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Meeting the E-Learning and Information and Computer Technology Needs of Post-Secondary Students with Visual Impairments: An Overview of Two Studies

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Abstract: We present the findings from two Canada-wide studies involving post-secondary students who self-identified as either being totally blind (n = 29) or having low vision (n = 143). The first study examined the information and communication technologies (ICTs) used by students and how adequately these met their on and off campus needs, and the second study explored the accessibility of e-learning at the post-secondary level, including which e-learning tools participants find most and least accessible. The findings indicate that several e-learning tools, such as PDF documents and web-based content, pose a number of accessibility problems. Moreover, the results suggest that participants encounter problems when using ICTs at home and at school, such as ICTs not being adequately up-to-date. We present these findings and provide recommendations to address these concerns, such as the need to ensure that universal design and web-accessibility guidelines are considered when e-learning tools are implemented.

Introduction

Developments made in the areas of mainstream and adaptive computer and information technologies in recent decades have increased opportunities for students with visual impairments, both those who are blind and those with low vision, to attend school at the post-secondary level, and strengthened their chances of securing employment after graduation. Whereas information was once primarily distributed through traditional (hardcopy) printed texts, the proliferation of information and computer technologies (ICTs) and e-learning tools have allowed these students, who are unable to read regular print, to access information with greater ease and independence. Through the use of adaptive computer technologies (such as text-to-speech programs that read information on the screen or specialized magnification software), students with visual impairments are able to benefit from certain e-learning tools; yet a number of accessibility barriers persist.

To explore the e-learning and computer accessibility needs of postsecondary students with visual impairments, we conducted two Canada-wide studies during the past six years using web-based questionnaires. Respondents included students who self-identified as either being totally blind or having low vision. The ICT Study examined the availability of ICTs on and off campus for students with visual impairments, and how adequately such technologies met their needs both at school and at home. The second study examined the accessibility of e-learning tools at the college and university levels, including the benefits of e-learning for students with visual impairments as well as the accessibility barriers they confronted. The findings are telling, and indicate that several widely used e-learning tools, such as PDF files and web-based content, are often inaccessible to users who are blind or have low vision. Moreover, the results suggest that these students encounter problems when using ICTs both at home and at school. These include adaptive ICTs not being sufficiently up-to-date, inadequate technical support, and lack of adequate and appropriate training. Such results are important for e-learning professionals – both producers and distributors – to understand, as a lack of accessibility prevents a large number of students from adequately using such tools. Here, we propose a number of recommendations for e-learning professionals to consider when producing their products, such as understanding the accessibility needs of e-learning users, becoming aware of universal design principles and current web accessibility guidelines, and the importance of dialoguing with learners who have diverse disabilities to ensure that products implemented in the classroom can easily be used by all.

In a second, related investigation (E-Learning Study) we asked students to indicate the primary e-learning barriers that posed academic difficulties for them. Among the top barriers identified by respondents with visual impairments are those related to a lack of access to print materials and inaccessible e-learning technologies (i.e., technologies that do not work, or do not work well, with screen readers or magnification programs and, therefore, cannot easily be used by students who have visual impairments). If e-learning is to continue to evolve and serve a diverse student demographic, the needs of learners with disabilities (such as those with visual impairments) must be taken into account. Producers of e-learning tools must, consequently, understand the ways in which such students access ICTs and the benefits and disadvantages that current e-learning tools present.

Methodology

ICT Study

In our first study, we explored which ICTs students who are blind or have low vision use and how adequately their technology needs are met. The participants consisted of a convenience sample of 139 students from 52 Canadian universities and junior or community colleges (24 who identified themselves as being blind and 115 as

having low vision). All participants had attended a postsecondary institution within the past year or were currently attending one. An online questionnaire was developed and administered to more than 1000 college and university students with various disabilities; however, here we only present the data for those participants who identified themselves as being blind or having low vision. On the POSITIVES Scale, students rated how well their computer-related needs were being met on and off campus in diverse contexts. The POSITIVES Scale uses a 6-point scale (1=strongly disagree, 6= strongly agree) (Fichten, Asuncion, Nguyen, Budd, & Amsel, 2010).

E-Learning Study

The second study focused on the accessibility of e-learning materials and barriers that were encountered by students with visual impairments while using e-learning tools. Participants were a convenience sample of 33 students from 26 Canadian universities and junior or community colleges. Of these 33 participants, 28 identified themselves as having low vision, and 5 indicated that they were blind. Each participant had taken at least one course that used some form of e-learning in the last three years. Before administering the online survey, 22 interviews were conducted with key informants, including students with diverse disabilities, faculty, individuals who provided disability-related accommodations on campus, professionals who supported or implemented e-learning on campus, and vendors of e-learning materials for the postsecondary community (Fichten, Ferraro, Asuncion, Chwojka, Barile, Nguyen, Klomp, & Wolforth, 2009). Web-based surveys were developed on the basis of these interviews, and then pretested and administered. Participants were asked to indicate three key problems they encountered while using e-learning materials and to state how these difficulties were resolved.

Results

ICT Study

Adaptive technologies, if they are available and adequate training is provided, can promote equitable access to education for students with visual impairments. Results show that the adaptive technologies most frequently used by students who are blind are software that reads what is on the screen (96%), scanning and optical character recognition (88%), refreshable braille display (produces braille output) (71%), and software that improves the quality of writing (such as grammar and spell check, colors, and highlighting) (42%). The ICTs used by students with low vision include software that enlarges what is on the screen (such as magnification and zoom) (70%), software that improves the quality of writing (such as grammar and spell check, colors, and highlighting) (55%), software that reads what is on the screen (50%), large screen monitors (46%), and scanning and optical character recognition (34%). Despite using different ICTs from their classmates, students who are blind and have low vision felt comfortable using the necessary ICTs in a classroom setting, with those who are blind feeling significantly more comfortable.

The ICT study also asked participants to indicate how well their technology needs are met at home and at school. The students' needs were better met at home than at school for both students who are blind and for those who have low vision, and the ICTs participants used at home were significantly more up to date than those used at school, especially for the participants who were blind. The needs of participants with low vision were reasonably well met in most areas, with the exception of the availability of adaptive computer technologies in both specialized and general-use computer labs (mean score = 3.50 on a 6-point scale where 6 is the best score), use of e-learning for testing (i.e., online quizzes) (mean = 3.96), and the school's technology-loan program (mean = 3.48). The technology needs of students who were blind were consistently less well met than those of students with low vision. The participants who were blind indicated the same problem areas where their needs were not as well met as those with low vision: availability of adaptive computer technology in both specialized and general-use computer labs (mean = 2.10), use of e-learning for testing (i.e. online quizzes) (mean = 2.94), and the school's technology-loan program (mean = 3.92). However, they also identified additional accessibility barriers in the following situations: completing courses at a distance (mean = 3.19), when seeking informal help related to ICTs at school (mean = 3.91), attempting to access the library's computer systems (mean = 3.30), and when the instructors use e-learning materials (mean = 3.77).

E-Learning Study

Properly implemented, e-learning can greatly increase the feasibility of achieving universal design of instruction (UDI). UDI is based on the theory that, properly designed, classrooms should be naturally and

universally accessible to the vast majority of learners, without the need for special "accommodations" in order to facilitate the basic learning process (Burgstahler, 2010). For example, if the textbook, lecture notes and PowerPoint slides are available electronically in a format that a student with a visual impairment can read, then he or she need not seek out "accommodations" to access otherwise inaccessible content. In the e-learning study, students who are blind or who have low vision were asked to identify the benefits that e-learning provided in their own academic lives. Interestingly, blind and low vision students identified similar top benefits to e-learning, including the convenience of communicating with peers/professors through electronic means and the availability of electronic notes.

Respondents were asked to rank various e-learning tools in terms of their accessibility on a 6-point scale (1=totally inaccessible, 6=very accessible). The most accessible and easy-to-use formats included Microsoft Word and PowerPoint documents, and material sent by email (blind: mean = 4.2, low vision: mean = 4.71). Notably, the least accessible forms of e-learning for blind and low vision students differed. For students who are blind, online slideshow presentations, video conferencing, Adobe Flash content, and CD-ROM-based tutorials presented the greatest difficulties (mean = 1.00). Conversely, live online chat and Adobe Flash content presented the greatest challenges for students with low vision (mean = 3.00 and mean = 3.63, respectively).

Recommendations

Understanding the needs of diverse e-learning users is imperative if such tools are to be most effective in the future, particularly given the increasing presence of students with a variety of disabilities at the post-secondary level. A greater emphasis must, thus, be placed both on ensuring that e-learning tools are designed to be accessible from the start, and that e-learning professionals are aware of the ways in which students with visual impairments use such tools and how such tools interact with the adaptive software such users may require. Indeed, modifications that increase the usability of e-learning tools will not only benefit students with visual impairments, but will also increase the usability of such products for all students. We propose the following recommendations for e-learning professionals to consider:

- Institutions should evaluate the accessibility of e-learning tools during the procurement process.
- Ensure that e-learning producers are aware of the principles of universal design of products and, more specifically, the accessibility needs of students with visual impairments. Such information can be distributed through workshops and conference presentations.
- Where possible, producers of e-learning content should ensure that their products are tested for accessibility prior to their launch, by reaching out to users with visual impairments.
- Producers of e-learning should also be aware of the current web accessibility guidelines, as these are already extended to many government websites and their application is increasingly being advocated in other sectors (W3C Web Accessibility Initiative, 2011).
- The use of graphics, images, and other non-text content is often problematic for blind and low vision users. Providing a textual alternative is essential where such information is important.
- The use of meaningful and semantic document "mark up" (for example using, where appropriate, headings lists and tables) dramatically improves the accessibility and usefulness of HTML content, upon which many e-learning tools are based.

Through dialogue that considers the accessibility and usability of e-learning tools for students with visual impairments, e-learning professionals are afforded opportunities to understand a segment of the population that often falls below the radar. As educational institutions become increasingly inclusive settings, it is imperative that the e-learning tools used by students with diverse needs remain up-to-date and inclusive. The findings of our two studies not only introduce such under-represented themes to e-learning professionals, but also ensure that discussions in the area of accessibility and e-learning continue to move forward.

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