousand Canadian college and university students with a variety of disabilities (including learning disabilities). The studies involved focus groups, telephone interviews, and a comprehensive mail-back survey. We examined issues concerning how these students did, or did not, use computers in the context of their studies. We wanted to understand the types of technologies they were currently using; those they wished they could use; what technologies they had available to them at school; and problems they had either using or accessing necessary technology to pursue their academic goals.

Here we provide a snapshot of our findings, tell about the types of adaptive hardware (e.g., an adapted mouse) and software (e.g., software that reads what is on the screen) that students with different disabilities told us they use, and make recommendations to all who are involved in technology integration. It is important to note that while our research and context lie in the higher education community, it is our expectation that those working in elementary and high schools will find our suggestions useful, since technology integration is happening throughout all levels of education.

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Snapshot of Our Findings

- Almost all students in our sample used computers.
- No sex or age differences were observed in computer related attitudes or computer or Internet use.
- Close to 50% of students reported having more than one impairment/disability.
- Approximately half of the students told us they needed adaptive hardware/software.
- Only one-quarter of students used adaptive hardware/software—the main reason: cost.
- Problems related to computers reported include difficulties with cost, compatibility, upgrading, support, training, and lack of information about what is available.

Results from all stages of our research converge on a variety of important points. First, it is evident that computer technologies have considerable potential to "level the playing field" for individuals with all types of disabilities. Second, while the perceived advantages of computer technologies far outweighed the disadvantages, these technologies can act to either help or hinder students. Postsecondary students with disabilities have a high level of computer and Internet usage and literacy. Nevertheless, there are a variety of problems and issues regarding the availability and accessibility of such technologies which need to be addressed. These include concern over inadequate funding for computers and adaptive hardware/software, both for the students themselves and for their institutions. Lack of awareness about the computer related accessibility needs of students with disabilities by both faculty and other postsecondary personnel involved in designing and implementing campus-wide instructional technologies also poses a significant barrier.

Adaptive Software and Hardware

Students who are blind told us that they typically use software that reads to them what is on the screen via synthetic speech (e.g., JAWS for Windows; http://www.freedomscientific.com/fs_products/software_jaws.asp). Some also use a special hardware/software combination that takes a line of text on the screen and converts it into a line of either 40 or 80 characters of Braille on a refreshable display. To turn a hard copy page into a format they can read, students often use specialized systems that use a scanner and optical character recognition (e.g., Kurzweil; http://www.kurzweiledu.com/products.asp) software. Once

scanned into a file, they can use either speech or Braille.

Students with low vision indicated that they use either software that magnifies text from 2 to 16 times (e.g., ZoomText; http://www.aisquared.com/) and/or a large screen monitor. Some also use screen reading software. They, too, can use a scanner and OCR software to turn the printed page into electronic text. Persons with low vision also use a variety of specialized software as well as built-in features of popular commercially available software to change the contrast and to enlarge and otherwise make text, cursors, and other visual elements more visible.

Students with learning disabilities such as dyslexia mentioned using many of the same technologies as students with visual impairments to help them better process printed materials and what is written on the screen. In addition, dictation software, document managers and schedulers, concept mapping software, electronic dictionaries, grammar and spell checkers, and word prediction software were frequently cited.

Students with hearing impairments reported using writing aids such as spelling and grammar checkers, along with e-mail and chat programs. They told us they take advantage of accessibility features built into the operating system of conventional software (e.g., visual flash instead of sounds), and captions and subtitles for video clips (when available). Real-time captioning (typing of what is said), when available, is also used.

Students with speech/communication impairments also used e-mail and chat programs. In addition, they used portable note-taking devices to interact with others in face-to-face contexts and multimedia projectors for oral presentations.

Students with mobility and hand/arm impairments used ergonomic adaptations, voice recognition and voice control software that allows hands free dictation and control of menus. They also talked about software based keyboard adaptations, software or hardware that allows for one handed typing, along with a variety of alternative mice and input devices.

Recommendations for Planners

The following suggestions result not only from our student research, but also from follow-up studies we undertook with smaller samples of faculty and professionals who provide disability-related accommodations to students with disabilities on college and university campuses.

- Think of access by students with disabilities as an absolute requirement rather than as a luxury.
- Get into the mind-set of assuming that you will have a student with a disability needing to access your material/application.
- Keep in mind that for the United States acquisition of equipment that is not accessible to learners with disabilities is against the law (see Section 508 (http://www.usdoj.gov/crt/508/508home.html).
- Planning for universal accessibility at the outset is just good design, and less costly than retrofitting later.
- Two excellent starting points are to consult the IMS Guidelines for Developing Accessible Learning Applications (http://www.imsglobal.org/accessibility/index.cfm) and Making Educational Software and Web Sites Accessible (http://ncam.wgbh.org/cdrom/guideline/).
- When conducting evaluations of courseware, we recommend that learners with disabilities be included whenever possible. This ensures that accessibility-related issues are identified and dealt with before implementation or adoption.
- Accessibility subject matter experts need to be identified and consulted during the instructional design and technology implementation processes.
- Web authoring tools with built-in accessibility features (e.g., Macromedia MX Suite: http://www.macromedia.com/macromedia/accessibility/features/flash/; WebCT: http://www.Webct.com/ accessibility/home; Blackboard: http://products.blackboard.com/cp/bb5/access/index.cgi) should be used when designing Web-based applications.
- Make use of tools, such as Bobby (http://bobby.watchfire.com) and A-Prompt (http:// www.aprompt.ca) that can evaluate Web pages for accessibility and provide suggestions for improvements.
- The National Center for Accessible Media (NCAM) recently released free software (MAGpie: Media Access Generator: http://ncam.wgbh.org/webaccess/magpie/) that provides the facility to add captions to QuickTime, SMIL, and SAMI formats and to incorporate audio descriptions into SMIL presentations.
- Participate in any one of a number of online workshops around accessibility (e.g., WebAim: http://www.Webaim.org, or EASI http://www.rit.edu/~easi).
- A listing of helpful English and French organizations and resources is available from the second author at catherine.fichten@mcgill.ca

If the trend of teaching and learning with various instructional technologies continues to be a priority across all levels of education, then there is a need to ensure that such learning is accessible to everyone, including students with disabilities. Here, we define accessibility as the ability by these students to independently access the same learning materials and meet the same learning objectives as their nondisabled peers. This requirement exists regardless of whether they are using the types of adaptive hardware or software described above to interact with this learning.

We firmly believe that the implication of failing to

For the past six years, the Adaptech Research Network has conducted grant-funded research into the use of computer technologies by Canadian college and university students with disabilities. The Adaptech Research Network is based at Dawson College in Montreal Canada. Additional information is available at: http://www.adaptech.org

Recent Projects

AdaptCan (completed: 1999) Between fall 1997 and spring 1999 we explored the computer, information, and adaptive computer technologies needs and concerns of Canadian university and community/junior college students. These involved more than 800 participants (Fichten, Asuncion, Barile, Fossey, & De Simone, 2000; Fichten, Asuncion, Barile, Généreux, Fossey, Judd, Robillard, De Simone, & Wells, 2001; Fichten, Barile, Asuncion, & Fossey, 2000). To obtain an overview of the important issues about computer technologies, we first conducted focus groups with postsecondary personnel responsible for providing services to students with disabilities, postsecondary students with various disabilities, professors, and other concerned individuals. We then obtained in-depth information form structured interviews with larger and more representative samples of students with disabilities (n = 37) and individuals responsible for providing services to students with disabilities (n = 30). Finally, we collected comprehensive information via questionnaire from a Canada-wide convenience sample of university and junior/community college students (n = 725).

ITAC (completed: 2000) In this Quebec based project (Informatique et technologies adaptées dans les cégeps pour les étudiants handicapés) data from 97 community/junior college students with disabilities and 71 individuals responsible for providing services to them were obtained using focus groups, interviews, and closed-ended questionnaires (Fichten, Barile, Robillard, Fossey, Asuncion, Généreux, Judd, & Guimont, 2000). This investigation sensitized us to (1) the realities of using computer technologies when one's language is French rather than English, (2) the importance of the size of the college, and (3) special concerns experienced in institutions with few students with disabilities.

DSSFocus (completed: 2001) The focus of this study was on the technology-related needs and concerns of the campus-based professionals who deliver disability-related supports to students in higher education. Here, we studied the views and concerns of 156 individuals at Canadian universities and community/junior colleges who oversee support services to students with disabilities (Fichten, Asuncion, Barile, Robillard, Fossey, Judd, Guimont, Tam, Lamb, Généreux, Juhel, Senécal, & Wolforth, 2001).

Success (ongoing) Here we investigate what happens to students with disabilities after they enroll in college and what factors facilitate or hamper their success. Preliminary data from 437 Dawson College students with disabilities indicate that students with disabilities graduated at a slightly, although not significantly (approximately 1%) higher rate than students without disabilities in the same programs (Jorgensen, Havel, Lamb, James, Barile, & Fichten, 2002).

Free or Inexpensive Computer Products (ongoing) This bilingual undertaking responds to an identified need for inexpensive or free hardware or software alternatives to costly adaptive technology solutions currently available (Fichten, Lavers, Barile, Asuncion, Généreux, & Robillard, 1999). Students with disabilities, in particular, are not in a position to make expensive purchases of their own. We want to ensure that they have some access to technology. The listing of free and inexpensive projects is continually updated on our Web site (http://adaptech.dawson college.qc.ca/download.htm)

provide accessible learning materials is that instructional technologies become exclusionary technologies. Learning with and using instructional and information technologies build the confidence and technology-related skill sets that are demanded of graduates by today's labor market. The inability to participate in these learning opportunities has obvious negative consequences for students with disabilities, not the least of which is unemployment. And before you think that this is just a small group of students, it is worth noting that in North America alone, between five and eleven percent of students attending colleges and universities have a disability (for a review, see Fichten, Asuncion, Barile, Robillard, Fossey, & Lamb, 2003).

Conclusions

Computers are technologies that are enabling—that allow students with disabilities to prepare for and to participate in our knowledge-based economy. The complexity of the issues suggest that diverse sectors of the campus community need to collaborate to ensure that instructional technologies and resources are accessible to students with different impairments. In this regard, we recommend that multidisciplinary computer accessibility advisory committees be constituted in schools with representation, at a minimum, by students with different disabilities; faculty, those responsible for providing computer related services to students with disabilities; and someone from computer support services as well as administration. Such committees could benefit from the expertise of academic computer staff, adaptive computer technology specialists, educational technologists, librarians, audio-visual specialists, and rehabilitation professionals, among others.

Campus-wide IT plans need to be reviewed to ensure that accessibility is a key check-point prior to sign-off on large-scale projects or vendor contracts. Faculty need to be trained in how to design technology-rich courses that also take accessibility into account. Without such action, students with disabilities face new and unnecessary exclusion from participating and benefiting from the learning opportunities that technologies are now affording the campus community. □

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