Development and Validation of the POSITIVES Scale (Postsecondary Information Technology Initiative Scale)

Final Report Presented to the Canadian Council on Learning

February 2009

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Executive Summary: Development and Validation of the POSITIVES Scale (Postsecondary Information Technology Initiative Scale)

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Executive Summary

Abstract

Data on how well the information and communication technology (ICT) needs of 1354 Canadian college and university students with disabilities are met on and off campus were collected using the newly developed POSITIVES Scale (Postsecondary Information Technology Initiative Scale). The measure contains 26 items which use a 6-point Likert scale (1 = strongly disagree, 6 = strongly agree) to indicate level of agreement with each of the positively worded items. It has three factor analysis-derived subscales (ICTs at School Meet Student's Needs, ICTs at Home Meet Student's Needs, E-learning ICTs Meet Student's Needs) and a total score. Reliability and validity are excellent for both English and French versions. Versions that could be completed online, on paper (printable PDF), and within a Microsoft Word document were found to be equivalent.

The measure has a variety of attractive features. Only 26 items, it is easy for learners with all types of disabilities to complete, and the simple scoring requires only a straightforward calculation of means. The measure also has the advantage of flexibility due to its "face validity." Thus, the scale (a) permits item-by-item analysis to identify individual areas of perceived strength and weakness, (b) can assess modifiable aspects of ICT availability, usability, and accessibility on campus as well as (c) monitor and evaluate the effects of efforts to improve these. The scale may be used to evaluate how well an institution's ICTs meet students' needs, provide empirical data to influence ICT policy, and pinpoint areas of strength as well as areas for improvement, all from the perspective of students with diverse disabilities.

Findings on POSITIVES Scale subscales indicate that, overall, students' ICT-related needs are better met at school than at home and that their e-learning-related ICT needs are met quite well.

Nevertheless, the results also show substantial differences in how the ICT-related needs of students with various disabilities are met in different contexts.

Goals

The objective of this research was to develop the POSITIVES Scale (Postsecondary Information Technology Initiative Scale), a brief, bilingual, reliable, and valid measure to allow staff at postsecondary and rehabilitation institutions a means to assess the extent to which the information and communication technology (ICT)-related needs of students with various disabilities are met. The goal was to ensure that we develop a scale that (a) can be completed by students with all types of disabilities and (b) that would be able to evaluate how well students' general use and adaptive computer and communication technologies-related needs are met both on and off campus. Another requirement was (c) to ensure that the measure can be administered in a variety of alternate formats.

Method

In 2007, a bilingual online questionnaire was developed and completed by 1354 Canadian university and junior/community college students with various disabilities. They were recruited through email-based discussion lists and with the assistance of our project partners. Interested participants were directed to the study's website where they selected their language of choice (English or French), provided informed consent, and completed the online questionnaire.

The questionnaire consisted of (a) demographic questions (e.g., sex, program of study), (b) items where participants could indicate their disability(ies)/impairment(s) (e.g., totally blind, learning disability), (c) as well as any adaptive computer technologies that they use (e.g., software that reads what is on the screen, adapted keyboard), (d) two overall criterion items that inquire about how well students' computer and/or adaptive computer needs are met at school and at home, and (e) the POSITIVES Scale itself.

The POSITIVES Scale has 26 positively worded items that are scored using 6-point Likert scaling (1 = strongly disagree, 6 = strongly agree). It has three factor analysis-derived subscales (ICTs at School Meet Student's Needs, ICTs at Home Meet Student's Needs, E-learning ICTs Meet Student's Needs) and a total score.

Results

Sample Characteristics

Student participants were relatively old (mean age was 28) and about half of the sample reported a learning disability, about a third reported a psychological/psychiatric disability, and over a third reported more than one disability. This implies that different adaptive computer technologies meant to support people with different disabilities need to be able to operate together.

Software/Hardware Used

Half of the students indicated needing specialized software and/or hardware to use a computer effectively. Over 40% indicated using software to improve writing quality, such as grammar and spell checkers followed, in rank order of popularity, by software that reads what is on the screen, scanning and optical character recognition (OCR), dictation software, and software that enlarges what is on the screen.

A minimum of 15% of students in each of the following disability groups indicated using the following computer technologies:

- Learning disability/ADD/ADHD: software that improves writing quality, software that reads what is on the screen, scanning and optical character recognition (OCR), dictation software;
- Totally blind: software that reads what is on the screen, scanning and optical character recognition (OCR), refreshable Braille display, software that improves writing quality;
- Low vision: software that enlarges what is on the screen, software that reads what is on the screen, large screen monitor, software that improves writing quality, scanning and optical character recognition (OCR);
- Deaf: software that improves writing quality, scanning and optical character recognition (OCR);
- Hard of hearing: software that improves writing quality;
- Mobility impairment: software that improves writing quality;
- Limited use of hands or arms: software that improves writing quality, dictation software, alternative mouse, adapted keyboard;
- Medically related/health problem: software that improves writing quality, software that enlarges what is on the screen;
- Psychological/psychiatric disability: software that improves writing quality;
- Neurological impairment: software that improves writing quality, dictation software;
- Pervasive developmental disorder (PDD): software that improves writing quality;
- Multiple disabilities: software that improves writing quality, software that reads what is on the screen, dictation software, software that enlarges what is on the screen, scanning and optical character recognition (OCR), large screen monitor.

POSITIVES Scale Properties

The key deliverable of this project, a valid and reliable measure of how well the ICT-related needs of postsecondary students with disabilities are met, is the 26-item POSITIVES Scale (Postsecondary Information Technology Initiative Scale). It has a total score as well as three factor analysis-derived subscales which evaluate how well ICTs available at school, at home, and in e-learning contexts meet the needs of students with different disabilities in postsecondary education. In addition, alternate formats of the measure (i.e., web-based, Microsoft Word-based, and print-based versions) yielded equivalent results. The full report's Appendix contains the three alternate formats in both French and English, scoring instructions, and norms for the whole sample as well as for English- and French-speaking college and university students separately.

The Appendix also contains preliminary norms for students with specific disabilities. Because of the wording of scale items, we believe that the measure can be used with nondisabled postsecondary students as well, although data for this group were not collected in the context of this investigation.

POSITIVES Scale Subscales. In addition to a total score, the POSITIVES Scale has the following subscales:

- Subscale 1 - ICTs at School Meet Student's Needs. This 12-item subscale evaluates the extent to which students' ICT-related needs are met while they are at school (e.g., My school has enough computers with internet access to meet my needs; The hours of access to computer technologies at my school meet my needs).
- Subscale 2 - ICTs at Home Meet Student's Needs. This 5-item subscale evaluates the extent to which ICT-related needs are met off campus (e.g., Funding for computer technologies for personal use is adequate to meet my needs; My personal computer technologies are sufficiently up-to-date to meet my needs).
- Subscale 3 - E-learning ICTs Meet Student's Needs. This 9-item subscale evaluates the extent to which the school's e-learning meets the student's needs (e.g., My school's web pages are accessible to me; I have no problems when professors use e-learning for tests and exams).

Reliability. Reliability and validity estimates for both English- and French-speaking students with disabilities indicate excellent psychometric properties for the scale. Four-week test-retest reliabilities for the three subscales range from .73 to .79 and the reliability of the total score is .81. Paired t-tests on test and retest scores show no significant differences. Cronbach's alpha, a measure of internal consistency which averages the correlation of items in a survey instrument to assess how well the set of items measures a single construct, ranges from .79 to .91 for the three subscales and it is .94 for the total score. Split-half reliabilities and subscale:total correlations all exceed .70.

Validity. Convergent validity data show moderate correlations among the three subscales and strong relationships between subscale and total scores, suggesting that the subscales measure different concepts, all of which are important components of the accessibility of ICTs. There was no reason to expect that females and males' POSITIVES Scale subscale or total scores would differ. Therefore, to test discriminant validity we compared female and male participants' POSITIVES Scale scores. There were no significant differences between the groups. As expected, score on the overall criterion item "In general, my computer and/or adaptive computer technology needs at my *school* are adequately met" was most closely correlated with Subscale 1 - ICTs at School Meet Student's Needs, and the overall criterion item, "In general, my computer and/or adaptive computer technology needs *at home* are adequately met" was most closely related to Subscale 2 - ICTs at Home Meet Student's Needs. These findings provide concurrent validity information. Based on a priori assumptions, students with psychological/psychiatric disabilities were expected to have their ICT-related needs better met than students with multiple disabilities. To test criterion validity we examined the extent to which the POSITIVES Scale subscales and total scores were able to differentiate between these two groups. The findings show significant differences between the two groups on all subscales as well as on the total score.

How Well Students' ICT-Related Needs are Met

Our results show more favorable than unfavorable scores. Nevertheless, there are some concerns about the availability of adapted computers in school specialized computer laboratories, institutional ICT loan programs, funding for ICTs for personal use, training on ICTs both on and off campus, and technical support when the student is not at school.

The findings also show that students felt the school's web pages are accessible, that they could effectively use the ICTs they needed, that expertise in adaptive ICTs was readily available on campus, that needed electronic format course materials were available, and that the school's interactive online services as well as the library's computer systems were generally quite accessible.

Home versus school. Findings on POSITIVES Scale Subscales indicate that students' e-learning needs and their ICT-related needs at school are better met than their ICT-related needs at home. Comparisons of the views of students with different disabilities about how well their ICT-related needs are met in various contexts at home and at school indicate significant differences.

ICT-related needs of students with different disabilities. Examination of the scores of students with different disabilities/impairments shows that the following needs were better met at home than at school: ICT-related needs of students with low vision, up-to-date features of ICTs of students who are totally blind.

POSITIVES Scale subscales findings suggest that for Subscale 1 (ICTs at School Meet Needs) and Subscale 3 (e-learning ICTs meet students' needs), needs of students who are totally blind, those with multiple disabilities, and those with low vision were met least well, while those of students who are hard of hearing, have a medically related/health problem, have a mobility impairment or a psychological/psychiatric disability were met most effectively.

For Subscale 2 (ICTs at Home Meet Needs), ICT-related needs of the following groups were least well met: multiple disabilities, psychological/psychiatric disability, and learning disability/ADD/ADHD, while needs of students with a mobility impairment, those who are hard of hearing, and those who are totally blind are met best.

Language, institution type and size. The needs of university students who speak French were better met than those of their English-speaking counterparts, while the reverse was true for junior/community college students. Institution size, per se, was not related to how well students felt that their ICT-related needs are met although, in general, students' ICT related needs are better met in colleges than in universities.

Implications and Conclusions

The POSITIVES Scale represents a key step in addressing the evaluation of how well the ICT-related needs of students with disabilities in postsecondary education are met, allowing these students to have a say about the availability, usability, and accessibility of on- and off-campus

ICTs. The measure is brief, simple to score, and can be administered in a variety of formats. The scale (a) permits item-by-item analysis to identify individual areas of perceived strength and weakness, (b) can assess modifiable aspects of the accessibility of ICTs on and off campus, (c) can monitor and evaluate the effects of efforts to improve accessibility, usability, and availability, (d) allows for evaluation of one's own institution's ICTs, and provides a means for (e) continuously measuring progress through internal and external benchmark setting, (f) identifying gaps, (g) targeting specific areas for improvement, and (h) informing policy documents, institutional changes, and ICT budget allocations.

Possible future research directions include: (a) continued validation, (b) additions to the normative data, and (c) collecting new samples, including nondisabled students and samples outside Canada.

To ensure that the ICT-related needs of students with all types of disabilities are well met, using a tool such as the POSITIVES Scale needs to become an institutional priority for colleges, universities, tutoring centers, and rehabilitation facilities. This will result in fewer ICT-related needs being unmet, contribute to the removal of barriers for students, and equip students with disabilities with the skills needed to succeed in the increasingly ICT-driven world of school work, community, and leisure.

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Introduction

During the past few years, skill using information and communication technologies (ICTs) has become mandatory in postsecondary education and the workplace (Stodden, Conway, & Chang, 2003). For example, the literature shows that computer use on the job is linked to higher salaries for employees both with and without disabilities (Canadian Council on Social Development, 2004; Kruse, Krueger, & Drastal, 1996). This makes it important that evidence-based data about how well ICT-related needs of learners with disabilities are met be provided to postsecondary information technology decision makers. Better system-wide collection and publication of data will help to achieve this.

The use of information and communication technologies (ICTs), including e-learning, both on campus and in distance education, is ubiquitous. By now, it is self-evident that for students to succeed in postsecondary education they need to have good access to computer technologies both on and off campus (Green, 2005). As the numbers of students with disabilities

in postsecondary education continue to rise both in Canada (Fichten, Jorgensen, Havel, & Barile, 2006; Tremblay & Le May, 2005) and the US (National Council on Disability, 2003), where a recent large scale study showed that in 2003-2004 11% of undergraduates had a disability (Snyder & Dillow, 2007), so does the need to assure that the growing array of available ICTs on campus is accessible (Konur, 2007; Waddell, 2007).

General Use ICTs and E-learning

Students need to use a variety of general use software such as Microsoft Word for writing papers and email programs as well as software related to their specialties (e.g., for statistical analyses, for virtual science experiments, for language tutorials).

To succeed in college or university learners must also adapt to the extensive use of e-learning used by faculty (Abrami et al. 2006; Weller, Pegler, & Mason, 2005). This includes PowerPoint presentations in class, web-based discussions to further in-class dialogue, and the full range of ICTs that professors use when teaching their courses entirely in the classroom, entirely online, or a combination of both. Students are expected to download materials from course websites, to access course management systems (CMS) such as WebCT and Blackboard, and to give presentations using PowerPoint.

Adaptive Computer Technologies

In addition to general use and e-learning ICTs, many students with disabilities also need to acquire and learn to use adaptive software as well as software which allows them to use ICTs effectively. Findings from our previous investigations indicate how students with different disabilities use computers. The section that follows is based on Fichten, Asuncion, Barile, Fossey, and De Simone's (2000) paper.

Students Who are Blind

Most students who are blind use software that reads what is on the screen (popularly known as a screen reader). In addition to reading text, many of these can "read" icons, tabs, and menu bars as well. By using a scanner and optical character recognition (OCR) software, printed text can be converted into electronic text, which can then be read. Laptops with screen readers and refreshable Braille displays can be used to take notes. In Canada, a popular bilingual screen reading software for students who are blind is Jaws, and a popular OCR software is OpenBook.

Students with Low Vision

These students use software that enlarges the size of visual elements (magnification) as well as employing synthesized speech (text-to-speech) to read electronic text files. Many use both, along with large screen monitors. Many students also need to control the visual display through changing zoom, font size, and font and background color to enhance contrast and visibility. These students, too, use scanners and OCR to enlarge printed materials or to convert printed material into electronic text. A popular bilingual screen reading/magnification software for students with low vision in Canada is ZoomText. Many of these students are able to use the OCR software that comes with their scanner, such as OmniPage.

Students with Mobility and Hand/Arm Impairments

A variety of ergonomic adaptations are likely to be used by these students. Software-based keyboard adaptations include accessibility features in Windows operating systems such as sticky keys (built-in software to allow one keystroke use of keys that require Shift, Control, Alt, etc.), filter keys (to instruct the computer to ignore brief or repeated keystrokes or to slow key repeat rates), mouse keys (allow mouse movements to be emulated by keystrokes), and a virtual

keyboard (similar to those found on certain smart phones). Both software and hardware adaptations can allow for one-handed typing. Students can also use a keyguard (plastic keyboard overlay to prevent hitting two keys at the same time), splints, wrist rests, as well as a variety of alternative mice including trackballs and touch pads. Many students can benefit from dictation software that allows them to dictate content as well as control menus and dialog boxes by voice. Students can also use alternate input devices such as a mouth wand (chopstick like rod with a rubberized tip for typing using one's mouth), a sip-and-puff device (system to give computer commands by blowing or sucking through a straw-like device), or Morse input. Some of these students, too, can benefit from electronic text (no need to handle paper). Thus, scanners with OCR software can be useful for these students as well. Some students also use word prediction software to speed up their typing (after typing two or more letters, multiple options for completing the word are provided). Portable devices such as a laptop or a portable note taking device can also be useful. A popular bilingual dictation software used by students is Dragon Naturally Speaking, and a popular bilingual word prediction software is WordQ.

Students with Hearing Impairments

A variety of electronic dictionaries/encyclopedias as well as both general use (e.g., spell check and grammar check) and specialized writing aids (e.g., word prediction software) can be helpful for these students. They can also use Windows operating system built-in accessibility features such as visual flash (instead of sounds) as well as computer-based and mobile chat programs such as Windows Live Messenger. When accessing video and audio clips, these students can make use of subtitles/captions where available.

Students with Speech/Communication Impairments

These students can use a portable, light-weight laptop, palm-top, or note-taker device (e.g., AlphaSmart 2000) to communicate with others in face-to-face contexts. For class presentations, these students can use a word processor with a multimedia projector instead of speaking or have PowerPoint or other presentation materials projected onto a large screen.

Students with a Learning Disability

Equipment developed for students with disabilities mentioned above can be used by students with learning disabilities. For example, students who have dyslexia or other reading problems can use software that reads what is on the screen as well as screen magnification and highlighting. A popular free product used by many Canadian students is ReadPlease. These students can also use a scanner and OCR to convert printed materials to electronic text. For students who have difficulty writing cursive text, a laptop or portable note-taking device can be useful. Students who have difficulty with grammar and spelling sometimes find dictation software helpful. Those with problems related to organization can use commonly available document manager and scheduling programs. Of course, spelling and grammar check are also important. These students can also benefit from word prediction as well as electronic dictionaries and encyclopedias. Specialized "mind mapping" flow-charting software may also be of interest. Popular bilingual "high end" (i.e., expensive) products that combine many of these elements are Kurzweil 3000 and WYNN.

Adaptable Technologies

Students often engage in the creative use of general use ICTs that are, in fact, used as adaptive aids (e.g., dictation software such as Dragon Naturally Speaking). Such products can be considered “adaptable,” as we found in a previous investigation where we noted a blurring

between adaptive and general use technologies (Fichten, Asuncion, Barile, Fossey, & De Simone, 2000). For example, most people use spell checkers. Students with some learning disabilities use this tool as an assistive aid to help compensate for their disability. Students with a variety of hand or arm impairments and some types of learning disabilities use voice dictation software, originally intended for professionals and executives, as an adaptive technology. In addition screen reading technologies, originally used by individuals with visual impairments, have crossed over into the mainstream. These now form part of mobile computer, GPS-based map and "smart phone" technologies for nondisabled users to access email or receive travel directions on the road. The same is true for scanners and optical character recognition software, currently used as adaptive technologies by students with visual and other print impairments.

Benefits and Advantages of ICTs for Students with Disabilities

ICTs, including e-learning, can promote the inclusion of students with various disabilities (Burgstahler & Doe, 2006). For example, online courses provide enhanced opportunities for people who, because of climate, health, transportation or physical accessibility, experience barriers to attending classroom-based courses (e.g., Debenham, 2002). Similarly, in traditional classes, students who have print impairments can access course notes and handouts available on the course website without assistance.

The most commonly reported advantage of adaptive ICTs noted by students in a previous investigation of 44 junior/community college students with various disabilities (Ferraro, Fichten, & Barile, in press) was associated with the use of spelling and grammar checking (e.g., fewer spelling mistakes), followed by the ability of these technologies to save time (e.g., get essays done faster) and to improve the visual presentation (e.g., neater work) and overall quality of written work (e.g., helps in the development of written assignments). Ommerborn and Schuemer (2001)

surveyed 105 distance education students with disabilities at a German university about the advantages and disadvantages of using a personal computer. Among the advantages most frequently cited by students in their sample were: easier to write essays, easier access to information, easier communication with university staff and with fellow students.

In a recent investigation of the responses of 241 students with various disabilities about the advantages of e-learning, we found that students listed the following e-learning benefits (Fichten, Ferraro, Asuncion, Chwojka, Barile, Nguyen, Klomp, & Wolforth, in press): availability of online course notes and course materials, availability of information anywhere and any time, and easy communication with classmates and professors.

Problems with ICTs for Students with Disabilities

Nevertheless, a variety of barriers can interfere with the effective use of ICTs (Michaels, Prezant, Morabito, & Jackson, 2002; Bouchard & Veillette, 2005; Fichten, Jorgensen, Havel, & Barile, 2005).

In spite of the tremendous opportunities afforded by e-learning for learners with disabilities, there are a variety of barriers that interfere with their effective use. A key concern is that faculty and individuals accountable for supporting and implementing e-learning within postsecondary institutions, in the rush to integrate technology into teaching, fail to think about the accessibility needs of students with various disabilities (Bissonnette, 2006). For example, those in charge of supporting and deploying e-learning generally do not check ahead of time whether newly purchased academic software is compatible with adaptive software that reads what is on the screen to individuals who are blind or ensure the availability of at least one large-screen monitor in general use computer labs (Armstrong, Lewis, Turingan, & Neault, 1997).

In addition, PowerPoint presentations in class, if not posted online ahead of time, can cause difficulties for students with visual and other disabilities requiring adaptive software to read and follow the presentation. Video clips posted on a course website with no captioning can pose problems for students with hearing impairments. This is the case even when students use adaptive software such as screen magnification, screen reading, and dictation software (Bohman, 2007; Burgstahler, Corrigan, & McCarter, 2005; Roberts & Stodden, 2005; Sharpe, Johnson, Izzo, & Murray, 2005).

In our recently completed study of e-learning problems noted by 284 students with various disabilities (Fichten et al. in press), the following problems were noted by at least 10% of students: inaccessibility of websites/course management systems, technical difficulties, poor use of e-learning by professors, difficulty connecting to websites/course management systems, and students' lack of knowledge of how to use e-learning. Also, many of the problems experienced by students with disabilities closely resemble difficulties experienced by nondisabled students: poor usability of websites, course/learning management systems, and e-learning products; technical glitches; problems connecting to websites and downloading and opening files; and lack of instruction in the use of e-learning technologies.

There are problems related to adaptive computer technologies as well. In a recent study of adaptive computer technologies (Ferraro, Fichten, & Barile, in press), we found that the most frequently mentioned issues were related to difficulties using these technologies (e.g., difficulty connecting to the internet using adaptive technologies), a lack of computers with needed adaptive features at home or school (e.g., limited access to computer labs), and problems with spell check/grammar check/correction software not meeting students' needs (e.g., doesn’t correct all mistakes). The lack of available computers reported by students in our sample echoes the findings

of Sharpe and colleagues (2005), who also noted problems with inadequate access. The students in the Ferraro et al. sample indicated that the vast majority of the problems they had encountered using computer technologies either remained unresolved or had required students to devote extra time and effort to resolve (e.g., practice using the software during my spare time). It is noteworthy that in the Ferraro et al. sample, the most frequently mentioned unresolved problems were also the most frequently encountered problems, namely, a lack of computer technologies and difficulties using these. Ommerborn and Schuemer (2001) also showed that the disadvantages most frequently associated with computer use in their sample were: high cost of equipment and internet use, fatigue of posture/wrists/eyes as a result of extended computer use, and a lack of training opportunities for learning how to use a computer effectively. Participants in their study also suggested that increased training and information on adaptive computer technologies for students with disabilities and increased accessibility of e-learning materials and course related websites would improve computer use by students with disabilities.

Recent Changes

Problems experienced by students with disabilities when using all types of ICTs, including e-learning, adaptive, general use, and adaptable products, have changed over the years for a variety of reasons. These include: increasing use of ICTs and e-learning in all aspects of postsecondary teaching and learning, increasing use of computer-based testing materials and tutorials, increasing presence of adaptive technologists on campus, the maturing of adaptive ICTs and their increasing compatibility with general use ICTs, and the improved accessibility and functionality of general use products.

Another change has been the increasing popularity of universal "inclusive" instructional design. At its core, this approach suggests (1) the design of instructional strategies, products and

environments that are usable by all students, to the greatest extent possible, without the need for adaptation, specialized design or extra cost (McGuire, Scott, & Shaw, 2003; Nguyen, Fichten, Barile, & Lévesque, 2006), and (2) that e-learning materials be created keeping the inclusion of students with different disabilities in mind from the beginning (Burgstahler, 2006). Nevertheless, poor availability and accessibility of ICTs as well as some specific forms of e-learning can pose problems even when students use adaptive software (Burgstahler, Corrigan, & McCarter, 2005).

Evaluation of How Well Students' ICT-Related Needs are Met

An important aspect of increased use of ICTs on campus includes ongoing evaluation of how well these technologies meet the needs of students, faculty and other members of the institution's constituencies (Educause, undated). Evaluation should be carried out for a variety of reasons. These include ensuring a return on investment, measuring penetration and acceptance, and pinpointing areas for improvement (Bullock & Ory, 2000). A neglected topic in such evaluations has been consideration of how well ICTs used by students with different disabilities meet their needs. It was recently noted by Burton and Nieuwenhuijsen (2008) that, "The instruments currently used to measure issues and concerns about computer-related technologies among the disabled community clearly are inadequate" (p. 105). They recommended that survey items specifically applicable to computer related ICTs for individuals with disabilities be developed. This is especially true for postsecondary students with disabilities, where ICT use is ubiquitous.

A recent investigation by Thompson and colleagues (Asuncion, Draffan, Guinan, & Thompson, 2009) surveyed junior/community college and university adaptive computer technologists in seven countries, including the U.S. and Canada. This investigation inquired about adaptive ICT use at postsecondary institutions. While this was an extensive investigation of policies and practices, it did not evaluate the views and experiences of the students

themselves. To obtain the student view, the present investigation explored the types of ICTs students indicated using on and off campus.

Recently, we developed a scale concerning adaptive ICTs for campus disability service providers (Fossey et al. 2005) as well as a companion measure to evaluate the availability of adaptive ICTs from the students' vantage point (Fichten et al. 2007). Because of the variety of ICTs used by students with different disabilities it is important to evaluate not only adaptive technologies, but all types of ICTs, including e-learning, general use products, and those needed for the student's program of study, as well as adaptive and adaptable computer and communication technologies. Therefore, in the present investigation we developed the POSITIVES Scale, a brief measure to evaluate how well the ICT-related needs of postsecondary students with various disabilities are met in a variety of contexts both on and off campus.

Method

Participants

A convenience sample of 1354 students (456 males, 894 females, 4 did not indicate, mean age = 28.10, standard deviation = 9.42, range = 18–64, median = 24), from 111 different Canadian universities and junior/community colleges who completed the POSITIVES Scale and the other measures were participants. Of these, 972 students (73%) attended a university and 368 (27%) a junior/community college (see Table 1 for additional details). Participants attended school in all 10 of Canada's provinces (see Table 2 for additional details). Participants were either current students or had attended a postsecondary institution within the past year. One hundred and thirty attended French-speaking institutions (38 university, 91 junior/community college, 1 did not indicate), 1201 attended English-speaking institutions (866 university, 329 junior/community college, 2 distance education university, 4 did not indicate) and 16 attended

bilingual institutions (15 university, 1 junior/community college) (see Table 3 for additional details). One hundred forty-one participants (97 females and 44 males) chose to complete the measures in French and 1213 in English (797 females, 412 males, 4 did not specify). We defined whether students were French- or English-speaking by the language in which they chose to complete the questionnaire, not by the language of their institution. Information on participants' disabilities, broken down by province, is available in Table 4.

Table 1

Institution Attended and Qualifications Pursued

Type of qualification	n	%	Mean age	Sex		Langauge	
				Females	Males	English	French
Qualification sought							
College certificate/diploma	283	20.90%	29.35	184	98	242	41
Undergraduate degree/diploma	736	54.40%	26.22	486	248	715	54
University certificate/diploma	111	8.20%	28.11	72	39	57	21
Graduate degree/diploma	179	13.20%	32.54	122	57	161	18
Other	28	2.10%	36.46	14	13	26	2
Graduated bachelor and/or not in school now	5	0.40%	25.80	5	0	4	1
Institution attended							
College	368	27.46%	30.22	236	130	329	39
University	972	72.54%	27.22	649	321	873	99
Distance education - university	2	<.01%	39.00	1	1	2	-

Note. n = 1348. 12 participants did not report their qualification pursued. 1 participant obtaining a college certificate/diploma, 2 participants obtaining an undergraduate degree, 2 participants attending college, 2 participants attending university and 1 participant pursuing another type of qualification did not specify their sex.1 participant obtaining a college certificate/diploma, 4 participants obtaining an undergraduate degree and 2 participants obtaining a master's degree, 2 participants in college, and 4 participants in university did not report their age. Several participants did not indicate their institution.

Table 2

Demographics of all Participants

Province	n	Sex		Langauge	
		Females	Males	English	French
Provinces					
British Columbia	128	79	48	128	-
Alberta	95	61	34	95	-
Saskatchewan	98	60	38	98	-
Manitoba	59	38	21	57	2
Ontario	482	335	146	477	5
Quebec	277	179	97	147	130
New Brunswick	13	11	2	12	1
Nova Scotia	179	117	61	179	-
Prince Edward Island	1	-	1	1	-
Newfoundland	10	6	4	10	-
Territories					
Yukon	-	-	-	-	-
Northwest Territories	-	-	-	-	-
Nunavut	-	-	-	-	-
Total	1342	886	452	1204	138

Note. n = 1342. 12 participants did not report the province of their school. 1 participant from British Columbia, 1 participant from Ontario, 1 participant from Quebec, and 1 participant from Nova Scotia did not report their sex.

Table 3

Type and Language of Institution Attended

Type of Institution	n	English	French	Bilingual
College/university college	368	329	38	1
University	972	866	91	15
Distance education	2	2	-	-
Total	1342	1197	129	16

Note. n = 1342. 12 participants did not specify the type of institution they attend.

Table 4

Students' Disabilities in Each Province

Type of disability/impairment	n	British Columbia	Alberta	Sask.	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Prince Edward Island	New-foundland
Totally blind	24	6	5	1	1	6	3	1	-	-	1
Low vision	114	21	8	6	9	30	26	1	13	-	-
Deaf	18	-	3	-	-	9	5	-	-	-	1
Hard of hearing	90	10	9	3	5	19	24	-	15	-	5
Speech/communication impairment	45	5	-	4	6	12	13	-	4	-	1
Learning disability/ADD/ADHD	599	45	48	48	13	233	117	11	83	-	1
Mobility impairment	172	28	7	11	14	31	58	1	21	1	-
Limitation in the use of hands/arms	172	25	12	15	11	48	40	-	20	-	1
Medically related/health problem	254	24	15	17	16	85	53	-	43	-	1
Psychological/psychiatric disability	427	42	29	24	28	184	52	2	64	-	2
Neurological impairment	106	12	10	5	10	35	23	-	11	-	-
PDD	17	1	1	3	-	5	5	-	1	-	1
Other	4	1	-	-	-	1	-	-	2	-	-
Total	2042	193	131	130	113	698	419	16	277	1	14

Note: 1354 reported 2042 disabilities. Participants may have more than 1 disability. 1 participant who has low vision, a medically related impairment and a neurological impairment did not report a province.

Measures

Demographic Questions

These include objective questions related to: sex, age, postsecondary institution name and program of study, language, and the nature of students' disabilities/impairments. We have used most of these questions in previous studies (Fichten, Barile, & Asuncion, 1999; Fichten et al. 2005; Fichten, Asuncion, Barile, Ferraro, & Wolforth, in press).

Disabilities

We provided the following list and asked students to indicate as many as applied to them.

a. Totally blind

b. Visual impairment (that is not adequately corrected by wearing glasses or contact lenses)

c. Deaf

d. Hard of hearing

e. Speech/communication impairment

f. Learning disability/ADD/ADHD (e.g., dyslexia)

g. Mobility impairment (e.g., use of a wheelchair/cane/crutches)

h. Limitation in the use of hands/arms

i. Medically related/health problem (e.g., diabetes, Crohn's)

j. Psychological/psychiatric disability (e.g., anxiety, depression)

k. Neurological impairment (e.g., epilepsy, traumatic brain injury)

l. PDD (e.g., autism, Asperger's)

m. Other (please specify)

n. None of the above

Disciplines

Students' programs were classified into nine categories in accordance with a discipline coding manual (Martiniello, Budd, Tibbs, & Ferraro, 2008): business, social sciences, arts and humanities, science and engineering, upgrading and continuing education, professional programs, computer and information technology, career or technical program, and other discipline. In developing the manual, two researchers reviewed existing coding systems (e.g., Holmes, 2005; Statistics Canada, 2008) as well as a sample of participants' responses and noted commonalities that emerged. These findings were then used as the basis for the creation of the nine discipline categories. Two coders independently classified each of the responses according to these categories. In cases where ambiguity existed (for example, where a student reported being registered in a program leading to a Bachelor of Science and who simultaneously indicated an intention to pursue dentistry), disciplines were coded based on the current program of study. Additionally, when a respondent listed more than one program of study, only the primary discipline was considered. The coders then met to discuss any remaining discrepancies until all response codes were agreed upon.

The reliability of coding was assessed according to the following inter-rater reliability formula: Inter-Rater Agreement (%) = 2 (Number of Coder 1 and Coder 2 Agreements) / (Number of codes recorded by Coder 1 + Number of codes recorded by Coder 2) x 100. Inter-rater agreement calculations are based on a total of 1412 codes. Mean inter-rater agreement was 88%. A second measure of inter-rater reliability, Cohen's kappa coefficient, was computed to take into account agreement occurring by chance. The Kappa coefficient was .86. These reliabilities represent substantial agreement between the two raters.

Software/Hardware Used

We asked participants to check as many of the following adaptive computer technologies as they used:

- Software that improves writing quality (e.g., grammar/spell check, outlining, colors and highlighting, word prediction)
- Software that enlarges what is on the screen (e.g., magnification, zoom)
- Software that reads what is on the screen (e.g., screen reader, text-to-speech, listen to text instead of reading it)
- Dictation software (e.g., software writes what you say, speech recognition, speech-to-text, issue voice commands for "Save," "Open," etc.)
- Adapted keyboard (e.g., large keys, on-screen keyboard)
- Alternative mouse (e.g., track ball, mouse keys, joystick mouse)
- Scanning and optical character recognition (OCR) (e.g., scans and reads paper documents)
- Large screen monitor
- Refreshable Braille display

Overall Criterion Items

Using a 6-point Likert scale (1 = strongly disagree, 6 = strongly agree), participants rated two Overall Criterion Items that inquired about how well their computer and/or adaptive computer needs are met at school and at home: "In general, my computer and/or adaptive computer technology needs *at my school* are adequately met" and "In general, my computer and/or adaptive computer technology needs *at home* are adequately met."

POSITIVES Scale (Postsecondary Information Technology Initiative Scale)

We developed this 26-item objective measure concerning how well students' ICT-related needs are met for the present investigation. We adapted the items from a questionnaire we developed earlier to evaluate the accessibility of adaptive computer technologies used by junior/community college students (Fichten et al. 2007) and for disability service providers (Fossey et al. 2005), with modifications suggested by our partner groups of students with disabilities and campus disability service providers. Questions were pilot tested by key informant students with different disabilities to uncover problems.

The POSITIVES Scale examines the extent to which students' computer related needs are met. To complete the measure, students use a 6-point Likert scale (1 = strongly disagree, 6 = strongly agree, N/A = not applicable) to indicate their level of agreement with each of the positively worded items. The measure has three subscales derived using factor analysis (ICTs at School Meet Student's Needs, ICTs at Home Meet Student's Needs, E-learning ICTs Meet Student's Needs), and a Total Score. The measure can be administered online, on paper (printable PDF), and within a Microsoft Word document that can be submitted on a diskette or emailed as an attachment. The measure is available in both French and English in the Appendix.

Procedure

In 2007, an online questionnaire was developed and completed by 1354 Canadian university and junior/community college students with various disabilities. Participants were recruited through email discussion lists (listservs) dealing with Canadian postsecondary education. Project partners publicized the study to their memberships and students who had participated in previous investigations carried out by the authors were contacted. The research protocol was approved by Dawson College's Human Research Ethics Committee.

Potential participants were asked to email the researchers for more information. Those indicating interest were directed to the study's website where they chose the language (English or French) in which they preferred to read the consent form, which provided information about the study, including the honorarium of $10, and to complete the questionnaire. Clicking the "I consent" button brought participants to the online questionnaire, which took approximately 10 minutes to complete.

Once participants clicked on the "Submit" button, they were brought to a screen which asked for contact information to enable us to send the honorarium of $10. Students were also asked if we may contact them again for future projects.

Retest

Four weeks after receipt of students' completed questionnaires we emailed those who indicated that we may do so to request that they complete the measure a second time. Potential participants were informed that the purpose of the retest was to test the reliability of the measure and that upon completion of this we would send another $10 honorarium as a token of our appreciation. Of the original sample, 638 participants (47%) completed the measure a second time (432 females, 205 males, 1 did not indicate, mean age = 28.70, standard deviation = 9.45,

range = 18-59, median = 25). Of these students, 496 (78%) attended a university and 141 (22%) a junior/community college (see Table 5). Participants attended school in 9 of Canada's 10 provinces (see Table 6). Students' sex and the language in which they completed the questionnaire, broken down by province, are provided in Table 7. Students' disabilities, broken down by type of institution, is available in Table 8. Sixty-eight students completed measures in French (51 university, 17 junior/community college) and 569 in English (445 university, 124 junior/community college) (see Table 9). Details concerning participants' disabilities are available in Tables 10 (English-speaking) and Table 11 (French-speaking).

Table 5

Number of Students in University and Junior/Community College: Test-Retest Sample

Type of institution	n	%	Sex		Langauge	
			Females	Males	English	French
College/university college	141	22.10%	96	45	124	17
University	496	77.74%	336	159	445	51
Distance education	-	-	-	-	-	-

Note. n = 637. 1 participant did not specify an institution. 1 participant attending university did not specify sex.

Table 6

Students' Disabilities by Province: Test-Retest Sample

Disability/impairment	n	British Columbia	Alberta	Sask.	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Prince Edward Island	New-foundland
Totally blind	12	1	3	-	1	4	1	1	-	-	1
Low vision	58	9	5	3	6	15	10	-	9	-	-
Deaf	11	-	2	-	-	6	2	-	-	-	1
Hard of hearing	56	4	6	3	4	11	16	-	11	-	1
Speech/communication impairment	24	3	-	2	5	7	6	-	1	-	-
Learning disability/ADD/ADHD	248	26	15	21	6	110	44	3	22	-	1
Mobility impairment	88	16	2	5	8	15	31	-	11	-	-
Limitation in the use of hands/arms	90	12	5	7	7	29	23	-	7	-	-
Medically related/health problem	141	11	8	10	10	47	34	-	21	-	-
Psychological/psychiatric disability	232	30	17	11	17	95	26	1	33	-	2
Neurological impairment	55	8	4	2	6	18	10	-	5	-	-
PDD	8	-	1	2	-	2	1	-	1	-	1
Other	2	1	-	-	-	-	-	-	1	-	-
Total	1025	121	68	66	70	359	204	5	122	0	7

Note. 638 participants reported 1025 disabilities. Participants may have more than 1 disability. Three participants (1 with low vison, 1 with a medically related impairment and 1 with a neurological impairment) did not report a province.

Table 7

Sex and Language: Test-Retest Sample

Province	n	Sex		Language	
		Female	Male	English	French
British Columbia	68	48	20	68	-
Alberta	45	30	15	45	-
Saskatchewan	46	31	15	46	-
Manitoba	34	23	11	34	-
Ontario	233	165	67	233	-
Quebec	126	78	48	59	67
New Brunswick	4	3	1	3	1
Nova Scotia	76	52	24	76	-
Prince Edward Island	5	2	3	5	
Newfoundland	5	2	3	5	-
Total	637	432	204	574	68

Note. n = 637. 1 French-speaking female participant with medical and mobility impairments did not report the province of her school. 1 English-speaking participant with LD from Ontario did not report his/her sex.

Table 8

Disabilities/Impairments Reported by Participants in the Test-Retest Sample Broken Down by Institution Type

Type of disability/impairment	Total n	Junior / Community College		University	
		n	%	n	%
Totally blind	12	3	25%	9	75%
Low vision	59	12	21%	46	79%
Deaf	11	3	27%	8	73%
Hard of hearing	56	15	27%	41	73%
Speech/communication	24	8	33%	16	67%
Learning disability/ADD/ADHD	248	52	21%	196	79%
Mobility impairment	88	25	28%	63	72%
Limitation in the use of hands/arms	90	17	19%	73	81%
Medically related/health problem	142	31	22%	110	78%
Psychological/psychiatric	232	57	25%	175	75%
Neurological impairment	56	9	16%	46	84%
PDD	8	3	38%	5	63%
Other	2	2	100%	0	0%

Note. n = 638. Three participants (1 with low vision, 1 with a medically related impairment and 1 with a neurological impairment) did not report an institution.

Table 9

Number of English- and French-Speaking Students in University and Junior/Community College: Test-Retest Sample

Type of institution	n	Percent	Females	Males
English-speaking				
Junior/community	124	21.79%	88	36
University	445	78.21%	302	142
Total	569	100%	390	178
French-speaking				
Junior/community	17	25.00%	8	9
University	51	75.00%	34	17
Total	68	100%	42	26

Note. n = 637. 1 English-speaking participant did not report his/her sex.

Table 10

Sex and Disabilities of English-Speaking Participants: Test-Retest Sample

Disability/impairment	n	Percent	Mean age	Females	Males
Totally blind	11	1.21%	33.55	7	4
Low vision	53	5.83%	32.55	31	22
Deaf	9	0.99%	30.78	6	3
Hard of hearing	47	5.17%	30.66	29	18
Speech/communication impairment	19	2.09%	29.63	9	10
Learning disability/ADD/ADHD (e.g., dyslexia)	232	25.52%	27.16	154	77
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	64	7.04%	31.75	42	22
Limitation in the use of hands/arms	72	7.92%	31.28	52	20
Medically related/health problem (e.g., diabetes, Crohn's)	123	13.53%	33.17	94	29
Psychological/psychiatric disability (e.g., anxiety, depression)	221	24.31%	29.95	166	55
Neurological impairment (e.g., epilepsy, traumatic brain injury)	49	5.39%	29.90	28	21
PDD (e.g., autism, Asperger's)	7	0.77%	28.71	3	4
Other	2	0.22%	47.50	2	-

Note: 570 participants reported 909 disabilities/impairments. 1 participant with LD did not report his/her sex.

Table 11

Sex and Disabilities of French-Speaking Participants: Test-Retest Sample

Disability/impairment	n	Percent	Mean age	Females	Males
Totally blind	1	1.47%	22.00	1	-
Low vision	6	8.82%	31.33	5	1
Deaf	2	2.94%	26.50	1	1
Hard of hearing	9	13.24%	24.78	6	3
Speech/communication impairment	5	7.35%	33.60	2	3
Learning disability/ADD/ADHD (e.g., dyslexia)	16	23.53%	29.81	10	6
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	24	35.29%	32.42	11	13
Limitation in the use of hands/arms	18	26.47%	30.89	12	6
Medically related/health problem (e.g., diabetes, Crohn's)	19	27.94%	32.21	14	5
Psychological/psychiatric disability (e.g., anxiety, depression)	11	16.18%	31.91	11	-
Neurological impairment (e.g., epilepsy, traumatic brain injury)	7	10.29%	37.86	7	-
PDD (e.g., autism, Asperger's)	1	1.47%	24.00	1	-
Other	-	-	-	-	-

Note: 68 participants reported 119 disabilities/impairments.

Alternate formats. To determine the equivalence of POSITIVES Scale versions that could be completed online, on paper (printable PDF), and within a Microsoft Word document we randomly assigned a subset of English-speaking participants with learning disabilities to complete the retest using one of these three modalities (stratified random sampling by sex). Fifty-nine students participated in this trial (31 females and 28 males). Twenty-one students completed the online version, 14 the paper (printable PDF) version, and 24 the Microsoft Word version. Table 12 provides test-retest intervals. Tables 13 and 14 provide sex and age data for this sample. Table 15 provides information on the type of postsecondary institution attended, and Table 16 provides information on the types of qualifications students were pursuing.

Table 12

Test-Retest Interval for Alternate Format Returns: Weeks

Alternate format	n	Minimum	Maximum	Mean	Standard deviation
Web format	21	3.74	6.60	4.37	0.72
Word format	24	1.04	13.93	5.48	2.58
PDF format	14	4.62	16.27	7.93	3.09
Total	59	1.04	16.27	5.67	2.61

Note: n = 59.

Table 13

Participants who Completed the Retest in an Alternate Format: Sex

Alternate format	n	Percent	Female	Male
Web format	21	35.59%	10	11
Word format	24	40.68%	13	11
PDF format	14	23.73%	8	6

Note: n = 59.

Table 14

Participants who Completed the Retest in an Alternate Format: Age

Alternate format	n	Minimum	Maximum	Mean	Standard deviation
Web format	21	19	53	29.33	10.44
Word format	24	19	53	25.79	7.34
PDF format	14	20	54	28.29	10.45

Note: n = 59.

Table 15

Participants who Completed the Retest in an Alternate Format: Type of Postsecondary Institution

Alternate format		Junior/Community College		University	
	n	n	%	n	%
Web format	21	8	38.10%	13	61.90%
Word format	24	8	33.33%	16	66.67%
PDF format	14	0	0.00%	14	100.00%

Note: n = 59.

Table 16

Participants who Completed the Retest in an Alternate Format: Types of Qualifications Pursued

Qualification pursued	n	%	Web	Word	PDF
College certificate/diploma	9	15.25%	4	5	0
Undergraduate degree/diploma	37	62.71%	13	14	10
University certificate/diploma	2	3.39%	1	1	0
Graduate degree/diploma	7	11.86%	3	3	1
Other	4	6.78%	0	1	3
Graduated bachelor and/or not in school now	0	0.00%	0	0	0

Note: n = 59.

Results

Sample Characteristics

Students' Disabilities

On a 13-item list students checked as many disabilities and impairments as applied to them. Tables 17 and 18 present detailed demographic and disability related information for the whole sample as well as for English- and French-speaking participants separately. The 1354 students reported a total of 2062 disabilities (mean = 1.53 disabilities/student). Table 18 shows that 460 students (34%) reported more than one disability. Table 19 shows that 22% of students indicated two, 8% indicated three, and 4% of students indicated four or more disabilities. It can be seen in Table 17 that the most common disability reported by participants was a learning disability (with or without attention deficit disorder), followed by a psychological/psychiatric disability, and a medically related/health problem.

It can be seen in Table 17 that 45% of students reported having a learning disability with or without attention deficit or hyperactivity disorder, 32% reported a psychological/psychiatric disability, 19% a medically related/health problem, 13% a mobility impairment, 13% a limitation in the use of hands/arms, 9% a "visual impairment that is not adequately corrected by wearing glasses or contact lenses," 8% a neurological impairment, 7% a hearing impairment, 3% a speech/communication impairment, 2% being "totally blind," 1% being Deaf, 1%, having a pervasive developmental disorder (PDD such as autism and Asperger's), and 1% having another disability. Data in Table 17 are presented for English- and French-speaking participants separately. Additional details concerning demographics and the disabilities of English- and French-speaking participants are available in Tables 20 and 21, respectively. The data show that, like English-speaking students, large numbers of students who completed the measure in French

also had a learning disability, a psychological/psychiatric disability or a medically related/health problem. Nevertheless, the most common disabilities for French-speaking participants were a mobility impairment and limitation in the use of hands and/or arms.

Table 17

Demogrpahics and Disabilities of Participants: All Participants Reporting Each Disability

Disability/impairment	n	Percent	Mean age	Sex		Language	
				Females	Males	English	French
Totally blind	24	2%	31.83	13	11	23	1
Low vision	116	9%	31.24	70	45	98	18
Deaf	19	1%	29.78	13	6	14	5
Hard of hearing	92	7%	29.22	58	34	76	16
Speech/communication impairment	45	3%	28.98	24	21	36	9
Learning disability/ADD/ADHD (e.g., dyslexia)	603	45%	26.31	387	215	565	38
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	176	13%	32.03	111	65	129	47
Limitation in the use of hands/arms	172	13%	32.64	113	58	141	31
Medically related/health problem (e.g., diabetes, Crohn's)	258	19%	32.39	197	58	226	32
Psychological/psychiatric disability (e.g., anxiety, depression)	429	32%	29.25	319	110	407	22
Neurological impairment (e.g., epilepsy, traumatic brain injury)	107	8%	30.98	70	37	91	16
PDD (e.g., autism, Asperger's)	17	1%	25.59	6	11	15	2
Other	4	<1%	38.50	3	1	4	0

Note: 1354 participants reported 2062 disabilities. Participants may have more than one disability. 1 participant with a visual impairment, 1 participant who is Deaf, 5 participants with LD, 2 participants with a mobility impairment, 1 participant with a limitation in the use of hands/arms, 1 participant with a medically related impairment, 1 participant with a psychological/psychiatric impairment, and 1 participant with a neurological impairment did not specify their age. 1 participant with a visual impairment, 1 participant with LD, 1 participant with a limitation in the use of hands/arms, and 3 participants with a medically related impairment did not specify their sex.

Table 18

Demographics and Disabilities of Participants: Single Versus Multiple Disabilities

Disability/impairment	n	Percent	Mean age	Sex		Language	
				Female	Male	English	French
Totally blind	17	1%	30.71	8	9	16	1
Low vision	62	5%	27.26	33	29	51	11
Deaf	14	1%	27.36	8	6	9	5
Hard of hearing	43	3%	26.58	28	15	34	9
Speech/communication impairment	2	<1%	21.00	1	1	2	0
Learning disability/ADD/ADHD	386	29%	24.44	243	142	367	19
Mobility impairment	51	4%	31.02	31	20	34	17
Limitation in the use of hands/arms	47	3%	29.49	32	15	44	3
Medically related/health problem	67	5%	30.82	50	16	60	7
Psychological/psychiatric disability	172	13%	27.52	125	47	169	3
Neurological impairment	27	2%	29.63	16	11	23	4
PDD	6	<1%	25.00	2	4	5	1
Other	0	0%	n/a	n/a	n/a	n/a	n/a
Multiple disabilities/impairments	460	34%	30.70	317	141	399	61

Note : n = 1354. 1 subject with a visual impairment, 3 subjects with LD, 1 subject with a mobility impairment, and 3 with multiple impairments did not report age. 1 subject with LD, 1 with a medical impairment and 2 subjects with multiple disabilities did not specify sex. All subjects reported either a single disability (e.g., totally blind) or multiple disabilities (e.g., totally blind and LD).

Table 19

Number of Different Disabilities: Whole Sample, English- and French-Speaking Samples

Number of different disabilities	Number of students	% of students	# English-speaking	% of English-speaking	# French-speaking	% of French-speaking
1	893	65.95%	813	67.02%	80	56.74%
2	300	22.16%	262	21.60%	38	26.95%
3	107	7.90%	90	7.42%	17	12.06%
4	34	2.51%	31	2.56%	3	2.13%
5	13	0.96%	11	0.91%	2	1.42%
6	4	0.30%	4	0.33%	0	0.00%
7	1	0.07%	1	0.08%	0	0.00%
8	2	0.15%	1	0.08%	1	0.71%
Total	1354	100.00%	1213	100.00%	141	100.00%

Note: n = 1354.

Table 20

Demographics and Disabilities of Participants: All English-Speaking Participants Reporting Each Disability

Disability/impairment	n	Percent	Mean age	Females	Males
Totally blind	23	1.90%	32.26	12	11
Low vision	98	8.08%	31.29	56	41
Deaf	14	1.15%	30.85	10	4
Hard of hearing	76	6.27%	30.22	46	30
Speech/communication impairment	36	2.97%	28.28	18	18
Learning disability/ADD/ADHD (e.g., dyslexia)	565	46.58%	26.26	360	204
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	129	10.63%	31.68	81	48
Limitation in the use of hands/arms	141	11.62%	33.07	94	46
Medically related/health problem (e.g., diabetes, Crohn's)	226	18.63%	32.39	173	50
Psychological/psychiatric disability (e.g., anxiety, depression)	407	33.55%	29.20	298	109
Neurological impairment (e.g., epilepsy, traumatic brain injury)	91	7.50%	30.33	55	36
PDD (e.g., autism, Asperger's)	15	1.24%	25.80	5	10
Other	4	0.33%	38.50	3	1

Note: 1213 participants reported 1825 disabilities/impairments. 1 participant with a visual impairment, 1 participant with LD, 1 participant with a limitation in the use of hands/arms, and 3 participants with medically related impairments did not report their sex. 1 participant who is Deaf, 1 participant with a visual impairment, 5 participants with LD, 2 participants with mobility impairments, 1 participant with a limitation in the use of hands/arms, 1 participant with a medically related impairment, 1 participant with a psychiatric disability, and 1 participant with a neurological impairment did not specify their age.

Table 21

Demographics and Disabilities of Participants: All French-Speaking Participants Reporting Each Disability

Disability/impairment	n	Percent	Mean age	Females	Males
Totally blind	1	0.71%	22.00	1	0
Low vision	18	12.77%	31.00	14	4
Deaf	5	3.55%	27.00	3	2
Hard of hearing	16	11.35%	24.44	12	4
Speech/communication impairment	9	6.38%	31.78	6	3
Learning disability/ADD/ADHD (e.g., dyslexia)	38	26.95%	27.03	27	11
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	47	33.33%	32.98	30	17
Limitation in the use of hands/arms	31	21.99%	30.71	19	12
Medically related/health problem (e.g., diabetes, Crohn's)	32	22.70%	32.34	24	8
Psychological/psychiatric disability (e.g., anxiety, depression)	22	15.60%	30.18	21	1
Neurological impairment (e.g., epilepsy, traumatic brain injury)	16	11.35%	34.63	15	1
PDD (e.g., autism, Asperger's)	2	1.42%	24.00	1	1
Other	-	-	-	-	-

Note: 141 participants reported 237 disabilities/impairments.

Students' Academic Programs and Disciplines

It can be seen in Table 1 that the majority of students, both English- and French-speaking, were pursuing an undergraduate degree (54%) or a college certificate/diploma (Associate's Degree: 21%). Additional details about the type of qualification pursued by students with different disabilities are available in Table 22.

Table 22

Qualifications Pursued by Participants with Various Disabilities

Disability/impairment	Total n	College certificate/ diploma		Undergraduate degree/ diploma		University certificate/ diploma		Graduate degree/ diploma		Other		Graduated Bachelor and/or not in school now	
		n	%	n	%	n	%	n	%	n	%	n	%
Blind	24	3	13%	11	46%	0	0%	4	17%	6	25%	0	0%
Low vision	116	23	20%	53	46%	12	10%	21	18%	5	4%	1	1%
Deaf	19	4	21%	7	37%	1	5%	6	32%	1	5%	0	0%
Hard of hearing	92	23	25%	47	51%	6	7%	12	13%	1	1%	0	0%
Speech/communication	45	14	31%	20	44%	5	11%	6	13%	0	0%	0	0%
Learning disability/ADD/ADHD	603	120	20%	371	62%	34	6%	64	11%	10	2%	0	0%
Mobility impairment	176	42	24%	80	45%	21	12%	25	14%	6	3%	0	0%
Limitation in the use of hands/arms	172	43	25%	82	48%	11	6%	29	17%	6	3%	0	0%
Medically related/health problem	258	61	24%	135	52%	13	5%	41	16%	6	2%	0	0%
Psychological/psychiatric	429	92	21%	247	58%	21	5%	61	14%	2	0%	3	1%
Neurological impairment	107	17	16%	49	46%	9	8%	25	23%	6	6%	1	1%
PDD	17	6	35%	10	59%	1	6%	0	0%	0	0%	0	0%
Other	4	3	75%	0	0%	0	0%	1	25%	0	0%	0	0%

Note : 1354 participants reported 2062 disabilities. 1 participant with a visual impairment, 3 participants who are hard of hearing, 4 participants with LD, 2 participants with a mobility impairment, 1 participant with limitation in the use of hands/arms, 2 participants with medical impairments, and 3 participants with psychological impairments did not specify a qualification pursued.

Participants' responses to the question, "What is your field of study/discipline?" broken down by sex are presented in Table 23. Overall, the findings show that the largest proportion of participants (29%) were enrolled in the social sciences followed by arts and humanities (18%) and by science and engineering (16%). Chi-square tests on proportions indicate that males were more likely than females to be enrolled in business, science and engineering, and computer and information technology programs, and that females were more likely than males to be enrolled in arts and humanities, professional programs (e.g., law, social work), and career or technical programs (e.g., nursing, radiation oncology).

Table 23

Participants Enrolled in Each Discipline Broken Down by Sex

	Total sample		Females		Males		χ^2	df	p
Discipline	n	%	n	%	n	%			
Business	146	11%	77	8.77%	68	15.01%	11.99	1,145	0.0005
Social sciences	385	29%	269	30.64%	116	25.61%	3.68	1.385	0.0550
Arts and humanities	241	18%	175	19.93%	65	14.35%	6.30	1,240	0.0120
Science and engineering	215	16%	117	13.33%	98	21.63%	15.23	1,215	0.0001
Upgrading and continuing education	26	2%	17	1.94%	8	1.77%	0.05	1.25	0.8284
Professional programs	171	13%	136	15.49%	34	7.51%	17.10	1,170	0.0000
Computer and information technology	72	5%	24	2.73%	48	10.60%	36.10	1,72	0.0000
Career or technical program	61	5%	52	5.92%	9	1.99%	10.59	1.61	0.0011
Other	18	1%	11	1.25%	7	1.55%	0.19	1.18	0.6617
Total	1335	100%	878	100.00%	453	100.00%			

Note: n = 1335. 16 female and 3 male participants did not report what discipline they were studying. 1 participant in business, 1 participant in arts and humanities, 1 participant in upgrading/continuing education, and 1 participant in a professional program did not report their sex.

Disciplines, broken down by students' disability, are available in Table 24. This shows that students who were totally blind were most likely to be enrolled in the social sciences and in upgrading and continuing education; students with low vision were most likely to be in business and in social sciences; students who were Deaf were most likely to be in social sciences, in sciences and engineering, and in professional programs; students who were hard of hearing were most likely to be in arts and humanities and in science and engineering; students who have a learning disability, with or with attention deficit and/or attention deficit hyperactivity disorder, were most likely to be in social sciences and in sciences and engineering; students with a mobility impairment were most likely to be in business and in science and engineering; students with limitations in the use of their hands or arms as well as students with a neurological impairment were most likely to be in social sciences and in professional programs; students with a medically related or health problem were most likely to be in business, in social sciences and in science and engineering; students with a psychological or psychiatric disability as well as those with multiple disabilities were most like to be in social sciences and in arts and humanities; and those with a pervasive developmental disorder (PDD) were most likely to be in arts and

humanities as well as in computer and information technology. There were insufficient numbers of students with a speech or communication impairment for meaningful results. For English- and French-speaking students' disciplines see Tables 25 and 26.

To evaluate the representativeness of our sample of students we recoded our data to enable us to carry out a comparison with recent data from Holmes (2005), who examined the disciplines of large samples of university and college students with and without disabilities based on two random sampling surveys carried out in 2002: the Canadian Undergraduate Student Survey and the Canadian College Student Survey. These included 10,606 university undergraduates without disabilities and 691 with disabilities, and 3,722 junior/community college students without disabilities and 518 with disabilities.

Our nine coding categories include all six of Holmes' (2005) discipline categories for university students. To compare Holmes' six categories of university disciplines to the nine used in our sample it was necessary to (a) recode our data into six categories and (b) calculate the percentages of students within each discipline in the Holmes sample. Because these were not available in the text, percentages had to be computed from the bar graph in the article. The bar graph increased by increments of 5%. To obtain the most accurate percentage estimates based on Holmes' data we scanned and enlarged the figure presenting the data, drew vertical gridlines at increments of 5% and measured the distance between vertical gridlines to be 2.5 cm. Dividing 2.5 cm by 5%, each percentage point was represented by 0.5 cm on the graph. When a bar ended between two gridlines, we measured the distance between the end of the bar and the previous gridline. The smallest distance we were able to measure was 0.05 cm, which represented 0.1% according to our established scale. This technique was used to obtain the percentages of students with and without disabilities for all six of the disciplines of university students presented in Holmes' article.

Table 24

Disciplines Broken Down By Students' Disability and Sex

	Total	Female	Male	Business			Social sciences			Arts and humanities			Science and engineering			Upgrading and continuing ed.			Professional programs			Computer and information technology			Career or technical program			Other		
Disability/impairment	n	n	n	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %
Totally blind	17	8	9	1	0	6%	3	3	35%	2	1	18%	0	1	6%	1	3	24%	0	0	0%	0	1	6%	1	0	6%	0	0	0%
Low vision	60	31	29	4	11	25%	8	5	22%	7	4	18%	5	3	13%	1	1	3%	5	2	12%	0	3	5%	1	0	2%	0	0	0%
Deaf	13	8	5	1	1	15%	2	1	23%	0	1	8%	2	1	23%	0	0	0%	3	0	23%	0	1	8%	0	0	0%	0	0	0%
Hard of hearing	41	26	15	5	3	20%	4	2	15%	6	6	29%	5	4	22%	2	0	5%	2	0	5%	0	0	0%	2	0	5%	0	0	0%
Speech/communication impairment	2	1	1	0	1	50%	0	0	0%	0	0	0%	1	0	50%	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Learning disability/ADD/ADHD	383	240	142	14	22	9%	73	35	28%	46	21	17%	43	41	22%	4	1	1%	38	8	12%	4	12	4%	13	2	4%	5	0	1%
Mobility impairment	49	30	19	5	8	27%	6	2	16%	3	3	12%	9	2	22%	0	0	0%	4	1	10%	0	3	6%	3	0	6%	0	0	0%
Limitation in the use of hands/arms	46	31	15	4	0	9%	7	3	22%	5	2	15%	4	5	20%	1	0	2%	7	3	22%	0	1	2%	3	0	7%	0	1	2%
Medically related/ health problem	66	49	16	9	2	17%	13	2	23%	8	1	14%	4	7	17%	0	1	2%	9	1	15%	5	1	9%	1	1	3%	0	0	0%
Psychological/psychiatric disability	171	124	47	9	8	10%	57	19	44%	19	6	15%	14	4	11%	1	0	1%	11	5	9%	6	2	5%	6	3	5%	1	0	1%
Neurological impairment	27	16	11	2	1	11%	7	3	37%	3	0	11%	1	2	11%	0	0	0%	2	5	26%	0	0	0%	1	0	4%	0	0	0%
PDD	6	2	4	0	0	0%	0	0	0%	1	1	33%	0	0	0%	0	0	0%	1	0	17%	0	2	33%	0	0	0%	0	1	17%
Multiple disabilities/impairments	454	312	140	23	11	7%	89	41	29%	75	19	21%	29	28	13%	7	2	2%	54	9	14%	9	22	7%	21	3	5%	5	5	2%
Total	1335	878	453	77	68	11%	269	116	29%	175	65	18%	117	98	16%	17	8	2%	136	34	13%	24	48	5%	52	9	5%	11	7	1%

Note: n = 1335. 16 female participants and 3 male participants did not report what discipline they were studying. 1 participant studying business, 1 participant studying arts and humanities, 1 participant in upgrading/continuing education, and 1 participant studying a professional program did not report their sex.
Boxed items denote the most popular disciplines for each disability group.

Table 25

English-Speaking Participants' Disciplines Broken Down By Students' Disability and Sex

	Total	Female	Male	Business			Social sciences			Arts and humanities			Science and engineering			Upgrading and continuing ed.			Professional programs			Computer and information technology			Career or technical program			Other		
Disability/impairment	n	n	n	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %
Totally blind	16	7	9	1	0	6%	3	3	38%	1	1	13%	0	1	6%	1	3	25%	0	0	0%	0	1	6%	1	0	6%	0	0	0%
Low vision	50	24	26	3	10	26%	7	4	22%	6	4	20%	2	3	10%	1	1	4%	4	2	12%	0	2	4%	1	0	2%	0	0	0%
Deaf	9	5	4	1	1	22%	1	1	22%	0	1	11%	2	1	33%	0	0	0%	1	0	11%	0	0	0%	0	0	0%	0	0	0%
Hard of hearing	34	22	12	5	3	24%	3	2	15%	5	5	29%	3	2	15%	2	0	6%	2	0	6%	0	0	0%	2	0	6%	0	0	0%
Learning disability/ADD/ADHD	364	229	134	12	21	9%	70	33	28%	44	20	18%	42	38	22%	4	1	1%	35	7	12%	4	12	4%	13	2	4%	5	0	1%
Mobility impairment	33	21	12	4	5	27%	5	1	18%	2	2	12%	7	0	21%	0	0	0%	2	1	9%	0	3	9%	1	0	3%	0	0	0%
Limitation in the use of hands/arms	43	30	13	4	0	9%	7	3	23%	5	2	16%	4	5	21%	1	0	2%	6	1	16%	0	1	2%	3	0	7%	0	1	0%
Medically related/health problem	59	43	15	8	2	17%	11	2	22%	8	1	15%	3	6	15%	0	1	2%	8	1	15%	4	1	8%	1	1	2%	0	0	0%
Psychological/psychiatric disability	168	121	47	8	8	10%	56	19	45%	19	6	15%	13	4	10%	1	0	1%	11	5	10%	6	2	5%	6	3	4%	1	0	1%
Neurological impairment	23	13	10	2	1	13%	6	3	39%	2	0	9%	1	2	13%	0	0	0%	2	4	26%	0	0	0%	0	0	0%	0	0	0%
Multiple disabilities/impairments	394	269	123	19	9	7%	73	38	28%	69	13	21%	26	26	13%	7	2	2%	46	9	14%	7	18	6%	18	3	5%	4	5	1%
Total	1193	784	405	67	60	11%	242	109	29%	161	55	18%	103	88	16%	17	8	2%	117	30	12%	21	40	5%	46	9	4%	10	6	1%

Note: n = 1193. 13 female and 7 male participants did not report the discipline they were studying. 1 participant with LD, 1 participant with a medically related impairment, and 2 participants with multiple disabilities did not report their sex. 2 participants in business, 3 participants in arts and humanities, 1 participant in science and engineering, 1 participant in upgrading/continuing education, 2 participants in a professional program, and 1 participant in "other" did not report their sex.

Table 26

French-Speaking Participants' Disciplines Broken Down By Students' Disability and Sex

	Total	Female	Male	Business			Social sciences			Arts and humanities			Science and engineering			Upgrading and continuing ed.			Professional programs			Computer and information technology			Career or technical program			Other		
Disability/impairment	n	n	n	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %	F n	M n	Total %
Totally blind	1	1	0	0	0	0%	0	0	0%	1	0	100%	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Low vision	10	7	3	1	1	20%	1	1	20%	1	0	10%	3	0	30%	0	0	0%	1	0	10%	0	1	10%	0	0	0%	0	0	0%
Deaf	4	3	1	0	0	0%	1	0	25%	0	0	0%	0	0	0%	0	0	0%	2	0	50%	0	1	25%	0	0	0%	0	0	0%
Hard of hearing	7	4	3	0	0	0%	1	0	14%	1	1	29%	2	2	57%	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Learning disability/ADD/ADHD	19	11	8	2	1	16%	3	2	26%	2	1	16%	1	3	21%	0	0	0%	3	1	21%	0	0	0%	0	0	0%	0	0	0%
Mobility impairment	16	9	7	1	3	25%	1	1	13%	1	1	13%	2	2	25%	0	0	0%	2	0	13%	0	0	0%	2	0	13%	0	0	0%
Limitation in the use of hands/arms	3	1	2	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%	1	2	100%	0	0	0%	0	0	0%	0	0	0%
Medically related/health problem	7	6	1	1	0	14%	2	0	29%	0	0	0%	1	1	29%	0	0	0%	1	0	14%	1	0	14%	0	0	0%	0	0	0%
Psychological/psychiatric disability	3	3	0	1	0	33%	1	0	33%	0	0	0%	1	0	33%	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Neurological impairment	4	3	1	0	0	0%	1	0	25%	1	0	25%	0	0	0%	0	0	0%	0	1	25%	0	0	0%	1	0	25%	0	0	0%
Multiple disabilities/impairments	60	43	17	4	2	10%	16	3	32%	6	6	20%	3	2	8%	0	0	0%	8	0	13%	2	4	10%	3	0	5%	1	0	2%
Total	134	91	43	10	7	13%	27	7	25%	13	9	16%	13	10	17%	0	0	0%	18	4	16%	3	6	7%	6	0	4%	1	0	1%

Note: n = 134. 1 male and 6 female participants did not report what discipline they were studying. 1 participant studying a professional program did not report his/her sex.

Holmes (2005) had severe restrictions when analyzing data from junior/community colleges. This resulted in a limited and very narrow set of choices. Therefore, we did not attempt to compare our data for junior/community college students with those of his samples.

Results in Table 27 show that in both our sample and in that of Holmes (2005), the most popular disciplines for university students with disabilities were social sciences and arts and humanities, followed by science and engineering. The percentages, both in our sample as well as in Holmes', show that students with disabilities were more likely than nondisabled students to be taking a program in social science or in arts/humanities and less likely to be taking business. Although in Holmes' sample students with disabilities were less likely to be taking science and engineering than nondisabled students, this was not the case in our sample. Table 27 shows that 21% of students with disabilities in our sample and 22% of students in Holmes' nondisabled sample were enrolled in science and engineering.

Table 27

Disciplines: Comparison of University Students in the Present Sample with Those in Holmes (2005)

Discipline	Present Sample		Holmes' Sample	
	n	Students with disabilities	Students with disabilities	Students without disabilities
Business	84	8.76%	9.80%	16.00%
Social Sciences	306	31.91%	20.60%	19.40%
Arts and Humanities	206	21.48%	26.00%	18.20%
Science and Engineering	205	21.38%	15.40%	21.70%
Professional Programs	137	14.29%	8.40%	8.00%
Other	21	2.19%	19.50%	16.40%
Total	959	100.00%	99.70%	99.70%

Note: n = 959 for our study. 13 university participants did not indicate their discipline. Numbers don't sum to 100% because of rounding.

Software/Hardware Used

Table 28 shows the types of adaptive ICTs students with different disabilities reported using. Tables 29 and 30 provide data for English- and French-speaking participants separately.

Overall, the findings indicate that specialized software which improves writing quality, such as grammar and spell checkers, are used by over 40% of students in the sample. In rank order, for all students in the sample, the results show the following:

1. Software that improves writing quality
2. Software that reads what is on the screen
3. Scanning and optical character recognition (OCR)
4. Dictation software
5. Software that enlarges what is on the screen
6. Large screen monitor
7. Alternative mouse
8. Adapted keyboard
9. Refreshable Braille display

But the numbers of students with different disabilities varies in the sample and the very large numbers of students with a learning disability, with psychological/psychiatric impairments, and with multiple disabilities can skew the results. Therefore, we also note here the adaptive computer technologies mentioned by a minimum of 15% of students in each disability grouping. Students who were totally blind indicated using

1. Software that reads what is on the screen
2. Scanning and optical character recognition (OCR)
3. Refreshable Braille display

4. Software that improves writing quality

Students with low vision indicated using

1. Software that enlarges what is on the screen
2. Software that reads what is on the screen
3. Large screen monitor
4. Software that improves writing quality
5. Scanning and optical character recognition (OCR)

Students who are Deaf indicated using

1. Software that improves writing quality
2. Scanning and optical character recognition (OCR)

Students who are hard of hearing indicated using

1. Software that improves writing quality

Students with a learning disability/ADD/ADHD indicated using

1. Software that improves writing quality
2. Software that reads what is on the screen
3. Scanning and optical character recognition (OCR)
4. Dictation software

Students with a mobility impairment indicated using

1. Software that improves writing quality

Students with a limitation in the use of their hands or arms indicated using

1. Software that improves writing quality
2. Dictation software
3. Alternative mouse

4. Adapted keyboard

Students with a medically related/health problem indicated using

1. Software that improves writing quality
2. Software that enlarges what is on the screen

Students with a psychological/psychiatric disability indicated using

1. Software that improves writing quality

Students with a neurological impairment indicated using

1. Software that improves writing quality
2. Dictation software

Students with pervasive developmental disorder (PDD) indicated using

1. Software that improves writing quality

Students with multiple disabilities/impairments indicated using

1. Software that improves writing quality
2. Software that reads what is on the screen
3. Dictation software
4. Software that enlarges what is on the screen
5. Scanning and optical character recognition (OCR)
6. Large screen monitor

Table 28

Adaptive Computer Technologies Used by Participants

Disability/impairment	Total n	Software that improves writing quality		Software that reads what is on the screen		Scanning and optical character recognition (OCR)		Dictation software		Software that enlarges what is on the screen		Large screen monitor		Alternative mouse		Adapted keyboard		Refreshable Braille display		Other	
		n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students
Totally blind	17	7	41%	17	100%	15	88%	0	0%	0	0%	0	0%	1	6%	0	0%	12	71%	3	18%
Low vision	62	27	44%	29	47%	18	29%	2	3%	44	71%	31	50%	4	6%	4	6%	3	5%	0	0%
Deaf	14	7	50%	1	7%	4	29%	0	0%	0	0%	0	0%	2	14%	0	0%	0	0%	2	14%
Hard of hearing	43	23	53%	4	9%	2	5%	2	5%	2	5%	2	5%	4	9%	0	0%	0	0%	3	7%
Speech/communication impairment	2	2	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Learning disability/ADD/ADHD	386	299	77%	129	33%	80	21%	77	20%	28	7%	16	4%	12	3%	5	1%	0	0%	17	4%
Mobility impairment	51	23	45%	2	4%	2	4%	7	14%	3	6%	2	4%	3	6%	0	0%	0	0%	2	4%
Limitation in the use of hands/arms	47	27	57%	2	4%	2	4%	14	30%	2	4%	5	11%	10	21%	9	19%	0	0%	2	4%
Medically related/health problem	67	36	54%	2	3%	3	4%	4	6%	11	16%	5	7%	3	4%	0	0%	0	0%	3	4%
Psychological/psychiatric disability	172	97	56%	12	7%	11	6%	8	5%	13	8%	8	5%	10	6%	1	1%	0	0%	2	1%
Neurological impairment	27	14	52%	4	15%	2	7%	5	19%	0	0%	1	4%	1	4%	0	0%	0	0%	1	4%
PDD	6	*5*	83%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Multiple disabilities/impairments	460	313	68%	107	23%	86	19%	99	22%	95	21%	73	16%	54	12%	26	6%	8	2%	23	5%
Total	1354	880	65%	309	23%	225	17%	218	16%	198	15%	143	11%	##	8%	45	3%	23	2%	58	4%

Note: n = 1354. Boxed items denote 15% or greater.

Table 29

Adaptive Computer Technologies Used by English-Speaking Participants

		Software that improves writing quality		Software that reads what is on the screen		Scanning and optical character recognition (OCR)		Dictation software		Software that enlarges what is on the screen		Large screen monitor		Alternative mouse		Adapted keyboard		Refreshable Braille display		Other	
Disability/impairment	Total n	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Totally blind	16	6	38%	0	0%	16	100%	0	0%	0	0%	1	6%	14	88%	0	0%	11	69%	3	19%
Low vision	51	24	47%	37	73%	26	51%	2	4%	3	6%	3	6%	16	31%	28	55%	3	6%	0	0%
Deaf	9	5	56%	0	0%	1	11%	0	0%	0	0%	0	0%	1	11%	0	0%	0	0%	2	22%
Hard of hearing	34	22	65%	1	3%	4	12%	2	6%	0	0%	3	9%	2	6%	1	3%	1	3%	2	6%
Speech/communication impairment	2	2	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Learning disability/ADD/ADHD	367	282	77%	28	8%	126	34%	77	21%	5	1%	12	3%	78	21%	15	4%	0	0%	16	4%
Mobility impairment	34	16	47%	1	3%	2	6%	7	21%	0	0%	2	6%	2	6%	1	3%	0	0%	1	3%
Limitation in the use of hands/arms	44	24	55%	2	5%	2	5%	14	32%	8	18%	9	20%	1	2%	5	11%	0	0%	1	2%
Medically related/health problem	60	34	57%	10	17%	2	3%	4	7%	0	0%	3	5%	3	5%	5	8%	0	0%	3	5%
Psychological/psychiatric disability	169	95	56%	11	7%	12	7%	8	5%	1	1%	10	6%	11	7%	7	4%	0	0%	2	1%
Neurological impairment	23	12	52%	0	0%	4	17%	5	22%	0	0%	1	4%	2	9%	1	4%	0	0%	1	4%
PDD	5	4	80%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Multiple disabilities/impairments	399	275	69%	88	22%	98	25%	89	22%	22	6%	50	13%	77	19%	64	16%	7	2%	23	6%
Total	1213	801	66%	178	15%	293	24%	208	17%	39	3%	94	8%	207	17%	127	10%	22	2%	54	4%

Note: n = 1213.

Table 30

Adaptive Computer Technologies Used by French-Speaking Participants

		Software that improves writing quality		Software that reads what is on the screen		Scanning and optical character recognition (OCR)		Dictation software		Software that enlarges what is on the screen		Large screen monitor		Alternative mouse		Adapted keyboard		Refreshable Braille display		Other	
Disability/impairment	Total n	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students	n	% of Students
Totally blind	1	1	100%	0	0%	1	100%	0	0%	0	0%	0	0%	1	100%	0	0%	1	100%	0	0%
Low vision	11	3	27%	7	64%	3	27%	0	0%	1	9%	1	9%	2	18%	3	27%	0	0%	0	0%
Deaf	5	2	40%	0	0%	0	0%	0	0%	0	0%	2	40%	3	60%	0	0%	0	0%	0	0%
Hard of hearing	9	1	11%	1	11%	0	0%	0	0%	0	0%	1	11%	0	0%	1	11%	0	0%	1	11%
Speech/communication impairment	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Learning disability/ADD/ADHD	19	17	89%	0	0%	3	16%	0	0%	0	0%	0	0%	2	11%	1	5%	0	0%	1	5%
Mobility impairment	17	7	41%	2	12%	0	0%	0	0%	0	0%	1	6%	0	0%	1	6%	0	0%	1	6%
Limitation in the use of hands/arms	3	3	100%	0	0%	0	0%	0	0%	1	33%	1	33%	1	33%	0	0%	0	0%	1	33%
Medically related/health problem	7	2	29%	1	14%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Psychological/psychiatric disability	3	2	67%	2	67%	0	0%	0	0%	0	0%	0	0%	0	0%	1	33%	0	0%	0	0%
Neurological impairment	4	2	50%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
PDD	1	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Multiple disabilities/impairments	61	38	62%	7	11%	9	15%	10	16%	4	7%	4	7%	9	15%	9	15%	1	2%	0	0%
Total	141	79	56%	20	14%	16	11%	10	7%	6	4%	10	7%	18	13%	16	11%	2	1%	4	3%

Note: n =141.

POSITIVES Scale Properties

Two types of reliability estimates were obtained for the POSITIVES Scale: temporal stability (test-retest) and internal consistency (Cronbach's alpha (a measure of internal consistency which averages the correlation of items in a survey instrument to assess how well the set of items measures a single construct), split-half, item:total). All items with acceptable test-retest reliability were included in a factor analysis which yielded 3 factors (Subscales). Construct, concurrent and criterion validity were evaluated (a) by correlating POSITIVES Scale Subscale and Total scores with each other, (b) by correlating Subscale scores with scores on the two Overall Criterion Items, (c) by correlating Subscale scores with aspects that were not expected to be related to how well ICT-related needs are met, and (d) by comparing the scores of groups of students with different impairments whose ICT-related needs were expected to be met especially well and those whose needs were expected to be met especially poorly.

Reliability

Test-retest reliability. Six hundred thirty-eight participants completed the POSITIVES Scale twice an average of 4.59 weeks apart (range = 1 week to 17.6 weeks, median = 4.24). Table 31 depicts test-retest Pearson product-moment reliability coefficients for Overall Criterion items as well as for POSITIVES Scale Subscale, Total, and item-by-item scores. The results show that correlation coefficients for all scores are significant at the .001 level or better. The coefficients for the two Overall Criterion Items are .53 and .68, (school: $r(606) = .53$, $p = .000$; home: $r(597 = .68$, $p = .000$). The coefficients for POSITIVES Scale single items range from .47 to .73, and the coefficients for the Subscales range from .73 to .79. The coefficient for the Total score is .81.

Table 31

POSITIVES Scale Test-Retest Correlations

Variable	n	r	Sig =
POSITIVES Scale item-by-item			
1 My school has enough computers with internet access to meet my needs	610	0.672	0.000
2 The hours of access to computer technologies at my school meet my needs	588	0.588	0.000
3 At my school, computer technologies are sufficiently up to date to meet my needs	543	0.558	0.000
4 There are enough computer technologies in my school's specialized labs/centres for students with	442	0.620	0.000
5 The availability of computer technologies in my school's general use computer labs meet my needs	579	0.614	0.000
6 My school's loan program for computer technologies meets my needs	261	0.635	0.000
7 Funding for computer technologies for personal use is adequate to meet my needs	410	0.729	0.000
8 The technical support provided at my school for computer technologies meets my needs	508	0.574	0.000
9 When I approach staff at my institution with problems related to the accessibility of computer	403	0.624	0.000
10 There is at least one person on staff at my school who has expertise in adaptive hardware and	432	0.639	0.000
11 The availability of technical support when I am not at school meets my needs	432	0.585	0.000
12 I know how to effectively use the computer technologies that I need	619	0.538	0.000
13 Training provided by my school on how to use the computer technologies meets my needs	405	0.651	0.000
14 Informal help is available at my school to show me how to use technologies if I need this	492	0.545	0.000
15 Training available off campus on how to use computer technologies meets my needs	265	0.640	0.000
16 When professors use eLearning, it is accessible to me	525	0.476	0.000
17 I have no problem when professors use eLearning for tests and exams	374	0.648	0.000
18 Distance education courses offered by my institution are accessible to me	291	0.680	0.000
19 If I bring computer technology into the classroom I am able to use it	507	0.601	0.000
20 I feel comfortable using needed computer technologies in the classroom	491	0.709	0.000
21 My school's interactive online services are accessible to me	591	0.473	0.000
22 The accessibility of the library's computer systems meets my needs	608	0.472	0.000
23 My personal computer technologies are sufficiently up-to-date to meet my needs	613	0.732	0.000
24 The physical access to computer technologies at my school meets my needs	395	0.642	0.000
25 My school's web pages are accessible to me	631	0.562	0.000
26 The availability of electronic format course materials meets my needs	609	0.530	0.000
POSITIVES Scale Subscales and Total score			
Subscale 1 - ICTs at school meet student's needs	592	0.788	0.000
Subscale 2 - ICTs at home meet student's needs	486	0.759	0.000
Subscale 3 - E-learning ICTs meet student's needs	589	0.731	0.000
Total (average) score	637	0.806	0.000

Note: n= 638.

When results were separated for English- and French-speaking participants the results indicate that 68 French- and 569 English-speaking participants completed the POSITIVES Scale twice. Reliability coefficients for Overall Criterion Items were as follows: English school: $r(541) = .53$, p = .000; English home: $r(531) = .68$, $p = .000$; French school: $r(63) = .45$, $p = .000$; French home: $r(64) = .70$, $p = .000$). Tables 32 and 33 depict test-retest Pearson product-moment correlation coefficients for POSITIVES Scale Subscale, Total, and item-by-item scores for English- and French-speaking participants separately. The results show that correlation

coefficients for all scores are significant. The coefficients for POSITIVES Scale single items for English-speaking students range from .46 to .73, and the coefficients for the Subscales range from .72 to .79. The coefficient for the Total score is .80. For French-speaking students, the coefficients are as follows: single item range = .26 to .86, Subscales range = .79 to .84, and for the Total score it is .85.

We also carried out paired t-test comparisons on test and retest scores. The results show no significant differences for Overall Criterion Items. The same is true for all POSITIVES Scale Subscale and Total scores; these are presented in Table 34. Five of the 26 item-by-item t-tests are significant at the .05 level. Because of the number of comparisons, a Bonferroni correction to the alpha level was made. Following this correction, none of the comparisons remain significant.

Results for French-speaking participants also show no significant differences for Overall Criterion Items or for Subscale or Total scores. Results, presented in Table 35, show that none of the comparisons on the 26 single items or on the 3 Subscales or the Total score are significant.

Table 32

POSITIVES Scale Test-Retest Correlations: English-Speaking Participants

Variable	r	Sig =	n
POSITIVES Scale item-by-item			
1 My school has enough computers with internet access to meet my needs	0.662	0.000	545
2 The hours of access to computer technologies at my school meet my needs	0.581	0.000	524
3 At my school, computer technologies are sufficiently up to date to meet my needs	0.550	0.000	494
4 There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	0.620	0.000	396
5 The availability of computer technologies in my school's general use computer labs meet my needs	0.619	0.000	521
6 My school's loan program for computer technologies meets my needs	0.630	0.000	230
7 Funding for computer technologies for personal use is adequate to meet my needs	0.728	0.000	365
8 The technical support provided at my school for computer technologies meets my needs	0.577	0.000	459
9 When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues	0.619	0.000	365
10 There is at least one person on staff at my school who has expertise in adaptive hardware and software	0.632	0.000	392
11 The availability of technical support when I am not at school meets my needs	0.591	0.000	401
12 I know how to effectively use the computer technologies that I need	0.538	0.000	552
13 Training provided by my school on how to use the computer technologies meets my needs	0.646	0.000	365
14 Informal help is available at my school to show me how to use technologies if I need this	0.545	0.000	444
15 Training available off campus on how to use computer technologies meets my needs	0.646	0.000	247
16 When professors use eLearning, it is accessible to me	0.461	0.000	469
17 I have no problem when professors use eLearning for tests and exams	0.630	0.000	342
18 Distance education courses offered by my institution are accessible to me	0.674	0.000	272
19 If I bring computer technology into the classroom I am able to use it	0.606	0.000	465
20 I feel comfortable using needed computer technologies in the classroom	0.702	0.000	442
21 My school's interactive online services are accessible to me	0.483	0.000	526
22 The accessibility of the library's computer systems meets my needs	0.490	0.000	546
23 My personal computer technologies are sufficiently up-to-date to meet my needs	0.724	0.000	551
24 The physical access to computer technologies at my school meets my needs	0.640	0.000	354
25 My school's web pages are accessible to me	0.569	0.000	566
26 The availability of electronic format course materials meets my needs	0.509	0.000	545
POSITIVES Scale Subscales and Total score			
Subscale 1 - ICTs at school meet student's needs	0.790	0.000	532
Subscale 2 - ICTs at home meet student's needs	0.746	0.000	432
Subscale 3 - E-learning ICTs meet student's needs	0.716	0.000	527
Total (average) score	0.802	0.000	569

Note: n = 569.

Table 33

POSITIVES Scale Test-Retest Correlations: French-Speaking Participants

Variable	r	Sig =	n
POSITIVES Scale item-by-item			
1 My school has enough computers with internet access to meet my needs	0.770	0.000	65
2 The hours of access to computer technologies at my school meet my needs	0.582	0.000	64
3 At my school, computer technologies are sufficiently up to date to meet my needs	0.659	0.000	49
4 There are enough computer technologies in my school's specialized labs/centers for students with disabilities to meet my needs	0.571	0.000	46
5 The availability of computer technologies in my school's general use computer labs meet my needs	0.540	0.000	58
6 My school's loan program for computer technologies meets my needs	0.592	0.000	31
7 Funding for computer technologies for personal use is adequate to meet my needs	0.728	0.000	45
8 The technical support provided at my school for computer technologies meets my needs	0.540	0.000	49
9 When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues	0.696	0.000	38
10 There is at least one person on staff at my school who has expertise in adaptive hardware and software	0.695	0.000	40
11 The availability of technical support when I am not at school meets my needs	0.421	0.018	31
12 I know how to effectively use the computer technologies that I need	0.543	0.000	67
13 Training provided by my school on how to use the computer technologies meets my needs	0.691	0.000	40
14 Informal help is available at my school to show me how to use technologies if I need this	0.560	0.000	48
15 Training available off campus on how to use computer technologies meets my needs	0.452	0.060	18
16 When professors use eLearning, it is accessible to me	0.586	0.000	56
17 I have no problem when professors use eLearning for tests and exams	0.859	0.000	32
18 Distance education courses offered by my institution are accessible to me	0.765	0.000	19
19 If I bring computer technology into the classroom I am able to use it	0.572	0.000	42
20 I feel comfortable using needed computer technologies in the classroom	0.767	0.000	49
21 My school's interactive online services are accessible to me	0.380	0.002	65
22 The accessibility of the library's computer systems meets my needs	0.258	0.043	62
23 My personal computer technologies are sufficiently up-to-date to meet my needs	0.800	0.000	62
24 The physical access to computer technologies at my school meets my needs	0.659	0.000	41
25 My school's web pages are accessible to me	0.484	0.000	65
26 The availability of electronic format course materials meets my needs	0.707	0.000	64
POSITIVES Scale Subscales and Total score			
Subscale 1 - ICTs at school meet student's needs	0.786	0.000	60
Subscale 2 - ICTs at home meet student's needs	0.837	0.000	54
Subscale 3 - E-learning ICTs meet student's needs	0.833	0.000	62
Total (average) score	0.850	0.000	68

Note: n = 68.

Table 34

POSITIVES Scale Test-Retest Scores: Paired t-test Results: Whole Retest Sample

Variable	Test n	Test Mean	Test SD	Retest n	Retest Mean	Retest SD	t	df	Sig[1] =
POSITIVES Scale item-by-item									
1 My school has enough computers with internet access to meet my needs	610	4.82	1.46	610	4.84	1.44	0.41	609	0.680
2 The hours of access to computer technologies at my school meet my needs	588	4.91	1.45	588	4.95	1.35	0.81	587	0.420
3 At my school, computer technologies are sufficiently up to date to meet my needs	543	4.92	1.41	543	4.92	1.38	0.03	542	0.974
4 There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	442	4.18	1.70	442	4.23	1.61	0.72	441	0.470
5 The availability of computer technologies in my school's general use computer labs meet my needs	579	4.48	1.64	579	4.54	1.51	0.93	578	0.355
6 My school's loan program for computer technologies meets my needs	261	3.72	1.89	261	3.93	1.80	2.08	260	0.039
7 Funding for computer technologies for personal use is adequate to meet my needs	410	4.05	1.87	410	4.19	1.77	2.10	409	0.037
8 The technical support provided at my school for computer technologies meets my needs	508	4.62	1.48	508	4.67	1.38	0.87	507	0.383
9 When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues	403	4.69	1.43	403	4.66	1.44	0.52	402	0.603
10 There is at least one person on staff at my school who has expertise in adaptive hardware and software	432	5.03	1.37	432	5.00	1.41	0.37	431	0.714
11 The availability of technical support when I am not at school meets my needs	432	4.18	1.56	432	4.13	1.61	0.73	431	0.463
12 I know how to effectively use the computer technologies that I need	619	5.12	1.16	619	5.15	1.13	0.66	618	0.512
13 Training provided by my school on how to use the computer technologies meets my needs	405	4.36	1.57	405	4.45	1.52	1.42	404	0.156
14 Informal help is available at my school to show me how to use technologies if I need this	492	4.55	1.46	492	4.52	1.47	0.45	491	0.652
15 Training available off campus on how to use computer technologies meets my needs	265	3.72	1.65	265	3.52	1.66	2.31	264	0.021
16 When professors use eLearning, it is accessible to me	525	4.98	1.32	525	5.11	1.25	2.19	524	0.029
17 I have no problem when professors use eLearning for tests and exams	374	4.71	1.63	374	4.83	1.49	1.81	373	0.072
18 Distance education courses offered by my institution are accessible to me	291	4.64	1.65	291	4.75	1.62	1.39	290	0.166
19 If I bring computer technology into the classroom I am able to use it	507	4.56	1.50	507	4.68	1.49	2.02	506	0.043
20 I feel comfortable using needed computer technologies in the classroom	491	4.61	1.53	491	4.64	1.53	0.70	490	0.487
21 My school's interactive online services are accessible to me	591	5.37	1.07	591	5.30	1.13	1.57	590	0.118
22 The accessibility of the library's computer systems meets my needs	608	5.05	1.30	608	5.03	1.22	0.38	607	0.708
23 My personal computer technologies are sufficiently up-to-date to meet my needs	613	4.75	1.51	613	4.78	1.47	0.63	612	0.529
24 The physical access to computer technologies at my school meets my needs	395	4.85	1.51	395	4.88	1.46	0.56	394	0.575
25 My school's web pages are accessible to me	631	5.45	1.05	631	5.42	1.05	0.97	630	0.333
26 The availability of electronic format course materials meets my needs	609	5.04	1.35	609	5.06	1.26	0.32	608	0.749
POSITIVES Scale Subscales and Total score									
Subscale 1 - ICTs at school meet student's needs	592	4.65	1.03	592	4.69	1.05	1.39	591	0.166
Subscale 2 - ICTs at home meet student's needs	486	4.38	1.20	486	4.44	1.19	1.40	485	0.163
Subscale 3 - E-learning ICTs meet student's needs	589	4.98	0.88	589	5.01	0.92	0.91	588	0.364
Total (average) score	637	4.75	0.87	637	4.79	0.90	1.85	636	0.064

Note: n= 638.

[1] Because of the number of comparisons, a Bonferroni correction to the alpha level was made. Following this correction, which requires a significance level of .002, none of the comparisons remain significant.

Table 35

POSITIVES Scale Test-Retest Scores: Paired t-test Results: French Speaking Students

Variable	Test n	Test Mean	Test SD	Retest n	Retest Mean	Retest SD	t	df	Sig[1] =
POSITIVES Scale item-by-item									
1 My school has enough computers with internet access to meet my needs	65	5.14	1.16	65	5.20	1.26	-0.60	64	0.551
2 The hours of access to computer technologies at my school meet my needs	64	5.50	0.78	64	5.50	1.05	0.00	63	1.000
3 At my school, computer technologies are sufficiently up to date to meet my needs	49	5.16	1.20	49	5.10	1.33	0.41	48	0.685
4 There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	46	4.72	1.34	46	4.65	1.43	0.34	45	0.733
5 The availability of computer technologies in my school's general use computer labs meet my needs	58	4.97	1.41	58	4.76	1.37	1.18	57	0.243
6 My school's loan program for computer technologies meets my needs	31	4.45	1.55	31	4.68	1.62	-0.88	30	0.387
7 Funding for computer technologies for personal use is adequate to meet my needs	45	4.69	1.61	45	4.60	1.74	0.48	44	0.633
8 The technical support provided at my school for computer technologies meets my needs	49	4.96	1.15	49	4.80	1.29	0.97	48	0.337
9 When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues	38	5.00	1.16	38	4.79	1.44	1.24	37	0.222
10 There is at least one person on staff at my school who has expertise in adaptive hardware and software	40	4.90	1.57	40	4.53	1.77	1.80	39	0.079
11 The availability of technical support when I am not at school meets my needs	31	4.81	1.08	31	4.48	1.39	1.33	30	0.194
12 I know how to effectively use the computer technologies that I need	67	5.31	1.13	67	5.16	1.15	1.12	66	0.267
13 Training provided by my school on how to use the computer technologies meets my needs	40	4.63	1.44	40	4.73	1.36	-0.57	39	0.570
14 Informal help is available at my school to show me how to use technologies if I need this	48	4.52	1.52	48	4.79	1.38	-1.38	47	0.176
15 Training available off campus on how to use computer technologies meets my needs	18	4.28	1.49	18	4.44	1.38	-0.47	17	0.644
16 When professors use eLearning, it is accessible to me	56	5.13	1.47	56	5.27	1.27	-0.85	55	0.399
17 I have no problem when professors use eLearning for tests and exams	32	4.97	1.58	32	5.13	1.36	-1.09	31	0.282
18 Distance education courses offered by my institution are accessible to me	19	4.95	1.58	19	5.00	1.70	-0.20	18	0.841
19 If I bring computer technology into the classroom I am able to use it	42	4.33	1.75	42	4.74	1.58	-1.70	41	0.098
20 I feel comfortable using needed computer technologies in the classroom	49	4.65	1.61	49	4.71	1.57	-0.39	48	0.695
21 My school's interactive online services are accessible to me	65	5.46	1.05	65	5.51	1.09	-0.31	64	0.756
22 The accessibility of the library's computer systems meets my needs	62	5.39	0.78	62	5.13	1.22	1.60	61	0.114
23 My personal computer technologies are sufficiently up-to-date to meet my needs	62	4.95	1.41	62	5.03	1.35	-0.73	61	0.470
24 The physical access to computer technologies at my school meets my needs	41	4.56	1.53	41	4.76	1.37	-1.03	40	0.308
25 My school's web pages are accessible to me	65	5.60	1.04	65	5.57	1.05	0.23	64	0.816
26 The availability of electronic format course materials meets my needs	64	5.28	1.27	64	5.08	1.48	1.52	63	0.134
POSITIVES Scale Subscales and Rotal score									
Subscale 1 - ICTs at school meet student's needs	60	4.96	0.75	60	4.90	1.02	0.78	59	0.439
Subscale 2 - ICTs at home meet student's needs	54	4.79	1.12	54	4.79	1.23	-0.05	53	0.960
Subscale 3 - E-learning ICTs meet student's needs	62	5.14	0.92	62	5.18	0.96	-0.48	61	0.634
Total (average) score	68	5.01	0.72	68	4.99	0.89	0.34	67	0.736

Note: n= 68.

Internal consistency reliability. We conducted a series of internal consistency analyses. These can be seen in Table 36. Results show that Cronbach's alpha for the three Subscales ranges from .786 to .910 and that it is .936 for the Total score. The results also show that the removal of any item would not greatly affect alpha. Guttman split-half coefficients (these do not require equal variances between the two split forms) for the factors range from .715 to .852. Item-Total Pearson correlation coefficients range from .466 to .714 and the correlations between Subscale and Total scores range from .762 to .920.

Table 36

POSITIVES Scale Internal Consistency: Item Analysis - All Participants

Items	# of items	Mean	Cronbach's alpha [1]	Cronbach's alpha if item removed	Guttman Split-Half Coefficient	Range of Pearson Correlations: Item-Score
POSITIVES Scale Subscales and Total score						
Subscale 1 - ICTs at school meet student's needs	12	4.52	0.910	.900 to .908	0.852	.606-.733
Subscale 2 - ICTs at home meet student's needs	5	4.12	0.786	.715 to .772	0.715	.654-.802
Subscale 3 - E-learning ICTs meet student's needs	9	4.89	0.814	.774 to .800	0.774	.589-.689
Item - Total [2]	26		0.936	.931 to .936		.466-.714
Subscale - Total [3]	3		0.791	.649 to .710		.762-.920

[1] Cronbach's alpha based on standardized items.
[2] Cronbach's alpha for Total (based on the 26 items).
[3] Cronbach's alpha for Total (based on the 3 subscales).

When the data were analyzed separately for French-speaking participants, results presented in Table 37 indicate that Cronbach's alpha for the three Subscales ranges from .717 to .919 and that it is .938 for the Total score. The results also show that the removal of any item would not greatly affect alpha. Guttman split-half coefficients for the factors range from .686 to

.888. Item-Total Pearson correlation coefficients range from .352 to .713 and the correlations between Subscale and Total scores range from .836 to .895.

Table 37

POSITIVES Scale Internal Consistency: Item Analysis - French-Speaking Participants

Items	# of items	Mean	Cronbach's alpha [1]	Cronbach's alpha if item removed	Guttman Split-Half Coefficient	Range of Pearson Correlations: Item-Score
POSITIVES Scale Subscales and Total score						
Subscale 1 - ICTs at school meet student's needs	12	4.49	0.919	.899 to .923	0.888	.500-.772
Subscale 2 - ICTs at home meet student's needs	5	4.57	0.717	.597 to .770	0.686	.534-.827
Subscale 3 - E-learning ICTs meet student's needs	9	5.10	0.866	.765 to .820	0.754	.519-.766
Item - Total [2]	26		0.938	.919 to .936		.352-.713
Subscale - Total [3]	3		0.832	.715 to .801		.836-.895

[1] Cronbach's alpha based on standardized items.
[2] Cronbach's alpha for Total (based on the 26 items).
[3] Cronbach's alpha for Total (based on the 3 subscales).

Derivation of Subscales: Factor Analysis

We established Subscales using factor analysis (see Tables 38 and 39). A principal components analysis with varimax rotation was carried out both with and without mean substitution. This was done because of the large amount of missing data. Three factors were extracted. Table 38 presents the rotated factor loadings for each item for the entire sample, with and without mean substitution. Items were generally assigned to the factor (Subscale) corresponding to the highest factor loading for factor loadings greater than .4. The findings show remarkable consistency, regardless of the way in which the factor analysis was carried out (i.e., with or without mean substitution). Table 40 presents means and standard deviations for the three Subscales along with the means of all items comprising each Subscale, as well as scoring instructions.

Table 38

POSITIVES Scale Factor Loadings: Analyses with and without Mean Substitution

	No Mean Substitution [1]			With Mean Substitution [2]		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Item	Subscale 1 ICTs at School Meet Student's Needs	Subscale 3 - E-learning ICTs Meet Student's Needs	Subscale 2 - ICTs at Home Meet Student's Needs	Subscale 1 ICTs at School Meet Student's Needs	Subscale 3 - E-learning ICTs Meet Student's Needs	Subscale 2 - ICTs at Home Meet Student's Needs
4 There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	0.701	0.283	0.252	0.694	0.086	0.250
1 My school has enough computers with internet access to meet my needs	0.685	0.265	0.040	0.666	0.247	0.020
5 The availability of computer technologies in my school's general use computer labs meet my needs	0.676	0.345	0.200	0.694	0.224	0.100
3 At my school, computer technologies are sufficiently up to date to meet my needs	0.666	0.298	0.086	0.693	0.213	0.059
11 The availability of technical support when I am not at school meets my needs	0.665	0.117	0.387	0.404	0.153	0.484
14 Informal help is available at my school to show me how to use technologies if I need this	0.659	0.085	0.385	0.493	0.147	0.420
8 The technical support provided at my school for computer technologies meets my needs	0.657	0.195	0.417	0.575	0.111	0.379
24 The physical access to computer technologies at my school meets my needs	0.638	0.162	0.026	0.445	0.166	0.231
9 When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues	0.621	0.245	0.387	0.461	0.246	0.306
13 Training provided by my school on how to use the computer technologies meets my needs	0.618	0.129	0.485	0.455	0.139	0.550
2 The hours of access to computer technologies at my school meet my needs	0.605	0.385	0.123	0.632	0.203	0.050
10 There is at least one person on staff at my school who has expertise in adaptive hardware and software	0.484	0.071	0.344	0.471	0.100	0.269
7 Funding for computer technologies for personal use is adequate to meet my needs	0.012	0.252	0.718	0.028	0.113	0.662
12 I know how to effectively use the computer technologies that I need	0.258	0.021	0.705	0.157	0.206	0.607
23 My personal computer technologies are sufficiently up-to-date to meet my needs	0.196	0.288	0.672	0.085	0.311	0.564
6 My school's loan program for computer technologies meets my needs	0.217	0.339	0.661	0.158	0.123	0.605
15 Training available off campus on how to use computer technologies meets my needs	0.394	0.070	0.477	0.231	0.091	0.524
21 My school's interactive online services are accessible to me	0.193	0.705	0.115	0.215	0.691	0.050
18 Distance education courses offered by my institution are accessible to me	-0.040	0.694	0.186	0.051	0.483	0.105
25 My school's web pages are accessible to me	0.328	0.601	-0.008	0.214	0.667	0.026
22 The accessibility of the library's computer systems meets my needs	0.423	0.539	0.043	0.350	0.528	0.116
26 The availability of electronic format course materials meets my needs	0.308	0.530	0.282	0.248	0.551	0.262
17 I have no problem when professors use eLearning for tests and exams	0.121	0.503	0.352	0.088	0.534	0.194
19 If I bring computer technology into the classroom I am able to use it	0.239	0.469	0.160	0.140	0.405	0.196
20 I feel comfortable using needed computer technologies in the classroom	0.272	0.461	0.281	0.101	0.402	0.369
16 When professors use eLearning, it is accessible to me	0.306	0.445	0.455	0.180	0.636	0.176

Note. Rotated component matrix. Factor loadings belonging to each Subscale are boxed. Extraction method: Principal Component Analysis. Rotation method: Varimax with Kaiser Normalization.

[1] Test sample, n = 207.

[2] Test sample, n = 1354 (mean substitution).

Table 39

Factor Analysis: Total Variance Explained for Test Data with and without Mean Substituion

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Test sample, n = 207						
1	10.182	39.163	39.163	5.909	22.728	22.728
2	1.673	6.433	45.596	3.798	14.606	37.335
3	1.586	6.098	51.694	3.734	14.360	51.694
Test sample, n = 1354 (mean substitution)						
1	7.738	29.762	29.762	4.314	16.592	16.592
2	1.607	6.181	35.944	3.308	12.724	29.317
3	1.537	5.910	41.854	3.260	12.537	41.854

Subscale 1 - ICTs at School Meet Student's Needs. This 12-item subscale evaluates the extent to which students' ICT-related needs are met while they are at school (e.g., My school has enough computers with internet access to meet my needs. The hours of access to computer technologies at my school meet my needs).

Subscale 2 - ICTs at Home Meet Student's Needs. This 5-item subscale evaluates the extent to which ICT-related needs are met while students are off campus (e.g., Funding for computer technologies for personal use is adequate to meet my needs. My personal computer technologies are sufficiently up-to-date to meet my needs).

Subscale 3 - E-learning ICTs Meet Student's Needs. This 9-item subscale evaluates the extent to which the school's e-learning meets the student's needs (e.g., My school’s web pages are accessible to me. I have no problems when professors use e-learning for tests and exams).

Scoring, Standardization and Norms

Table 40 shows mean scores for all POSITIVES Scale single item, Subscale, and Total scores for all participants. These indicate that although all items have scores that are more

Table 40

POSITIVES Scale Items, Factors, and Scoring

Subscale/ Factor	Item number, item wording and scoring	Mean	SD	n
Subscale 1 - ICTs at school meet student's needs (Scoring: average all Factor 1 single item scores other than "not applicable")		4.65	1.03	592
1	1. My school has enough computers with internet access to meet my needs	4.83	1.46	1315
1	2. The hours of access to computer technologies at my school meet my needs	4.91	1.45	1290
1	3. At my school, computer technologies are sufficiently up to date to meet my needs (e.g., grammar checking, adaptive mouse, software that reads what is on the screen)	4.90	1.43	1221
1	4. There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	4.19	1.69	1069
1	5. The availability of computer technologies in my school's general use computer labs meet my needs	4.47	1.62	1273
1	8. The technical support provided at my school for computer technologies meets my needs	4.59	1.46	1172
1	9. When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues (e.g., cannot see the PowerPoint presentation, cannot hear a video clip, need a grammar checker to write an essay)	4.72	1.43	978
1	10. There is at least one person on staff at my school who has expertise in adaptive hardware and software (e.g., knowledgeable about software that reads what is on the screen, keeps up to date with the latest in adapted keyboards)	5.00	1.37	1046
1	11. The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support)	4.22	1.55	1054
1	13. Training provided by my school on how to use the computer technologies meets my needs	4.29	1.60	996
1	14. Informal help is available at my school to show me how to use computer technologies if I need this	4.54	1.46	1167
1	24. The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway)	4.90	1.49	976
Subscale 2 - ICTs at home meet student's needs (Scoring: average all Factor 2 single item scores other than "not applicable")		4.38	1.20	486
2	6. My school's loan program for computer technologies meets my needs	3.88	1.86	703
2	7. Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program)	4.07	1.85	955
2	12. I know how to effectively use the computer technologies that I need	5.08	1.25	1331
2	15. Training available off campus on how to use computer technologies meets my needs	3.64	1.65	803
2	23. My personal computer technologies are sufficiently up-to-date to meet my needs	4.76	1.52	1318
Subscale 3 - E-learning ICTs meet student's needs (Scoring: average all Factor 3 single item scores other than "not applicable")		4.98	0.88	589
3	16. When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT)	4.99	1.32	1186
3	17. I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT)	4.71	1.57	941
3	18. Distance education courses offered by my institution are accessible to me	4.70	1.56	726
3	19. If I bring computer technology into the classroom I am able to use it (e.g., can plug it in)	4.59	1.50	1150
3	20. I feel comfortable using needed computer technologies in the classroom	4.63	1.54	1137
3	21. My school's interactive online services are accessible to me (e.g., registering, financial aid applications on the web)	5.36	1.06	1297
3	22. The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs)	5.02	1.28	1290
3	25. My school's web pages are accessible to me	5.52	0.94	1341
3	26. The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3)	5.04	1.35	1293
Total (average) score (Scoring: average all single item scores other than "not applicable")		4.75	0.86	1354

Note. Scoring: For all statements, rate your level of agreement using the following scale: 1 = Strongly Disagree, 2 = Moderately Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5 = Moderately Agree, 6 = Strongly Agree, 7 = Not Applicable

Note: n= 1354.

favorable than unfavorable (i.e., scores > 3.5 on the 6-point scale of agreement - items all positively worded), the most problematic items are those which deal with the availability of adapted computers at school in specialized computer laboratories as well as those available through the school's loan program. In addition, funding for computer technologies for personal use as well as problems with training, both on and off campus, had low scores, as did the item dealing with poor technical support when the student is not at school.

On the other hand, the results also show that students felt the school's web pages are accessible, that they can effectively use the computer technologies they need, that expertise in adaptive ICTs was readily available on campus, that needed electronic format course materials are available, and that the school's interactive online services (e.g., registering, financial aid applications on the web) as well as the library's computer systems were generally quite accessible.

Tables 41 and 42 show mean scores for all POSITIVES Scale single item, Subscale, and Total scores for all French-speaking and English-speaking participants. For English-speaking students, the results resemble those of the sample as a whole. Consistent with the somewhat higher scores for French-speaking than for English-speaking students, the results indicate that French-speaking students had concerns mainly about the number of adapted computers in specialized computer labs and the availability of training on ICTs off campus.

As for needs being especially well met, again, it can be seen in Tables 41 and 42 that the results for English-speaking students are very similar to those of the sample as a whole. For French-speaking students, the results show that the same items have scores suggesting that students' needs are especially well met, as are those for the whole sample, with the exception of

Table 41

POSITIVES Scale Items, Factors, and Scoring For English-Speaking Participants

Subscale/ Factor	Item number, item wording and scoring	Test		
		n	Mean	SD
Subscale 1 - ICTs at school meet student's needs (Scoring: average all Factor 1 single item scores other than "not applicable")		1169	4.64	1.03
1	1. My school has enough computers with internet access to meet my needs	1180	4.81	1.47
1	2. The hours of access to computer technologies at my school meet my needs	1155	4.87	1.47
1	3. At my school, computer technologies are sufficiently up to date to meet my needs (e.g., grammar checking, adaptive mouse, software that reads what is on the screen)	1106	4.90	1.44
1	4. There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	963	4.18	1.69
1	5. The availability of computer technologies in my school's general use computer labs meet my needs	1149	4.45	1.63
1	8. The technical support provided at my school for computer technologies meets my needs	1057	4.58	1.47
1	9. When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues (e.g., cannot see the PowerPoint presentation, cannot hear a video clip, need a grammar checker to write an essay)	890	4.71	1.44
1	10. There is at least one person on staff at my school who has expertise in adaptive hardware and software (e.g., knowledgeable about software that reads what is on the screen, keeps up to date with the latest in adapted keyboards)	945	5.04	1.33
1	11. The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support)	971	4.20	1.55
1	13. Training provided by my school on how to use the computer technologies meets my needs	894	4.26	1.61
1	14. Informal help is available at my school to show me how to use computer technologies if I need this	1051	4.55	1.46
1	24. The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway)	878	4.95	1.45
Subscale 2 - ICTs at home meet student's needs (Scoring: average all Factor 2 single item scores other than "not applicable")		992	4.33	1.21
2	6. My school's loan program for computer technologies meets my needs	620	3.79	1.88
2	7. Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program)	849	3.99	1.87
2	12. I know how to effectively use the computer technologies that I need	1192	5.07	1.24
2	15. Training available off campus on how to use computer technologies meets my needs	731	3.59	1.67
2	23. My personal computer technologies are sufficiently up-to-date to meet my needs	1183	4.75	1.53
Subscale 3 - E-learning ICTs meet student's needs (Scoring: average all Factor 3 single item scores other than "not applicable")		1173	4.99	0.84
3	16. When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT)	1060	4.98	1.29
3	17. I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT)	847	4.69	1.57
3	18. Distance education courses offered by my institution are accessible to me	668	4.70	1.56
3	19. If I bring computer technology into the classroom I am able to use it (e.g., can plug it in)	1044	4.57	1.49
3	20. I feel comfortable using needed computer technologies in the classroom	1017	4.63	1.54
3	21. My school's interactive online services are accessible to me (e.g., registering, financial aid applications on the web)	1160	5.35	1.06
3	22. The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs)	1159	5.02	1.29
3	25. My school's web pages are accessible to me	1201	5.51	0.94
3	26. The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3)	1162	5.03	1.34
Total (average) score (Scoring: average all single item scores other than "not applicable")		1213	4.73	0.86

Note. Scoring: For all statements, rate your level of agreement using the following scale: 1 = Strongly Disagree, 2 = Moderately Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5 = Moderately Agree, 6 = Strongly Agree, 7 = Not Applicable.

Note: n = 1213.

Table 42

POSITIVES Scale Items, Factors, and Scoring: French-Speaking Participants

Subscale / Factor	Item number, item wording and scoring	Test		
Subscale 1 - ICTs at school meet student's needs (Scoring: average all Factor 1 single item scores other than "not applicable")		4.74	0.96	132
1	1. My school has enough computers with internet access to meet my needs	5.07	1.35	135
1	2. The hours of access to computer technologies at my school meet my needs	5.27	1.23	135
1	3. At my school, computer technologies are sufficiently up to date to meet my needs (e.g., grammar checking, adaptive mouse, software that reads what is on the screen)	4.89	1.36	115
1	4. There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	4.33	1.72	106
1	5. The availability of computer technologies in my school's general use computer labs meet my needs	4.65	1.56	124
1	8. The technical support provided at my school for computer technologies meets my needs	4.75	1.27	115
1	9. When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues (e.g., cannot see the PowerPoint presentation, cannot hear a video clip, need a grammar checker to write an essay)	4.88	1.30	88
1	10. There is at least one person on staff at my school who has expertise in adaptive hardware and software (e.g., knowledgeable about software that reads what is on the screen, keeps up to date with the latest in adapted keyboards)	4.64	1.71	101
1	11. The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support)	4.45	1.46	83
1	13. Training provided by my school on how to use the computer technologies meets my needs	4.55	1.45	102
1	14. Informal help is available at my school to show me how to use computer technologies if I need this	4.46	1.51	116
1	24. The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway)	4.40	1.77	98
Subscale 2 - ICTs at home meet student's needs (Scoring: average all Factor 2 single item scores other than "not applicable")		4.76	1.09	123
2	6. My school's loan program for computer technologies meets my needs	4.54	1.55	83
2	7. Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program)	4.71	1.55	106
2	12. I know how to effectively use the computer technologies that I need	5.16	1.26	139
2	15. Training available off campus on how to use computer technologies meets my needs	4.17	1.41	72
2	23. My personal computer technologies are sufficiently up-to-date to meet my needs	4.82	1.45	135
Subscale 3 - E-learning ICTs meet student's needs (Scoring: average all Factor 3 single item scores other than "not applicable")		5.10	0.92	138
3	16. When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT)	5.06	1.52	126
3	17. I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT)	4.95	1.58	94
3	18. Distance education courses offered by my institution are accessible to me	4.76	1.56	58
3	19. If I bring computer technology into the classroom I am able to use it (e.g., can plug it in)	4.72	1.62	106
3	20. I feel comfortable using needed computer technologies in the classroom	4.66	1.61	120
3	21. My school's interactive online services are accessible to me (e.g., registering, financial aid applications on the web)	5.48	1.09	137
3	22. The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs)	5.07	1.20	131
3	25. My school's web pages are accessible to me	5.62	0.96	140
3	26. The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3)	5.13	1.38	131
Total (average) score (Scoring: average all single item scores other than "not applicable")		4.89	0.83	141

Scoring. For all statements, rate your level of agreement using the following scale: 1 = Strongly Disagree, 2 = Moderately Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5 = Moderately Agree, 6 = Strongly Agree, 7 = Not Applicable.

Note: n = 141.

the item dealing with the availability of expertise in adaptive ICTs on campus. On the other hand, French-speaking students also felt that the number of computers with internet access at their school met their needs especially well, as did the hours of access to ICTs, and professors' use of e-learning.

Students with different disabilities. The findings above represent the sample as a whole. To examine how well the specific needs of students with different disabilities are met, in Table 43 we provide Overall Criterion Item, POSITIVES Scale single item, Subscale, and Total scores for participants with different disabilities. We also conducted a series of 1-way analysis of variance (ANOVA) comparisons on scores for 10 of the 12 groups; the sample sizes for the speech/communication impairment group and the PDD group were too small for meaningful analyses or for the suggestion of norms. These comparisons were not carried out separately for French-speaking students because of small sample sizes. The ANOVAs show significant differences among groups for the Overall Criterion Item related to needs being met at school, for 20 of the 26 POSITIVES Scale single items, and for all 3 Subscales as well as the Total score.

To facilitate interpretation and to provide POSITIVES Scale norms for the different groups of participants, in Table 44 we provide mean scores for the three POSITIVES Scale Subscales and for the Total score in rank order of the different disability groups. Although, overall, the findings suggest that the ICT-related needs of students in all groups are relatively well met, needs of students who are totally blind, those with multiple disabilities, and those with low vision were met least well. Needs of students who are hard of hearing, have a medically related/health problem, have a mobility impairment, and those with psychological/psychiatric disabilities were met best.

Table 43

Mean POSITIVES Scale Scores for Participants with Different Disabilities and 1-way ANOVA Test Results

Item #	Variable	Totally blind			Low vision			Deaf			Hard of hearing			LD/ADD/ADHD			Mobility			Limitation in the use of hands/arms			Medically related/ health problem			Psychological/ psychiatric			Neurological			Multiple disabilities			ANOVA		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	df	F	Sig. =
Overall Criterion Items																																				
	In general, my computer technology needs at my school are adequately met	17	4.76	1.39	57	4.33	1.57	14	5.21	0.89	42	5.48	0.71	375	5.07	1.24	47	5.09	1.41	47	4.79	1.49	62	5.05	1.45	160	5.33	0.96	25	4.44	1.56	443	4.81	1.44	10,1278	4.61	0.000
	In general, my computer technology needs at home are adequately met	17	5.29	1.36	58	5.05	1.29	14	4.93	1.00	41	5.34	1.13	368	5.01	1.41	45	5.36	1.07	45	5.02	1.44	61	4.69	1.65	162	5.04	1.35	27	4.96	1.56	439	4.88	1.52	10,1266	1.18	0.299
Positives Scale Item-by-Item																																				
1	My school has enough computers with internet access to meet my needs	16	4.44	1.41	59	4.76	1.59	14	5.07	1.38	42	5.31	1.05	378	5.04	1.37	50	4.70	1.57	47	4.89	1.09	66	4.71	1.45	169	4.84	1.26	26	3.77	1.97	440	4.70	1.57	10,1296	3.29	0.000
2	The hours of access to computer technologies at my school meet my needs	15	4.33	1.45	61	4.75	1.56	14	5.29	0.83	42	5.14	1.18	375	5.02	1.41	50	5.06	1.43	45	4.93	1.25	64	5.08	1.36	163	4.94	1.39	27	4.26	1.87	426	4.79	1.52	10,1271	1.72	0.072
3	At my school, computer technologies are sufficiently up to date to meet my needs	16	4.19	1.72	57	4.53	1.63	12	5.00	0.74	36	5.28	0.78	362	5.02	1.36	45	5.00	1.49	42	4.43	1.7	54	5.22	1.13	152	5.25	1.11	24	4.79	1.44	413	4.68	1.56	10,1202	4.03	0.000
4	There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	15	3.80	1.66	53	3.96	1.82	12	4.08	1.38	31	4.74	1.34	321	4.30	1.67	40	4.38	1.64	40	3.95	1.54	43	4.91	1.43	112	4.51	1.58	16	3.31	1.74	380	3.96	1.76	10, 1052	3.15	0.001
5	The availability of computer technologies in my school's general use computer labs meet my needs	15	2.40	1.68	59	3.64	1.97	12	4.58	1.16	40	5.08	1.05	370	4.65	1.49	47	4.62	1.38	45	4.42	1.45	63	4.89	1.36	162	4.83	1.42	22	4.50	1.37	430	4.22	1.77	10,1254	7.68	0.000
6	My school's loan program for computer technologies meets my needs	11	4.27	1.68	32	4.00	1.83	9	4.11	1.17	22	4.68	1.32	204	3.88	1.90	29	4.07	1.73	23	4.43	1.59	29	4.1	1.68	66	3.89	1.95	14	4.43	1.99	262	3.64	1.91	10,690	1.32	0.216
7	Funding for computer technologies for personal use is adequate to meet my needs	17	4.53	1.50	51	4.63	1.55	12	4.50	1.51	27	4.41	1.67	267	4.06	1.89	32	4.56	1.70	35	4.17	1.71	41	4.15	1.78	97	3.93	1.85	17	3.94	1.85	354	3.88	1.91	10,939	1.39	0.178
8	The technical support provided at my school for computer technologies meets my needs	16	4.13	2.03	54	4.35	1.57	10	4.40	1.84	36	4.92	1.05	347	4.67	1.40	41	4.90	1.24	41	4.54	1.43	53	5.19	1.00	146	4.64	1.35	24	4.46	1.56	397	4.42	1.56	10,1154	2.29	0.012
9	When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve	16	4.81	1.38	52	4.46	1.51	11	3.45	1.97	34	4.50	1.40	277	4.73	1.45	32	5.31	1.00	34	4.62	1.46	37	5.14	1.32	115	4.91	1.29	17	4.71	1.36	347	4.65	1.45	10,961	2.32	0.011
10	There is at least one person on staff at my school who has expertise in adaptive hardware and software	17	4.76	1.71	58	4.93	1.47	11	3.91	1.58	33	4.76	1.52	317	5.22	1.23	35	4.89	1.53	36	4.92	1.52	40	5.13	1.14	111	5.10	1.19	17	5.35	0.86	367	4.83	1.47	10,1031	2.55	0.005
11	The availability of technical support when I am not at school meets my needs	17	3.88	2.06	49	4.41	1.55	10	3.80	1.32	27	4.63	1.21	314	4.29	1.51	31	4.68	1.33	35	4.4	1.31	45	4.62	1.47	137	4.15	1.48	16	4.31	1.30	366	4.01	1.65	10,1036	1.81	0.055
12	I know how to effectively use the computer technologies that I need	17	5.47	0.72	62	5.32	1.13	14	5.79	0.43	42	5.17	0.93	382	5.07	1.25	50	5.30	1.18	45	5.27	0.91	65	5.18	1.10	168	5.07	1.25	25	5.32	0.95	453	4.92	1.36	10,1312	2.00	0.030
13	Training provided by my school on how to use the computer technologies meets my needs	15	3.93	2.12	40	4.23	1.39	8	5.13	1.13	31	4.42	1.54	311	4.37	1.55	35	4.83	1.62	34	4.35	1.59	44	4.7	1.37	119	4.44	1.46	20	4.50	1.54	333	4.00	1.70	10,979	2.33	0.010
14	Informal help is available at my school to show me how to use technologies if I need this	17	4.24	1.75	56	4.36	1.52	10	4.80	1.62	40	4.35	1.44	337	4.66	1.45	45	4.93	1.23	37	4.68	1.29	54	4.78	1.30	151	4.58	1.34	23	4.35	1.47	389	4.37	1.54	10,1148	1.57	0.110
15	Training available off campus on how to use computer technologies meets my needs	14	3.79	2.12	40	3.75	1.82	6	3.83	1.94	25	4.20	1.35	248	3.70	1.63	26	3.88	1.51	23	3.48	1.62	32	3.94	1.56	98	3.65	1.60	12	3.83	1.95	274	3.43	1.68	10,787	0.99	0.453
16	When professors use eLearning, it is accessible to me	16	4.19	1.28	54	4.80	1.34	13	4.54	1.90	40	5.08	1.14	338	5.02	1.25	44	5.48	0.95	41	5.2	1.21	59	5.27	1.24	158	5.33	1.00	22	4.95	1.43	395	4.77	1.47	10,1169	4.06	0.000
17	I have no problem when professors use eLearning for tests and exams	13	3.31	1.75	43	4.33	1.76	8	5.25	1.16	34	5.03	1.42	271	4.75	1.54	34	5.15	1.31	32	4.63	1.79	46	5.24	1.35	118	4.95	1.41	15	5.07	0.88	321	4.52	1.65	10,924	3.21	0.000
18	Distance education courses offered by my institution are accessible to me	11	3.91	1.64	28	4.96	1.10	4	5.75	0.50	25	5.36	1.11	193	4.78	1.53	27	5.15	1.51	26	4.85	1.49	34	5.03	1.47	98	4.86	1.50	10	4.90	0.99	268	4.40	1.68	10,713	2.63	0.004
19	If I bring computer technology into the classroom I am able to use it	16	5.63	0.62	53	4.91	1.30	10	4.80	1.69	38	4.79	1.34	343	4.58	1.44	41	4.95	1.34	38	3.97	1.48	59	4.83	1.35	148	4.50	1.55	23	3.96	1.99	376	4.53	1.56	10,1134	2.69	0.003
20	I feel comfortable using needed computer technologies in the classroom	17	5.65	0.61	54	4.67	1.57	11	4.36	1.91	38	4.82	1.39	330	4.58	1.55	43	5.16	1.27	40	4.55	1.58	50	5.16	1.30	136	4.73	1.47	22	4.36	1.53	390	4.47	1.61	10,1120	2.53	0.005
21	My school's interactive online services are accessible to me	17	4.35	1.80	60	5.32	1.05	14	5.21	1.19	43	5.79	0.56	364	5.38	1.00	49	5.67	0.75	46	5.43	0.89	64	5.44	1.13	168	5.41	0.98	26	5.19	1.10	438	5.29	1.15	10,1278	3.10	0.001
22	The accessibility of the library's computer systems meets my needs	14	3.86	1.88	58	4.62	1.52	12	5.58	0.51	43	5.56	0.59	369	5.11	1.19	48	5.21	1.32	42	5.19	1.06	64	5.38	1.05	166	5.07	1.32	26	4.77	1.48	440	4.87	1.35	10,1271	4.40	0.000
23	My personal computer technologies are sufficiently up-to-date to meet my needs	17	5.35	1.06	62	4.95	1.21	12	5.25	0.87	41	5.07	1.27	374	4.84	1.51	49	5.22	1.28	45	4.91	1.44	67	4.69	1.67	167	4.85	1.46	27	4.78	1.50	449	4.51	1.62	10,1299	2.63	0.004
24	The physical access to computer technologies at my school meets my needs	12	5.58	1.44	41	5.02	1.27	6	4.83	1.33	28	5.36	0.87	266	5.06	1.38	48	4.44	1.58	38	4.53	1.56	46	5.11	1.35	111	5.49	0.92	19	5.16	1.17	354	4.56	1.70	10,958	5.45	0.000
25	My school's web pages are accessible to me	16	4.81	1.47	62	5.26	1.05	14	5.71	0.61	43	5.70	0.71	381	5.59	0.83	51	5.57	0.88	45	5.62	0.58	67	5.66	0.91	170	5.64	0.89	27	5.59	0.69	457	5.43	1.07	10,1322	2.73	0.002
26	The availability of electronic format course materials meets my needs	17	5.12	1.11	59	4.92	1.49	13	5.62	0.65	43	5.37	0.85	370	5.03	1.35	49	5.45	0.98	41	5.15	1.33	65	5.42	0.97	164	5.23	1.10	25	5.16	1.21	439	4.80	1.52	10,1274	3.31	0.000
Positive Scale Subscales																																				
	Subscale 1 - ICTs at School Meet Student's Needs	16	4.21	1.12	61	4.47	1.13	14	4.60	0.81	40	4.95	0.76	379	4.76	0.98	50	4.81	0.97	45	4.56	0.86	59	4.94	0.86	161	4.81	0.89	27	4.52	1.08	441	4.45	1.11	10,1282	4.08	0.000
	Subscale 2 - ICTs at Home Meet Student's Needs	17	4.80	0.96	55	4.69	1.11	12	4.86	0.67	33	4.73	0.92	322	4.39	1.20	42	4.70	1.21	36	4.48	1.02	50	4.47	1.15	123	4.37	1.21	18	4.58	0.93	401	4.19	1.26	10,1098	2.46	0.007
	Subscale 3 - E-learning ICTs Meet Student's Needs	17	4.63	0.69	59	4.90	0.93	14	5.15	0.80	43	5.30	0.54	368	5.01	0.80	50	5.37	0.76	45	5.02	0.69	67	5.28	0.86	170	5.13	0.76	26	4.91	0.86	445	4.85	0.92	10,1293	4.63	0.000
Total (average) score		17	4.48	0.73	62	4.67	0.90	14	4.86	0.64	43	5.05	0.63	386	4.81	0.84	51	5.03	0.82	47	4.72	0.73	67	5.03	0.78	172	4.87	0.79	27	4.69	0.90	460	4.57	0.92	10,1335	4.71	0.000

Note: Scores of participants with speech/communication related disabilities and PDD are not presented because of small sample sizes.

Table 44

POSITIVES Scale Norms for Groups with Different Disabilities - How Well Are the ICT Related Needs of Students with Different Disabilities Met: Means on POSITIVES Scale Subscales and Total Score in Rank Order

Group	Mean	SD	n
Subscale 1 - ICTs at school meet student's needs			
Totally blind	4.21	1.12	16
Multiple disabilities	4.45	1.11	441
Low vision	4.47	1.13	61
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.52	1.08	27
Limitation in the use of hands/arms	4.56	0.86	45
Deaf	4.60	0.81	14
Learning disability/ADD/ADHD (e.g., dyslexia)	4.76	0.98	379
Psychological/psychiatric disability (e.g., anxiety, depression)	4.81	0.89	161
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	4.81	0.97	50
Medically related/health problem (e.g., diabetes, Crohn's)	4.94	0.86	59
Hard of hearing	4.95	0.76	40
Whole sample [1]	4.65	1.02	1301
Subscale 2 - ICTs at home meet student's needs			
Multiple disabilities	4.19	1.26	401
Psychological/psychiatric disability (e.g., anxiety, depression)	4.37	1.21	123
Learning disability/ADD/ADHD (e.g., dyslexia)	4.39	1.20	322
Medically related/health problem (e.g., diabetes, Crohn's)	4.47	1.15	50
Limitation in the use of hands/arms	4.48	1.02	36
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.58	0.93	18
Low vision	4.69	1.11	55
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	4.70	1.21	42
Hard of hearing	4.73	0.92	33
Totally blind	4.80	0.96	17
Deaf	4.86	0.67	12
Whole sample [1]	4.38	1.20	1115
Subscale 3 - E-learning ICTs meet student's needs			
Totally blind	4.63	0.69	17
Multiple disabilities	4.85	0.92	445
Low vision	4.90	0.93	59
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.91	0.86	26
Learning disability/ADD/ADHD (e.g., dyslexia)	5.01	0.80	368
Limitation in the use of hands/arms	5.02	0.69	45
Psychological/psychiatric disability (e.g., anxiety, depression)	5.13	0.76	170
Deaf	5.15	0.80	14
Medically related/health problem (e.g., diabetes, Crohn's)	5.28	0.86	67
Hard of hearing	5.30	0.54	43
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	5.37	0.76	50
Whole sample [1]	5.00	0.85	1311
Total (average) score			
Totally blind	4.48	0.73	17
Multiple disabilities	4.57	0.92	460
Low vision	4.67	0.90	62
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.69	0.90	27
Limitation in the use of hands/arms	4.72	0.73	47
Learning disability/ADD/ADHD (e.g., dyslexia)	4.81	0.84	386
Deaf	4.86	0.64	14
Psychological/psychiatric disability (e.g., anxiety, depression)	4.87	0.79	172
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	5.03	0.82	51
Medically related/health problem (e.g., diabetes, Crohn's)	5.03	0.78	67
Hard of hearing	5.05	0.63	43
Whole sample [1]	4.75	0.86	1354

Note. Higher scores are better. Scores of participants with speech/communication related disabilities and PDD are not presented because of small sample sizes.

[1] Scores of participants with speech/communication related disabilities and PDD are included.

However, Subscale results suggest that while this pattern is true for Subscale 1 (ICTs at School Meet Needs) and Subscale 3 (E-learning ICTs meet students' needs), the pattern of results is very different for off campus use, where the ICT-related needs of the following groups are met least well: multiple disabilities, psychological/psychiatric disability, learning disability / ADD / ADHD. In contrast, the needs of students with mobility impairment, those who are hard of hearing and those who are totally blind are best met in this context.

Validity

Two types of construct validation were undertaken: convergent and discriminant validity. In addition, concurrent and criterion validity were examined.

Convergent validity. Examination of the properties of the POSITIVES measure, provided in Table 45, shows moderate correlations among the three Subscales (range $r = .521$ to $r = .622$). Internal validity correlation coefficients in this Table also show strong relationships between Subscale scores and the Total score (range from $r = .762$ to $r = .920$). Overall, the coefficients indicate that Subscales measure different concepts, all of which are important components of the accessibility of ICTs as measured by the Total score.

When we examined the properties of the POSITIVES measure separately for French- and English-speaking participants (provided in Tables 46 and 47, respectively), once again moderate correlations among the three Subscales were found for French-speaking (range $r = .563$ to $r = .650$) and English-speaking (range $r = .504$ to $r = .630$) participants. Internal validity correlation coefficients in this Table also show strong relationships between Subscale scores and the Total score (French-speaking: range from $r = .836$ to $r = .895$; English-speaking: range from $r = .752$ to $r = .923$). Overall, the coefficients indicate that Subscales measure different concepts, all of which are important components of the accessibility of ICTs as measured by the Total score.

Table 45

Correlations Among POSITIVES Scale Subscale and Total Scores and Overall Criterion Item Scores

Variables	Subscale 1 - ICTs at School Meet Student's Needs			Subscale 2 - ICTs at Home Meet Student's Needs			Subscale 3 - E-learning ICTs Meet Student's Needs			Total (average) score		
	n	r	Sig =	n	r	Sig =	n	r	Sig =	n	r	Sig =
Overall Criterion Items												
In general, my computer technology needs at my school are adequately met	1261	0.627	0.000	1083	0.446	0.000	1257	0.450	0.000	1297	0.616	0.000
In general, my computer technology needs at home are adequately met	1243	0.328	0.000	1068	0.590	0.000	1245	0.295	0.000	1284	0.438	0.000
POSITIVES Scale Subscales												
Subscale 1 - ICTs at School Meet Student's Needs	-	-	-	1081	0.567	0.000	1258	0.622	0.000	1301	0.920	0.000
Subscale 2 - ICTs at Home Meet Student's Needs	1081	0.567	0.000	-	-	-	1078	0.521	0.000	1115	0.762	0.000
Subscale 3 - E-learning ICTs Meet Student's Needs	1258	0.622	0.000	1078	0.521	0.000	-	-	-	1311	0.833	0.000
Total (average) score	1301	0.920	0.000	1115	0.762	0.000	1311	0.833	0.000	-	-	-

Discriminant validity. There was no reason to expect that females' and males' POSITIVES Scale Subscale or Total scores would differ. Therefore, to test discriminant validity we compared female and male participants' POSITIVES Scale Subscales and Total scores. The means, and the multivariate analysis of variance (MANOVA), ANOVA and t-test findings presented in Table 48 show that none of the Subscales differentiated between these two groups; nor did the Total score. Similar comparisons on French- and English-speaking participants' scores, also presented in Table 48, show no significant differences.

Table 46

French-Speaking Participants: Correlations Among POSITIVES Scale Subscale and Total Scores and Overall Criterion Item Scores

Variables	Subscale 1 ICTs at school meet student's needs			Subscale 2 ICTs at home meet student's needs			Subscale 3 E-learning ICTs meet student's needs			Total (average) score		
	n	r	Sig =	n	r	Sig =	n	r	Sig =	n	r	Sig =
Overall Criterion Items												
In general, my computer technology needs at my school are adequately met	128	0.655	0.000	120	0.577	0.000	133	0.465	0.000	136	0.673	0.000
In general, my computer technology needs at home are adequately met	130	0.437	0.000	123	0.591	0.000	136	0.444	0.000	139	0.554	0.000
POSITIVES Scale Subscales												
Subscale 1 - ICTs at school meet student's needs	-	-	-	116	0.632	0.000	129	0.563	0.000	132	0.895	0.000
Subscale 2 - ICTs at home meet student's needs	116	0.632	0.000	-	-	-	121	0.650	0.000	123	0.838	0.000
Subscale 3 - E-learning ICTs meet student's needs	129	0.563	0.000	121	0.650	0.000	-	-	-	138	0.836	0.000
Total (average) score	132	0.895	0.000	132	0.895	0.000	138	0.836	0.000	-	-	-

Note : n =141.

Table 47

English-Speaking Participants: Correlations Among POSITIVES Scale Subscale and Total Scores and Overall Criterion Item Scores

	Subscale 1 ICTs at school meet student's needs			Subscale 2 ICTs at home meet student's needs			Subscale 3 E-learning ICTs meet student's needs			Total (average) score		
Variables	n	r	Sig =	n	r	Sig =	n	r	Sig =	n	r	Sig =
Overall Criterion Items												
In general, my computer technology needs at my school are adequately met	1133	0.624	0.000	963	0.431	0.000	1124	0.448	0.000	1161	0.610	0.000
In general, my computer technology needs at home are adequately met	1113	0.317	0.000	945	0.589	0.000	1109	0.274	0.000	1145	0.423	0.000
POSITIVES Scale Subscales												
Subscale 1 - ICTs at school meet student's needs	-	-	-	965	0.561	0.000	1129	0.630	0.000	1169	0.923	0.000
Subscale 2 - ICTs at home meet student's needs	965	0.561	0.000	-	-	-	957	0.504	0.000	992	0.752	0.000
Subscale 3 - E-learning ICTs meet student's needs	1129	0.630	0.000	957	0.504	0.000	-	-	-	1173	0.833	0.000
Total (average) score	1169	0.923	0.000	992	0.752	0.000	1173	0.833	0.000	-	-	-

Note : n =1213.

Table 48

Discriminant Validity: Comparison of POSITIVES Scale Scores of Females and Males

POSITIVES Scale Variables	Females			Males			Significance test
	n	Mean	SD	n	Mean	SD	
Whole sample							
Subscales							MANOVA F(3,1036) = 2.355, p=.070
Subscale 1 - ICTs at School Meet Student's Needs	684	4.59	1.04	356	4.58	1.03	ANOVA F(1,1038) = .005, p = .943
Subscale 2 - ICTs at Home Meet Student's Needs	684	4.36	1.20	356	4.44	1.19	ANOVA F(1,1038) = .923, p = .337
Subscale 3 - E-learning ICTs Meet Student's Needs	684	4.96	0.85	356	4.87	0.89	ANOVA F(1,1038) = .245, p = .118
Total (average) score	894	4.75	0.87	456	4.75	0.86	t-test t(1348) = .015 p = .988
English-speaking participants							
Subscales							MANOVA F(3,922) = 2.221, p=.084
Subscale 1 - ICTs at School Meet Student's Needs	606	4.58	1.04	320	4.56	1.05	ANOVA F(1,924) = .057, p = .811
Subscale 2 - ICTs at Home Meet Student's Needs	606	4.32	1.20	320	4.39	1.20	ANOVA F(1,924) = .608, p = .436
Subscale 3 - E-learning ICTs Meet Student's Needs	606	4.95	0.83	320	4.85	0.88	ANOVA F(1,924) = 2.854, p = .091
Total (average) score	797	4.74	0.86	412	4.73	0.87	t-test t(1207) = .221 p = .825
French-speaking participants							
Subscales							MANOVA F(3,110) = .499, p=.684
Subscale 1 - ICTs at School Meet Student's Needs	78	4.66	1.04	36	4.77	0.78	ANOVA F(1,112) = .352, p = .554
Subscale 2 - ICTs at Home Meet Student's Needs	78	4.68	1.11	36	4.89	1.05	ANOVA F(1,112) = .935, p = .336
Subscale 3 - E-learning ICTs Meet Student's Needs	78	5.03	0.98	36	5.05	0.93	ANOVA F(1,112) = .009 p = .923
Total (average) score	97	4.85	0.89	44	4.98	0.68	t-test t(139) = .862 p = .390

Note. MANOVAs were carried out on Subscale scores and t-tests on Total scores.

Concurrent validity. Although the two Overall Criterion Items are significantly correlated with all Subscale and Total scores, coefficients in Table 45 show that, as expected, the Overall Item "In general, my computer and/or adaptive computer technology needs *at my school* are adequately met" was most closely correlated to Subscale 1 - ICTs at School Meet Student's Needs and that the Overall item, "In general, my computer and/or adaptive computer technology needs *at home* are adequately met" was most closely related to Subscale 2 - ICTs at Home Meet Student's Needs. This was found to be true for the whole sample as well as for English- and French-speaking samples separately (see Tables 47 and 46).

Criterion validity. Based on a priori assumptions, students with psychological/psychiatric disabilities would be expected to have their ICT-related needs better met than students with multiple disabilities. To test criterion validity we wanted to examine the extent to which the POSITIVES Scale Subscale and Total scores were able to differentiate between these two groups of participants. The means and MANOVA, ANOVA and t-test findings presented in Table 49 show that all three Subscales differentiated between these two groups, as did the Total score. There were insufficient numbers of French-speaking participants with psychological/psychiatric disabilities to carry out meaningful comparisons.

Equivalence of Formats

To evaluate whether the POSITIVES Scale can be administered in alternate formats we used a 1-way ANOVA to compare scores of English-speaking participants with learning disabilities who had been randomly assigned to one of three experimental conditions: completing the retest Online, within Microsoft Word, and on Paper (printable PDF) formats. Mean scores and 1-way ANOVA test results in Table 50 indicate that there were no significant differences on the 26 POSITIVES Scale single items or on the 3 Subscales or the Total score.

Table 49

Criterion Validity: Comparison of POSITIVES Scores of Participants with Psychological/Psychiatric Disabilities and with Multiple Disabilities

POSITIVES Scale Variables	Psychological/psychiatric disability			Multiple disabilities			Significance test
	n	Mean	SD	n	Mean	SD	
Whole sample							
Subscales							MANOVA F(3,483) = 4.16, p=.0045
Subscale 1 - ICTs at School Meet Student's Needs	115	4.78	0.84	372	4.38	1.12	ANOVA F(1,485) = 12.09, p = .0006
Subscale 2 - ICTs at Home Meet Student's Needs	115	4.43	1.17	372	4.17	1.26	ANOVA F(1,485) = 3.91, p = .0485
Subscale 3 - E-learning ICTs Meet Student's Needs	115	5.08	0.77	372	4.79	0.93	ANOVA F(1,485) = 9.05, p = .0028
Total (average) score	172	4.87	0.79	460	4.57	0.92	t-test t(630) = 4.11 p = .000
English-speaking participants							
Subscales							MANOVA F(3,431) = 4.93, p=.0022
Subscale 1 - ICTs at School Meet Student's Needs	112	4.78	0.85	323	4.36	1.13	ANOVA F(1,433) = 12.96, p = .000
Subscale 2 - ICTs at Home Meet Student's Needs	112	4.43	1.19	323	4.12	1.25	ANOVA F(1,433) = 5.179, p = .023
Subscale 3 - E-learning ICTs Meet Student's Needs	112	5.09	0.77	323	4.77	0.92	ANOVA F(1,433) = 11.420, p = .001
Total (average) score	169	4.88	0.79	399	4.54	0.93	t-test t(566) = 4.38 p = .000

Note. There were insufficient numbers of French-speaking participants with psychological/psychiatric impairments to carry out meaningful comparisons.

Table 50

POSITIVES Scale: Comparing Alternate Formats Using One-Way ANOVAs

Item #	Variable	Web			Word			PDF			ANOVA		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	df	F	Sig. =
POSITIVES Scale item-by-item													
1	My school has enough computers with internet access to meet my needs	20	4.70	1.38	24	4.50	1.47	14	5.14	0.66	2, 55	1.10	0.341
2	The hours of access to computer technologies at my school meet my needs	19	5.11	1.20	23	4.65	1.47	14	4.93	1.07	2, 53	0.66	0.521
3	At my school, computer technologies are sufficiently up to date to meet my needs	19	5.00	1.29	23	4.57	1.56	13	4.08	1.61	2, 52	1.50	0.232
4	There are enough computer technologies in my school's specialized labs/centers for students with disabilities to meet my needs	18	4.06	1.70	21	4.24	1.51	11	3.55	1.44	2, 47	0.71	0.496
5	The availability of computer technologies in my school's general use computer labs meet my needs	20	4.35	1.69	24	4.38	1.50	14	4.14	1.61	2, 55	0.10	0.902
6	My school's loan program for computer technologies meets my needs	16	3.94	2.02	14	3.93	1.86	8	3.00	1.69	2, 35	0.77	0.473
7	Funding for computer technologies for personal use is adequate to meet my needs	18	4.33	1.78	20	4.30	1.63	12	4.00	1.91	2, 47	0.15	0.861
8	The technical support provided at my school for computer technologies meets my needs	20	4.35	1.93	22	4.86	1.36	12	4.08	1.31	2, 51	1.08	0.346
9	When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues	19	4.89	1.10	20	4.90	1.07	9	4.67	1.50	2, 45	0.14	0.868
10	There is at least one person on staff at my school who has expertise in adaptive hardware and software	17	5.06	1.43	22	4.95	1.43	13	5.38	0.87	2, 49	0.45	0.643
11	The availability of technical support when I am not at school meets my needs	20	3.85	1.84	21	4.24	1.30	13	3.54	1.33	2, 51	0.88	0.422
12	I know how to effectively use the computer technologies that I need	20	5.05	1.15	24	5.04	1.23	14	4.50	1.40	2, 55	1.02	0.368
13	Training provided by my school on how to use the computer technologies meets my needs	19	4.42	1.57	19	4.68	1.16	12	4.00	1.76	2, 47	0.79	0.461
14	Informal help is available at my school to show me how to use technologies if I need this	17	4.71	1.21	21	4.95	1.28	12	3.83	1.70	2, 47	2.63	0.083
15	Training available off campus on how to use computer technologies meets my needs	17	3.47	1.77	18	3.56	1.50	7	1.86	1.21	2, 39	3.22	0.051
16	When professors use eLearning, it is accessible to me	20	4.90	1.29	20	4.75	1.29	14	4.79	0.97	2, 51	0.08	0.922
17	I have no problem when professors use eLearning for tests and exams	16	4.75	1.29	15	4.07	1.39	9	5.11	1.05	2, 37	2.11	0.135
18	Distance education courses offered by my institution are accessible to me	14	4.79	1.12	17	4.35	1.37	7	4.86	1.35	2, 35	0.61	0.550
19	If I bring computer technology into the classroom I am able to use it	19	4.53	1.84	23	4.39	1.41	14	3.79	1.48	2, 53	0.97	0.385
20	I feel comfortable using needed computer technologies in the classroom	18	3.67	2.11	23	4.39	1.47	12	4.33	1.87	2, 50	0.91	0.407
21	My school's interactive online services are accessible to me	18	4.72	1.49	23	4.87	1.32	13	5.38	0.87	2, 51	1.06	0.355
22	The accessibility of the library's computer systems meets my needs	20	4.95	1.19	23	4.61	1.56	13	5.15	0.80	2, 53	0.82	0.445
23	My personal computer technologies are sufficiently up-to-date to meet my needs	20	4.35	1.46	24	4.50	1.44	14	3.64	1.74	2, 55	1.48	0.238
24	The physical access to computer technologies at my school meets my needs	16	5.31	1.14	20	4.85	1.46	8	4.63	1.69	2, 41	0.80	0.456
25	My school's web pages are accessible to me	20	5.20	1.36	24	5.29	1.20	14	5.43	0.94	2, 55	0.15	0.862
26	The availability of electronic format course materials meets my needs	19	4.63	1.34	24	4.92	1.14	14	4.86	1.03	2, 54	0.32	0.725
POSITIVES Scale Subscales and Total score													
	Subscale 1 - ICTs at School Meet Student's Needs	20	4.62	1.02	23	4.65	1.03	14	4.40	1.03	2, 54	0.28	0.755
	Subscale 2 - ICTs at Home Meet Student's Needs	19	4.28	1.25	21	4.30	0.98	12	3.68	1.52	2, 49	1.14	0.328
	Subscale 3 - E-learning ICTs Meet Student's Needs	20	4.71	1.01	21	4.60	1.15	13	4.79	0.91	2, 51	0.13	0.875
Total (average) score		20	4.59	0.95	24	4.64	0.98	14	4.45	0.96	2, 55	0.18	0.835

How Adequately Students' ICT-Related Needs are Met

To examine how well students' ICT-related needs are met we compared the three POSITIVES Scale Subscales using a 1-way ANOVA. Means for these are illustrated in Table 51. The results indicate that scores on the three Subscales differ significantly, $F(2,2086) = 162.05$, $p < .001$. Post hoc tests show that the three Subscale scores are all significantly different from each other, with Subscale 2 - ICTs at Home Meet Student's Needs having the lowest and Subscale 3 - E-learning ICTs Meet Student's Needs having the highest means.

Table 51

Comparing POSITIVES Scale Subscale Scores

Subscale	Mean	SD	n
Subscale 1 - ICTs at School Meet Student's Needs	4.58	1.03	1044
Subscale 2 - ICTs at Home Meet Student's Needs	4.39	1.19	1044
Subscale 3 - E-learning ICTs Meet Student's Needs	4.93	0.86	1044

Colleges Versus Universities

To explore how well students' needs are being met at junior/community colleges and universities we carried out a MANOVA on the two Overall Criterion Items and on Positives Scale Subscale and Total scores. The results were significant, $F(6,978) = 2.41$, $p = .026$. t-test results in Table 52 indicate that junior/community college students' ICT related needs were better met at school than those of university students. The same was true for e-learning related ICT needs. There were no significant findings on ICTs for home use.

Table 52

How Well Students' ICT Related Needs are Met at Colleges and Universities

	School Type	N	Mean	SD	t	df	Sig.
Overall Criterion Items							
In general, my computer technology needs at my school are adequately met	College	358	5.10	1.31	2.07	1282	0.039
	University	926	4.93	1.34			
In general, my computer technology needs at home are adequately met	College	345	4.97	1.44	0.14	1268	0.888
	University	925	4.98	1.43			
Positives Scale Subscales							
Subscale 1 - ICTs at School Meet Student's Needs	College	358	4.80	0.99	3.24	1287	0.001
	University	931	4.59	1.02			
Subscale 2 - ICTs at Home Meet Student's Needs	College	310	4.48	1.17	1.83	1101	0.067
	University	793	4.33	1.22			
Subscale 3 - E-learning ICTs Meet Student's Needs	College	348	5.09	0.86	2.26	1297	0.024
	University	951	4.97	0.84			
Positives Scale Total	College	368	4.87	0.85	3.05	1338	0.002
	University	972	4.71	0.86			

On and Off Campus

Table 53 provides comparative information, using single items, about the views of students with different disabilities about how well their ICT-related needs are met in various contexts at home and at school. Two-way between-within analysis of variance (ANOVA) results (10 Groups x 2 Location (Home, School)) on four dependent variables (Overall ICT-related needs met in general, ICTs sufficiently up-to-date, Technical support needs met, Training needs met) indicate significant differences among Groups on all variables. Significant Location main effects on Technical support and on Training indicate that students' technical support as well as training needs were significantly better met at school than at home. In addition, significant Interaction effects were found on the Overall and the ICTs up-to-date items. These show that, Overall, students with low vision felt that their ICT-related needs were significantly better met at home than at school, while students with medically related and psychologically/psychiatrically related disabilities felt the opposite was true. On ICTs up-to-date items, students who were totally blind indicated that their technologies were significantly more up-to-date at home, while students with learning disabilities, as well as those with medically related, psychologically related and multiple disabilities indicated the opposite.

Table 53

How Well Students' Needs Are Met at Home and at School: Comparison of Students with Different Disabilities

Item #	Variable		Totally blind	Low vision	Deaf	Hard of hearing	Learning disability/ ADD/ ADHD	Mobility impairment	Limitation in the use of hands/ arms	Medically related/ health problem	Psychological/ psychiatric disability	Neurological impairment	Multiple disabilities	ANOVA	F	df	Sig
Overall Criterion Items																	
	In general, my computer technology needs at my *school* are adequately met	Mean	4.76	4.29	5.21	5.46	5.07	5.21	4.76	5.10	5.32	4.44	4.82	Location	1.38	1,1236	0.241
		SD	1.39	1.58	0.89	0.71	1.25	1.32	1.51	1.39	0.97	1.56	1.44	Groups	2.69	0,1236	0.003
	In general, my computer technology needs at *home* are adequately met	Mean	5.29	5.02	4.93	5.34	5.00	5.37	5.02	4.66	5.02	4.88	4.87	Interaction	3.12	0,1236	0.001
		SD	1.36	1.31	1.00	1.13	1.42	1.07	1.44	1.67	1.36	1.59	1.53				
		[1] t =	1.13	3.16 **	1.07	0.64	0.89	0.83	1.13	2.22 *	2.94 **	1.33	0.64				
		n	17	55	14	41	363	43	45	59	158	25	427				
	Average of 2 Locations	Mean	5.03	4.65	5.07	5.40	5.03	5.29	4.89	4.88	5.17	4.66	4.85				
Technologies up-to-date																	
3	At my *school,* computer technologies are sufficiently up-to-date to meet my needs	Mean	4.19	4.53	5.10	5.26	5.01	5.07	4.43	5.22	5.28	4.79	4.69	Location	0.43	1,1172	0.490
		SD	1.72	1.63	0.74	0.78	1.37	1.45	1.71	1.13	1.08	1.44	1.57	Groups	3.36	0,1172	0.001
23	My *personal* computer technologies are sufficiently up-to-date to meet my needs	Mean	5.38	4.89	5.30	5.09	4.81	5.19	5.00	4.63	4.81	4.71	4.48	Interaction	2.91	0,1172	0.001
		SD	1.09	1.23	0.95	1.15	1.53	1.35	1.34	1.77	1.49	1.55	1.62				
		[1] t =	2.37 *	1.48	0.61	0.72	2.29 *	0.43	1.91	2.10 *	3.72 ***	.033	1.97 *				
		n	16	57	10	35	353	43	40	54	149	24	402				
	Average of 2 Locations	Mean	4.78	4.71	5.20	5.17	4.91	5.13	4.71	4.93	5.05	4.75	4.58				
Technical support																	
8	The technical support provided at my *school* for computer technologies meets my needs	Mean	4.13	4.14	3.83	4.68	4.63	5.00	4.45	5.17	4.66	4.67	4.39	Location	11.65	1,923	0.001
		SD	2.03	1.60	2.23	1.21	1.44	1.00	1.48	1.02	1.37	1.45	1.59	Groups	2.10	10,923	0.022
11	The availability of technical support when I am *not at school* meets my needs	Mean	3.75	4.28	3.33	4.55	4.24	4.76	4.33	4.56	4.09	4.27	4.01	Interaction	0.95	10,923	0.483
		SD	2.05	1.59	1.51	1.26	1.52	1.33	1.31	1.50	1.52	1.33	1.63				
		[1] t =	0.64	0.53	0.47	0.50	4.33 ***	0.74	0.50	2.96 **	4.36	1.03	4.62 ***				
		n	16	43	6	22	289	25	33	41	117	15	327				
	Average of 2 Locations	Mean	3.94	4.21	3.58	4.61	4.44	4.88	4.39	4.87	4.37	4.47	4.20				
Training																	
13	Training provided by my *school* on how to use the computer technologies meets my	Mean	3.79	4.25	4.50	4.50	4.23	4.43	4.10	4.89	4.25	4.80	3.77	Location	28.53	1,688	0.000
		SD	2.12	1.44	1.29	1.44	1.59	1.91	1.48	1.26	1.43	1.75	1.71	Groups	12.00	10,688	0.031
15	Training available *off campus* on how to use computer technologies meets my needs	Mean	3.79	3.59	3.00	4.00	3.69	3.95	3.38	3.89	3.67	3.60	3.38	Interaction	0.81	10,688	0.628
		SD	2.12	1.76	1.83	1.31	1.63	1.53	1.60	1.64	1.58	2.07	1.64				
		[1] t =	0.00	1.96	1.04	1.53	4.42 ***	1.56	2.31 *	4.05 ***	3.77 ***	1.91	3.41 ***				
		n	14	32	4	22	229	21	21	28	83	10	235				
	Average of 2 Locations	Mean	3.79	3.92	3.75	4.25	3.96	4.19	3.74	4.39	3.96	4.20	3.58				

[1] Paired t-test on location for each disability group. * p < .05. ** p < .01. *** p < .001.

French- and English-speaking Participants

We conducted a series of independent t-tests to examine similarities and differences between English- and French-speaking participants on the two Overall Criterion Items, the three POSITIVES Subscales, and the POSITIVES Total scores. It can be seen in Table 54 that there was a significant difference on POSITIVES Scale Subscale 2, indicating that French-speaking students' scores were higher than those of English-speaking students. Although not significant, the direction of the means was the same on the Overall Criterion item that dealt with students' needs at home being met. In addition, the test on the POSITIVES Scale Total score was significant, again favoring French-speaking students. In fact, it is noteworthy that French-speaking students had higher scores on all six items evaluated.

Table 54

Comparisons of POSITIVES Scale and Overall Criterion Item Scores of English- and French-Speaking Participants

	English			French					
Variables	n	Mean	SD	n	Mean	SD	t	df	Sig =
Overall Criterion Items									
In general, my computer technology needs at my school are adequately met	1161	4.96	1.33	136	5.07	1.38	-0.86	1295	0.390
In general, my computer technology needs at home are adequately met	1145	4.97	1.43	139	5.12	1.40	-1.13	1282	0.259
POSITIVES Scale Subscales and Total score									
Subscale 1 - ICTs at school meet student's needs	1169	4.64	1.03	132	4.74	0.96	-1.08	1299	0.280
Subscale 2 - ICTs at home meet student's needs	992	4.33	1.21	123	4.76	1.09	-3.72	1113	0.000
Subscale 3 - e-Learning ICTs meet student's needs	1173	4.99	0.84	138	5.10	0.92	-1.53	1309	0.126
Total (average) score	1213	4.73	0.86	141	4.89	0.83	-2.08	1352	0.038

Note: Scores on the Overall Criterion Items for the whole sample are as follows: school: n = 1297, M = 4.97, SD = 1.34; home: n = 1284, M = 4.99, SD = 1.43

To further explore the issues we carried out 2-way ANOVAs (2 Language x 2 Institution (College/University)) on scores of English- and French-speaking participants from junior/community colleges and universities. The results, presented in Table 55, show that on Overall Criterion Items the only significant finding is a Language x Institution interaction on how well students' overall computer technology needs are met at school. This indicates that the needs of university students who speak French were better met than those of their English-speaking counterparts while the reverse was true for college students. The interaction on POSITIVES Scale Subscale 1 (ICTs at School Meet Student's Needs) only approached significance ($p = .076$); this, too shows the same pattern of findings. In addition, on POSITIVES Scale Subscale 2 (ICTs at Home Meet Student's Needs) there was a significant main effect for Language as well as a significant interaction. These show that French-speaking university students indicated that their needs were substantially better met than English-speaking university students indicated.

We also carried out a series of t-test comparisons on the two Overall Criterion Items and on the three POSITIVES Scale Subscale and Total data to compare scores of English- and French-speaking students within each of the nine disability groupings where there were sufficient numbers of participants for meaningful analyses. To allow for maximal sample sizes, all participants who indicated having a specific disability were included in each disability grouping (i.e., if a student had both a visual impairment as well as a learning disability, he or she was included in both analyses as well as in the analysis on multiple disabilities). Results, presented in Tables 56 to 68 show only three significant differences. These indicate that French-speaking students with a mobility impairment had higher scores on POSITIVES Scale Subscale 3 as well as on the Total score than English-speaking students and that French-speaking students with limitations in the use of their hands or arms had higher scores on Subscale 2 than English-speaking students.

Table 55

Comparison of POSITIVES Scale and Overall Criterion Item Scores of English- and French-Speaking College and University Participants

Language	Institution	Mean	SD	n	Source	df	F	Sig.
Overall Criterion Items								
In general, my computer technology needs at my *school* are adequately met								
English	College	5.14	1.24	320	Language	1, 1280	0.15	0.696
	University	4.89	1.35	831	Institution	1, 1280	0.93	0.335
French	College	4.71	1.78	38	Interaction	1, 1280	7.99	**0.005**
	University	5.22	1.18	95				
In general, my computer technology needs at *home* are adequately met								
English	College	4.98	1.42	306	Language	1, 1266	0.40	0.526
	University	4.96	1.44	828	Institution	1, 1266	0.78	0.378
French	College	4.92	1.61	39	Interaction	1, 1266	1.02	0.313
	University	5.20	1.34	97				
POSITIVES Scale Subscales								
Subscale 1 - ICTs at School Meet Student's Needs								
English	College	4.81	0.98	321	Language	1, 1285	0.08	0.780
	University	4.57	1.03	839	Institution	1, 1285	0.30	0.586
French	College	4.66	1.11	37	Interaction	1, 1285	3.16	0.076
	University	4.79	0.91	92				
Subscale 2 - ICTs at Home Meet Student's Needs								
English	College	4.48	1.16	279	Language	1, 1099	5.23	**0.022**
	University	4.27	1.22	703	Institution	1, 1099	0.39	0.534
French	College	4.48	1.26	31	Interaction	1, 1099	5.11	**0.024**
	University	4.86	1.02	90				
Subscale 3 - E-learning ICTs Meet Student's Needs								
English	College	5.08	0.82	311	Language	1, 1295	1.28	0.259
	University	4.95	0.84	852	Institution	1, 1295	0.68	0.410
French	College	5.12	1.15	37	Interaction	1, 1295	0.51	0.477
	University	5.11	0.83	99				
POSITIVES Scale Total (average) score								
English	College	4.87	0.83	329	Language	1, 1336	1.48	0.225
	University	4.68	0.87	873	Institution	1, 1336	0.24	0.625
French	College	4.83	1.03	39	Interaction	1, 1336	3.04	0.081
	University	4.93	0.75	99				

Note: Boxed items are significant.

Table 56

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students with Low Vision

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	95	4.42	1.69	15	4.33	1.45	0.19	108
In general, my computer technology needs at home are adequately met	94	4.88	1.49	17	4.76	1.60	0.30	109
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	95	4.23	1.22	17	4.63	1.07	-1.26	110
Subscale 2 - ICTs at home meet student's needs	88	4.41	1.27	14	4.13	1.67	0.73	100
Subscale 3 - E-learning ICTs meet student's needs	93	4.72	0.97	18	4.78	1.19	-0.24	109
Total (average) score	98	4.44	0.96	18	4.68	1.02	-0.93	114

Note. None of the comparisons are significant.

Table 57

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who are Deaf

	English			French		
Variables	n	Mean	SD	n	Mean	SD
Overall Criterion Items						
In general, my computer technology needs at my school are adequately met	14	4.93	1.59	5	4.80	1.10
In general, my computer technology needs at home are adequately met	13	5.08	1.04	5	5.20	0.84
POSITIVES Scale Subscales and Total score						
Subscale 1 - ICTs at school meet student's needs	13	4.42	1.07	5	4.80	0.69
Subscale 2 - ICTs at home meet student's needs	12	4.62	0.90	5	5.14	0.52
Subscale 3 - E-learning ICTs meet student's needs	14	4.87	1.19	5	4.95	1.17
Total (average) score	14	4.61	0.95	5	4.91	0.73

Note. Insufficient sample sizes for t-tests.

Table 58

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Hearing Impairment

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	73	5.06	1.20	16	5.56	0.63	-1.64	87
In general, my computer technology needs at home are adequately met	74	5.12	1.16	16	5.31	1.40	-0.58	88
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	73	4.69	0.99	14	5.04	0.61	-1.30	85
Subscale 2 - ICTs at home meet student's needs	62	4.49	1.05	12	5.00	1.13	-1.51	72
Subscale 3 - E-learning ICTs meet student's needs	74	5.14	0.71	16	5.44	0.54	-1.62	88
Total (average) score	76	4.84	0.76	16	5.17	0.60	-1.63	90

Note. None of the comparisons are significant.

Table 59

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Speech/Communication Impairment

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	36	4.36	1.64	9	5.11	0.93	-1.31	43
In general, my computer technology needs at home are adequately met	31	4.68	1.76	9	5.00	1.58	-0.49	38
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	35	4.28	1.30	9	4.62	0.71	-0.74	42
Subscale 2 - ICTs at home meet student's needs	34	4.16	1.33	9	4.30	1.25	-0.27	41
Subscale 3 - E-learning ICTs meet student's needs	34	4.88	1.05	9	5.04	1.01	-0.40	41
Total (average) score	36	4.45	1.10	9	4.67	0.58	-0.58	43

Note. None of the comparisons are significant.

Table 60

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Learning Disability

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	545	4.98	1.29	38	4.92	1.42	0.25	581
In general, my computer technology needs at home are adequately met	539	4.91	1.51	38	4.97	1.38	-0.26	575
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	550	4.65	1.03	38	4.76	0.96	-0.64	586
Subscale 2 - ICTs at home meet student's needs	478	4.28	1.23	36	4.58	1.27	-1.43	512
Subscale 3 - E-learning ICTs meet student's needs	539	4.92	0.85	38	4.81	1.11	0.72	575
Total (average) score	565	4.71	0.88	38	4.75	0.97	-0.31	601

Note. None of the comparisons are significant.

Table 61

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Mobility Impairment

	English			French			t	df
Variables	n	Mean	SD	n	Mean	SD		
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	124	4.73	1.56	45	5.02	1.59	-1.06	167
In general, my computer technology needs at home are adequately met	120	5.14	1.37	46	5.15	1.48	-0.04	164
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	125	4.39	1.19	44	4.75	1.11	-1.73	167
Subscale 2 - ICTs at home meet student's needs	110	4.31	1.27	40	4.73	1.14	-1.85	148
Subscale 3 - E-learning ICTs meet student's needs	124	4.89	0.91	45	5.32	0.79	-2.81**	167
Total (average) score	129	4.57	0.96	47	4.94	0.85	-2.31*	174

*$p < .05$. **$p < .01$.

Table 62

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Limitation in the Use of Hands/Arms

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	138	4.59	1.58	31	4.81	1.62	-0.67	167
In general, my computer technology needs at home are adequately met	132	5.03	1.39	30	4.90	1.79	0.44	160
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	136	4.46	1.06	27	4.69	1.03	-0.99	161
Subscale 2 - ICTs at home meet student's needs	123	4.18	1.25	25	4.72	1.16	-1.98*	146
Subscale 3 - E-Learning ICTs meet student's needs	135	4.90	0.87	31	5.13	0.83	-1.33	164
Total (average) score	141	4.57	0.90	31	4.86	0.80	-1.65	170

*$p < .05$.

Table 63

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Medically Related Impairment

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	212	4.75	1.54	32	4.91	1.40	-0.52	242
In general, my computer technology needs at home are adequately met	209	4.80	1.54	32	4.91	1.61	-0.36	239
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	213	4.49	1.16	29	4.58	1.10	-0.39	240
Subscale 2 - ICTs at home meet student's needs	185	4.14	1.26	28	4.56	1.27	-1.67	211
Subscale 3 - E-learning ICTs meet student's needs	218	4.94	0.93	31	5.00	0.98	-0.34	247
Total (average) score	226	4.62	0.98	32	4.74	0.87	-0.65	256

Note. None of the comparisons are significant.

Table 64

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Psychological/Psychiatric Disability

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	383	5.00	1.23	22	5.23	1.31	-0.85	403
In general, my computer technology needs at home are adequately met	387	4.81	1.52	22	4.45	1.95	1.06	407
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	386	4.56	1.03	21	4.67	0.99	-0.46	405
Subscale 2 - ICTs at home meet student's needs	327	4.10	1.27	17	4.31	1.32	-0.66	342
Subscale 3 - E-learning ICTs meet student's needs	396	4.92	0.85	22	4.81	1.07	0.62	416
Total (average) score	407	4.64	0.89	22	4.67	0.92	-0.15	427

Note. None of the comparisons are significant.

Table 65

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Neurological Impairment

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	85	4.87	1.30	16	4.63	1.63	0.67	99
In general, my computer technology needs at home are adequately met	84	5.04	1.42	16	4.63	1.96	0.99	98
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	88	4.54	1.08	15	4.89	1.08	-1.15	101
Subscale 2 - ICTs at home meet student's needs	74	4.23	1.25	14	4.66	1.22	-1.19	86
Subscale 3 - E-learning ICTs meet student's needs	89	4.90	0.89	15	5.00	0.81	-0.40	102
Total (average) score	91	4.64	0.92	16	4.85	0.72	-0.86	105

Note. None of the comparisons are significant.

Table 66

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who Have a Pervasive Developmental Disorder (PDD)

	English			French		
Variables	n	Mean	SD	n	Mean	SD
Overall Criterion Items						
In general, my computer technology needs at my school are adequately met	15	5.40	1.06	2	6.00	0.00
In general, my computer technology needs at home are adequately met	14	5.14	1.35	2	6.00	0.00
POSITIVES Scale Subscales and Total score						
Subscale 1 - ICTs at school meet student's needs	15	5.27	0.75	2	4.87	0.34
Subscale 2 - ICTs at home meet student's needs	11	5.13	0.83	2	5.30	0.71
Subscale 3 - E-learning ICTs meet student's needs	13	5.39	0.87	2	5.10	0.32
Total (average) score	15	5.29	0.72	2	5.04	0.12

Note. Insufficient sample sizes for t-test.

Table 67

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students with Multiple Disabilities

	English			French				
Variables	n	Mean	SD	n	Mean	SD	t	df
Overall Criterion Items								
In general, my computer technology needs at my school are adequately met	383	4.80	1.43	61	4.90	1.54	-0.52	442
In general, my computer technology needs at home are adequately met	380	4.88	1.51	62	4.92	1.48	-0.78	438
POSITIVES Scale Subscales and Total score								
Subscale 1 - ICTs at school meet student's needs	384	4.44	1.12	58	4.58	1.05	-0.91	440
Subscale 2 - ICTs at home meet student's needs	350	4.15	1.26	52	4.50	1.27	-1.89	400
Subscale 3 - E-learning ICTs meet student's needs	386	4.82	0.92	60	5.02	0.92	-1.52	444
Total (average) score	400	4.55	0.93	61	4.73	0.85	-1.12	459

Note. None of the comparisons are significant.

Table 68

Comparison of English- and French-Speaking Participants on POSITIVES Scale and Overall Criterion Items: Students who are Blind

	English			French		
Variables	n	Mean	SD	n	Mean	SD
Overall Criterion Items						
In general, my computer technology needs at my school are adequately met	22	4.64	1.68	1	3.00	-
In general, my computer technology needs at home are adequately met	22	5.27	1.35	1	5.00	-
POSITIVES Scale Subscales and Total score						
Subscale 1 - ICTs at school meet student's needs	22	3.85	1.30	1	3.33	-
Subscale 2 - ICTs at home meet student's needs	23	4.56	1.05	1	4.60	-
Subscale 3 - E-learning ICTs meet student's needs	23	4.21	1.05	1	4.33	-
Total (average) score	23	4.12	0.99	1	3.92	-

Note. No inferential tests were carried out because of the small sample size of French-speaking students.

Institution Size

Of course, total enrollments in colleges were found to be considerably lower than in universities; the discrepancy was especially prominent in the case of French language colleges and universities (see Table 69). To explore whether institution size was related to how well students' needs were met, we correlated POSITIVES Scale Subscale and Total scores for the whole sample as well as for French- and English-speaking university and college students separately. Pearson product-moment correlation coefficients in Table 70 consistently show low or non-significant correlation coefficients, suggesting that institution size, per se, is not related to how well students feel that their ICT-related needs are met.

Table 69

Mean Institution Size

	Mean full and part time enrollment [1]	SD	n
Whole sample	27993	21419	1314
University	32723	22242	968
English-speaking	33098	22859	869
French-speaking	29431	15524	99
College	14647	10928	344
English-speaking	15712	11017	309
French-speaking	5239	1974	35

[1] All campuses of an institution combined (e.g., all campuses of Nova Scotia Community College were combined and all campuses of the University of Toronto were combined.)

Table 70

Relationship Between Institution Size and POSITIVES Scale Subscale and Total Scores

		University			Junior/Community College		
	Whole sample	Whole sample	English speaking	French speaking	Whole sample	English speaking	French speaking
Subscale 1 - ICTs at School Meet Student's Needs							
Pearson Correlation	-.072(*)	-0.051	-0.064	0.200	-0.005	-0.013	-0.213
n	1262	927	835	92	334	301	33
Subscale 2 - ICTs at Home Meet Student's Needs							
Pearson Correlation	-0.054	-0.051	-0.048	0.021	0.032	0.035	-0.111
n	1077	789	699	90	286	259	27
Subscale 3 - E-learning ICTs Meet Student's Needs							
Pearson Correlation	-.071(*)	-.067(*)	-.070(*)	-0.002	0.017	0.025	-0.285
n	1276	948	849	99	326	292	34
Total score							
Pearson Correlation	-.078(**)	-.065(*)	-.072(*)	0.109	0.009	0.009	-0.230
n	1314	968	869	99	344	309	35

*$p < .05$. **$p < .01$.

Discussion

POSITIVES Scale Properties

The key deliverable of this project, a valid and reliable measure of how well the ICT-related needs of postsecondary students with disabilities are met, is the 26-item POSITIVES Scale (Postsecondary Information Technology Initiative Scale). It has a total score as well as three factor analysis-derived subscales which evaluate how well ICTs available at school, at home, and in e-learning contexts meet the needs of students with different disabilities in postsecondary education. In addition, alternate formats of the measure (i.e., versions that can be completed online, on paper (printable PDF), and within Microsoft Word) yielded equivalent results. The Appendix contains the three alternate formats in both French and English, scoring instructions, and norms for the whole sample as well as for English- and French-speaking college and university students separately. The Appendix also contains preliminary norms for students with specific disabilities. The norms are preliminary because of sample size limitations. Preliminary norms are provided in the Appendix for students with the following disabilities: total blindness, low vision, Deafness, hard of hearing, learning disability/ADD/ADHD, mobility impairment, limitation in the use of hands/arms, medically related/health problem, psychological/psychiatric disability, and neurological impairment. Because of the wording of scale items, we believe that the measure can be used with nondisabled postsecondary students as well, although data for this group were not collected in the context of this investigation.

POSITIVES Scale Subscales

In addition to a Total score, the POSITIVES Scale has the following Subscales:

Subscale 1 - ICTs at School Meet Student's Needs. This 12-item subscale evaluates the extent to which students' ICT-related needs are met while they are at school (e.g., My school has

enough computers with internet access to meet my needs. The hours of access to computer technologies at my school meet my needs).

Subscale 2 - ICTs at Home Meet Student's Needs. This 5-item subscale evaluates the extent to which ICT-related needs are met while they are at off campus (e.g., Funding for computer technologies for personal use is adequate to meet my needs. My personal computer technologies are sufficiently up-to-date to meet my needs).

Subscale 3 - E-learning ICTs Meet Student's Needs. This 9-item subscale evaluates the extent to which the school's e-learning meets the student's needs (e.g., My school's web pages are accessible to me. I have no problems when professors use e-learning for tests and exams).

Reliability

Reliability and validity estimates for both English- and French-speaking students with disabilities indicate excellent psychometric properties for the scale. Four-week test-retest reliabilities for the three Subscales range from .73 to .79 and the reliability of the total score is .81. Paired t-tests on test and retest scores show no significant differences. Cronbach's alpha, a measure of internal consistency which averages the correlation of items in a survey instrument to assess how well the set of items measures a single construct, ranges from .79 to .91 for the three Subscales and it is .94 for the total score. Split-half reliabilities and subscale:total correlations all exceed .70.

Validity

Convergent validity data show moderate correlations among the three Subscales and strong relationships between Subscale and Total scores, suggesting that the Subscales measure different concepts, all of which are important components of the accessibility of ICTs as measured by the total score.

Discriminant validity. There was no reason to expect that females and males' POSITIVES Scale Subscale or Total scores would differ. Therefore, to test discriminant validity we compared female and male participants' POSITIVES Scale Subscales and Total scores. There were no significant differences between the groups.

Concurrent validity. As expected, score on the overall criterion item "In general, my computer and/or adaptive computer technology needs at my *school* are adequately met" was most closely correlated with Subscale 1 - ICTs at School Meet Student's Needs, and the overall criterion item, "In general, my computer and/or adaptive computer technology needs at *home* are adequately met" was most closely related to Subscale 2 - ICTs at Home Meet Student's Needs.

Criterion validity. Based on a priori assumptions, students with psychological/psychiatric disabilities were expected to have their ICT-related needs better met than students with multiple disabilities. To test criterion validity we examined the extent to which the POSITIVES Scale Subscale and Total scores were able to differentiate between these two groups. The findings show significant differences between the two groups on all Subscales as well as on the Total score.

Limitations of the Present Study

Although the POSITIVES Scale has demonstrated acceptable reliability and validity, the present investigation has some limitations that need to be taken into account when interpreting the findings. The samples of French- and English-speaking students are neither random nor fully representative of the populations studied. First, students self-identified as having a disability. Second, given the nature of participant recruitment and self-selection biases, students who read online discussion lists (listservs), had experience using e-learning, or were power-users of ICTs are over-represented. The comparison of students' disciplines with those reported in Holmes (2005) show that university students in our sample were more likely to be enrolled in sciences

and engineering than in his sample of university students with disabilities. Especially troubling is that calculating a "return rate" was impossible because of the manner in which participants were recruited.

Yet, most available indices suggest that the studies' samples have characteristics which resemble the realities of Canadian postsecondary education. For example, the samples contained more females than males, students were older than typical postsecondary samples, and the proportions of students with different disabilities reflect the realities of many postsecondary institutions.

It should also be noted that the norms have not been cross-validated on another, independently recruited sample. All students are from Canada, necessitating additional validation of the POSITIVES Scale involving samples of postsecondary students from other English- and French-speaking countries. Thus, we present the POSITIVES Scale as a promising research tool that needs additional validation.

Key Findings

Sample Characteristics

Consistent with others' findings, students with disabilities were relatively old (mean age was 28) and approximately half of the sample reported a learning disability (e.g., Stodden, 2005).

Approximately 1/3 of the sample reported a psychological/psychiatric disability. This is not surprising given Blanco et al.'s (2008) findings showing that close to 50% of a large representative sample of American university students had a diagnosable psychiatric condition during the past 12 months,

It is noteworthy that over a third of our sample reported more than one disability, a finding similar to those of earlier investigations (e.g., Asuncion, Fichten, Fossey, & Barile, 2002;

Sharpe et al. 2005). This implies that ICTs need to be operable together and that conflicts between different adaptive technologies meant to support people with different disabilities need to be avoided.

Half of the students with disabilities we contacted indicated they needed specialized software and/or hardware to use a computer effectively. This suggests that a large proportion of students with disabilities on campus may need some type of specialized computer equipment.

French- versus English-speaking students. English- and French-speaking students had different disabilities. For example, while close to half of the English-speaking participants had a learning disability, only about ¼ of French-speaking students indicated having this disability. Instead, the most common disability among French-speaking students was a mobility impairment, followed by limitation in the use of hands or arms or a medically related/health related disability. This is not surprising given the lack of recognition of learning disabilities in Québec by government, psychologists, parents, and students (Fichten, Jorgensen, Havel, & Barile, 2006). Moreover, while email-based discussion lists were used to recruit students with disabilities, such national discussion forums exist primarily in English. Therefore, many of the French-speaking students likely learned about the study from their campus disability service provider. Whatever the reason, it is important to note that the French- and English-speaking samples have somewhat different compositions.

Students' Academic Programs and Disciplines

The majority of students, both English- and French-speaking, were pursuing an undergraduate degree (54%) or a junior/community college certificate/diploma (Associate's Degree: 21%). The findings also show that the largest proportion of participants (29%) were

enrolled in the social sciences followed by arts and humanities (18%) and science and engineering (16%).

To evaluate the representativeness of our sample and to compare the disciplines of students with disabilities to those without disabilities we recoded our data to enable us to carry out a comparison with recent data from Holmes (2005), who examined the disciplines of large samples of university and of college students with and without disabilities based on two random sampling surveys carried out in 2002: the Canadian Undergraduate Student Survey and the Canadian College Student Survey. Given limitations in Holmes' data set for junior/community college students, it was possible to do this for university students only. Both our data, as well as Holmes' show that students with disabilities are more likely than nondisabled students to be taking a program in social science or arts/humanities and less likely to be taking business. In Holmes' samples, students with disabilities were substantially less likely to be taking science and engineering than the 22% of nondisabled students. This was not the case in our sample, which shows that 21% of university students were enrolled in science and engineering. It is difficult to tell whether this is due to changes since 2002, when Holmes' data were collected, or to the nature of our sampling.

What Adaptive Hardware and/or Software do Students Use?

Overall, the findings indicate that students with most types of disabilities indicated using software to improve writing quality, such as grammar and spell checkers. Indeed, these are used by over 40% of students in our sample. In rank order of popularity, for entire sample, the results show the following:

- Software that improves writing quality
- Software that reads what is on the screen

- Scanning and optical character recognition (OCR)
- Dictation software
- Software that enlarges what is on the screen

But the numbers of students with different disabilities varies in the sample and the very large numbers of students with a learning disability, with psychological/psychiatric impairments, and with multiple disabilities can skew the results. Therefore, we also note, below, the adaptive computer technologies mentioned by a minimum of 15% of students in each disability grouping.

It was not surprising to find that students with a learning disability were most likely to report using software that improves writing quality. Students with learning disabilities also indicated using voice dictation and screen reading software, technologies traditionally considered to be useful primarily to students with visual and neuromuscular impairments (Ofiesh, Rice, Long, Merchant, & Gajar, 2002).

Students with a learning disability, with or without ADD / ADHD indicated using

1. Software that improves writing quality
2. Software that reads what is on the screen
3. Scanning and optical character recognition (OCR)
4. Dictation software

Students who were totally blind indicated using

1. Software that reads what is on the screen
2. Scanning and optical character recognition (OCR)
3. Refreshable Braille display
4. Software that improves writing quality

Students with low vision indicated using

1. Software that enlarges what is on the screen
2. Software that reads what is on the screen
3. Large screen monitor
4. Software that improves writing quality
5. Scanning and optical character recognition (OCR)

Students who are Deaf indicated using

1. Software that improves writing quality
2. Scanning and optical character recognition (OCR)

Students who are hard of hearing indicated using

1. Software that improves writing quality

Students with a mobility impairment indicated using

1. Software that improves writing quality

Students with a limitation in the use of their hands or arms indicated using

1. Software that improves writing quality
2. Dictation software
3. Alternative mouse
4. Adapted keyboard

Students with a medical related/health problem indicated using

1. Software that improves writing quality
2. Software that enlarges what is on the screen

Students with a psychological/psychiatric disability indicated using

1. Software that improves writing quality

Students with a neurological impairment indicated using

1. Software that improves writing quality
2. Dictation software

Students with pervasive developmental disorder (PDD) indicated using

1. Software that improves writing quality

Students with multiple disabilities/impairments indicated using

1. Software that improves writing quality
2. Software that reads what is on the screen
3. Dictation software
4. Software that enlarges what is on the screen
5. Scanning and optical character recognition (OCR)
6. Large screen monitor

Findings Using the POSITIVES Scale: How Well are Students' ICT-Related Needs Met?

Consistent with data from other researchers (Sharpe, Johnson, Izzo, & Murray, 2005) our results show more favorable than unfavorable scores and no significant differences between college and university students' ratings. Nevertheless, there are some concerns around the availability of adapted computers in the school's specialized computer laboratories as well as with institutional computer technology loan programs. The accessibility of computers in campus computer labs has been noted as an issue of concern by students elsewhere as well (e.g., Armstrong et al. 1997). In addition, funding for computer technologies for personal use as well as problems with training, both on and off campus, had low scores, as did the item dealing with poor technical support when the student is not at school.

On the plus side, the findings show that students feel the school's web pages are accessible, that they can effectively use the computer technologies they need, that expertise in adaptive ICTs was readily available on campus, that needed electronic format course materials are readily available, and that the school's interactive online services (e.g., registration, financial aid applications on the web) as well as the library's computer systems were generally quite accessible.

Home Versus School

Findings on POSITIVES Scale Subscales indicate that students' e-learning needs and ICT-related needs at school are better met than their ICT-related needs at home. To explore this finding further we compared the views of students with different disabilities about how well their ICT-related needs are met in various contexts at home and at school (i.e., overall ICT-related needs met, ICTs sufficiently up-to-date, technical support needs met, training needs met). The results indicate significant differences among students with different disabilities on all variables. In addition, the findings show that (a) students' technical support as well as training needs were significantly better met at school than at home; (b) students with low vision felt that their ICT-related needs were better met at home than at school; (c) students with medically related and psychologically/psychiatrically related disabilities felt the opposite was true; (d) on how adequately up-to-date their ICTs were, students who were totally blind indicated that their technologies were significantly more up-to-date at home, while students with learning disabilities, as well as with medically related, psychologically related and multiple disabilities indicated the opposite. These findings suggest that colleges and universities need to ensure that they install the latest version of adaptive software and, needless to say, students must be able to have up-to-date technologies at home available to them as well.

Students with different disabilities. Although overall the findings suggest that the ICT-related needs of students in all groups are relatively well met, those of students who are totally blind, those with multiple disabilities, and those with low vision were met least well, while the needs of students who are heard of hearing, have a medically related/health problem, have a mobility impairment or have a psychological/psychiatric disability were met most effectively.

However, the findings on POSITIVES Scale Subscales suggest that while this pattern is true for Subscales 1 (ICTs at School Meet Needs) and Subscale 3 (E-learning ICTs meet students' needs), the pattern of results is very different for home use, where the ICT-related needs of the following groups are least well met: multiple disabilities, psychological/psychiatric disability, learning disability/ADD/ADHD. That the ICT-related needs of students with learning disabilities are not well met has also been found in a recent study by Wolforth (2009). The home-based ICT-related needs of students with a mobility impairment, those who are hard of hearing and those who are totally blind are met best.

Language, Institution Type and Size

Students' ICT related needs were found to be better met in colleges than in universities, and this was not related to school size or to the disciplines pursued by the students. We also examined the relationship between the overall size of students' postsecondary institutions and the extent to which they felt their ICT-related needs were met. We did this separately for English- and French-speaking college and university students. The results conclusively show that institution size, per se, is not related to how well students feel that their ICT-related needs are met.

Examination of the POSITIVES Scale findings for university and for junior/community college students who speak French versus English show that the needs of university students who speak French were better met than those of their English-speaking counterparts, while the reverse

was true for college students. However, as noted earlier, substantial differences between the nature of French- and English-speaking students' disabilities preclude an explanation of these findings.

Implications for Future Research and Practice

As a key step in addressing the evaluation of how well the ICT needs of students with disabilities in postsecondary education are met, the POSITIVES Scale fills an important void. The reliability and validity testing conducted to date allow students with disabilities to have a say about the availability and accessibility of campus computing as well as of ICTs available for off campus use. The measure has a variety of attractive features. Only 26 items long, it is easy for learners with all types of disabilities to complete. The simple scoring requires only a straightforward calculation of means. The measure, which can be completed online, within a Microsoft Word file, and in print formats, has the advantage of flexibility due to its "face validity."

Potential uses. The POSITIVES Scale (a) permits item-by-item analysis to identify individual areas of perceived strength and weakness, (b) can assess modifiable aspects of the accessibility, usability, and availability of ICTs both on and off campus, as well as (c) permit monitoring and evaluation of the effects of efforts to improve meeting students' needs. For example, the measure could be administered at different times as major modifications occur in campus computing infrastructure or in ICT-related policies as these relate to students with disabilities. Other uses of the scale include: (d) evaluation of one's own institution; (e) a means for continuously measuring progress through internal and external benchmark setting; (f) identifying gaps and targeting specific areas for improvement; and (g) a means of informing policy documents, institutional changes, and ICT budget allocations.

Possible research directions include: (a) continued validation by comparing scores of students with disabilities with their grades as well as with their views about other aspects of their postsecondary experience, (b) additions to the normative data by testing larger, more diverse samples, by providing separate norms by student disability, by school type, location, and nature (e.g., junior/community college versus university, urban versus rural, private versus public), and (c) collecting new samples and samples outside Canada such as the U.S., Great Britain, Australia, France and Belgium.

Conclusions

The findings underscore the idea that ICTs that meet the needs of students with disabilities involve the availability of internet capable computers with accessibility features at home as well as in both specialized and general use school labs, good support for these technologies, the availability of training on ICTs as well as accessible campus computing infrastructure and e-learning used by faculty.

To support the academic success of students with disabilities, we recommend that colleges and universities, along with rehabilitation professionals and educators, identify and assess what training they provide to students on the use of ICTs and act upon any gaps, especially those identified by the students themselves. Students, of course, need to be proactive in managing their own learning experiences. They need to find out what kinds of adaptations are available to help them use ICTs effectively, learn to use adaptive ICTs that can help them access campus computing more easily, request accommodations they require, and ask for assistance where needed.

As long as mainstream software and hardware are designed and built without consideration for their accessibility and usability by learners with all types of different needs and as long as accessibility is not a key consideration when developing and purchasing college ICTs,

including off-the-shelf e-learning products, students with disabilities will experience difficulties. Universal instructional design (McGuire, Scott, & Shaw, 2003; Scott, McGuire, & Foley, 2003), which proposes using instructional strategies and products that are usable by all students whenever possible, without the need for adaptations, would go a long way toward removing access problems. Proponents of this concept hold that if something works well for people with disabilities, it works better for everyone (Shaw, 2002). Burgstahler's (2005, 2006) brochures as well as the excellent book edited by Burgstahler and Cory (2008) provide suggestions for implementing universal instructional design in the postsecondary environment.

Ensuring that the ICT-related needs of students with all types of disabilities are met needs to become and institutional priority for colleges, universities, tutoring centers and rehabilitation facilities. This will result in fewer ICT-related needs being unmet, will contribute to the removal of barriers for students, and will equip students with disabilities with the skills needed to succeed in the increasingly ICT-driven world of school, work, community, and leisure.

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Appendix

POSITIVES Scale (Postsecondary Information Technology Initiative Scale) Items, Factors, and Scoring

Factor	Item number, item wording and scoring	Mean	SD
Subscale 1 - ICTs at School Meet Student's Needs (Scoring: average all Subscale 1 single item scores other than "not applicable")		4.65	1.03
1	1. My school has enough computers with internet access to meet my needs	4.83	1.46
1	2. The hours of access to computer technologies at my school meet my needs	4.91	1.45
1	3. At my school, computer technologies are sufficiently up to date to meet my needs (e.g., grammar checking, adaptive mouse, software that reads what is on the screen)	4.90	1.43
1	4. There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	4.19	1.69
1	5. The availability of computer technologies in my school's general use computer labs meet my needs	4.47	1.62
1	8. The technical support provided at my school for computer technologies meets my needs	4.59	1.46
1	9. When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues (e.g., cannot see the PowerPoint presentation, cannot hear a video clip, need a grammar checker to write an essay)	4.72	1.43
1	10. There is at least one person on staff at my school who has expertise in adaptive hardware and software (e.g., knowledgeable about software that reads what is on the screen, keeps up to date with the latest in adapted keyboards)	5.00	1.37
1	11. The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support)	4.22	1.55
1	13. Training provided by my school on how to use the computer technologies meets my needs	4.29	1.60
1	14. Informal help is available at my school to show me how to use computer technologies if I need this	4.54	1.46
1	24. The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway)	4.90	1.49
Subscale 2 - ICTs at Home Meet Student's Needs (Scoring: average all Subscale 2 single item scores other than "not applicable")		4.38	1.20
2	6. My school's loan program for computer technologies meets my needs	3.88	1.86
2	7. Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program)	4.07	1.85
2	12. I know how to effectively use the computer technologies that I need	5.08	1.25
2	15. Training available off campus on how to use computer technologies meets my needs	3.64	1.65
2	23. My personal computer technologies are sufficiently up-to-date to meet my needs	4.76	1.52
Subscale 3 - E-learning ICTs Meet Student's Needs (Scoring: average all Subscale 3 single item scores other than "not applicable")		4.98	0.88
3	16. When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT)	4.99	1.32
3	17. I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT)	4.71	1.57
3	18. Distance education courses offered by my institution are accessible to me	4.70	1.56
3	19. If I bring computer technology into the classroom I am able to use it (e.g., can plug it in)	4.59	1.50
3	20. I feel comfortable using needed computer technologies in the classroom	4.63	1.54
3	21. My school's interactive online services are accessible to me (e.g., registering, financial aid applications on the web)	5.36	1.06
3	22. The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs)	5.02	1.28
3	25. My school's web pages are accessible to me	5.52	0.94
3	26. The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3)	5.04	1.35
Total (average) score (Scoring: average all single item scores other than "not applicable")		4.75	0.86

Scoring. For all statements, rate your level of agreement using the following scale: 1 = Strongly Disagree, 2 = Moderately Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5 = Moderately Agree, 6 = Strongly Agree, 7 = Not Applicable

POSITIVES Scale Norms for English- and French-speaking College and University Students

Language	Institution	Mean	SD
POSITIVES Scale Subscales			
Subscale 1 - ICTs at School Meet Student's Needs			
English	College	4.81	0.98
	University	4.57	1.03
French	College	4.66	1.11
	University	4.79	0.91
Subscale 2 - ICTs at Home Meet Student's Needs			
English	College	4.48	1.16
	University	4.27	1.22
French	College	4.48	1.26
	University	4.86	1.02
Subscale 3 - E-learning ICTs Meet Student's Needs			
English	College	5.08	0.82
	University	4.95	0.84
French	College	5.12	1.15
	University	5.11	0.83
POSITIVES Scale Total (average) score			
English	College	4.87	0.83
	University	4.68	0.87
French	College	4.83	1.03
	University	4.93	0.75

POSITIVES Scale Preliminary Norms for Students with Different Disabilities

Group	Mean	SD
Subscale 1 - ICTs at School Meet Student's Needs		
Totally blind	4.21	1.12
Low vision	4.47	1.13
Deaf	4.60	0.81
Hard of hearing	4.95	0.76
Learning disability/ADD/ADHD (e.g., dyslexia)	4.76	0.98
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	4.81	0.97
Limitation in the use of hands/arms	4.56	0.86
Medically related/health problem (e.g., diabetes, Crohn's)	4.94	0.86
Psychological/psychiatric disability (e.g., anxiety, depression)	4.81	0.89
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.52	1.08
Multiple disabilities	4.45	1.11
Whole sample	4.65	1.02
Subscale 2 - ICTs at Home Meet Student's Needs		
Totally blind	4.80	0.96
Low vision	4.69	1.11
Deaf	4.86	0.67
Hard of hearing	4.73	0.92
Learning disability/ADD/ADHD (e.g., dyslexia)	4.39	1.20
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	4.70	1.21
Limitation in the use of hands/arms	4.48	1.02
Medically related/health problem (e.g., diabetes, Crohn's)	4.47	1.15
Psychological/psychiatric disability (e.g., anxiety, depression)	4.37	1.21
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.58	0.93
Multiple disabilities	4.19	1.26
Whole sample	4.38	1.20
Subscale 3 - E-learning ICTs Meet Student's Needs		
Totally blind	4.63	0.69
Low vision	4.90	0.93
Deaf	5.15	0.80
Hard of hearing	5.30	0.54
Learning disability/ADD/ADHD (e.g., dyslexia)	5.01	0.80
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	5.37	0.76
Limitation in the use of hands/arms	5.02	0.69
Medically related/health problem (e.g., diabetes, Crohn's)	5.28	0.86
Psychological/psychiatric disability (e.g., anxiety, depression)	5.13	0.76
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.91	0.86
Multiple disabilities	4.85	0.92
Whole sample	5.00	0.85
Total (average) score		
Totally blind	4.48	0.73
Low vision	4.67	0.90
Deaf	4.86	0.64
Hard of hearing	5.05	0.63
Learning disability/ADD/ADHD (e.g., dyslexia)	4.81	0.84
Mobility impairment (e.g., use of a wheelchair/cane/crutches)	5.03	0.82
Limitation in the use of hands/arms	4.72	0.73
Medically related/health problem (e.g., diabetes, Crohn's)	5.03	0.78
Psychological/psychiatric disability (e.g., anxiety, depression)	4.87	0.79
Neurological impairment (e.g., epilepsy, traumatic brain injury)	4.69	0.90
Multiple disabilities	4.57	0.92
Whole sample	4.75	0.86

POSITIVES Scale Alternate Formats

POSITIVES Scale (Postsecondary Information Technology Initiative Scale) Online Version

Échelle POSITIVES (Échelle Postsecondary Information Technology Initiative Scale) Version en ligne

POSITIVES Scale (Postsecondary Information Technology Initiative Scale) Word Version

Échelle POSITIVES (Échelle Postsecondary Information Technology Initiative Scale) Version Word

POSITIVES Scale (Postsecondary Information Technology Initiative Scale) PDF Version

Échelle POSITIVES (Échelle Postsecondary Information Technology Initiative Scale) Version PDF

POSITIVES Scale (Postsecondary Information Technology Initiative Scale)

Online Version

For all statements, rate your level of agreement using the following scale:

Strongly Disagree
Moderately Disagree
Slightly Disagree
Slightly Agree
Moderately Agree
Strongly Agree
Not Applicable

Do not spend too much time on any one statement. Simply give the answer which best describes the general situation. Answer all items. If an item is not applicable to you, respond with not applicable.

1. My school has enough computers with internet access to meet my needs - Select One -
2. The hours of access to computer technologies at my school meet my needs - Select One -
3. At my school, computer technologies are sufficiently up to date to meet my needs (e.g., grammar checking, adaptive mouse, software that reads what is on the screen) - Select One -
4. There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs - Select One -
5. The availability of computer technologies in my school’s general use computer labs meets my needs - Select One -
6. My school’s loan program for computer technologies meets my needs - Select One -
7. Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program) - Select One -
8. The technical support provided at my school for computer technologies meets my needs - Select One -

9. When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues (e.g., cannot see the PowerPoint presentation, cannot hear a video clip, need a grammar checker to write an essay)
- Select One -

10. There is at least one person on staff at my school who has expertise in adaptive ICTs (e.g., knowledgeable about software that reads what is on the screen, keeps up to date with the latest in adapted keyboards)
- Select One -

11. The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support)
- Select One -

12. I know how to effectively use the computer technologies that I need
- Select One -

13. Training provided by my school on how to use the computer technologies meets my needs
- Select One -

14. Informal help is available at my school to show me how to use computer technologies if I need this
- Select One -

15. Training available off campus on how to use computer technologies meets my needs
- Select One -

16. When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT)
- Select One -

17. I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT)
- Select One -

18. Distance education courses offered by my institution are accessible to me
- Select One -

19. If I bring computer technology into the classroom I am able to use it (e.g., can plug it in)
- Select One -

20. I feel comfortable using needed computer technologies in the classroom
- Select One -

21. My school's interactive online services are accessible to me (e.g., registering, financial aid applications on the web)
- Select One -

22. The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs)

- Select One -

23. My personal computer technologies are sufficiently up-to-date to meet my needs

- Select One -

24. The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway)

- Select One -

25. My school's web pages are accessible to me

- Select One -

26. The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3)

- Select One -

Échelle POSITIVES (Échelle Postsecondary Information Technology Initiative Scale) Version en ligne

Pour chacun des énoncés suivants, indiquez votre degré d'accord à l'aide de l'échelle suivante :

Fortement en désaccord
Modérément en désaccord
Légèrement en désaccord
Légèrement en accord
Modérément en accord
Fortement en accord
Non Applicable

Indiquez la réponse qui vous vient spontanément et qui décrit le mieux votre situation. Répondez à chaque question. Si un item ne s'applique pas, inscrivez "Non applicable".

1. Mon école a suffisamment d'ordinateurs avec accès à l'Internet pour répondre à mes besoins - Choisir un -
2. Les heures d'accès aux technologies informatiques à mon école répondent à mes besoins - Choisir un -
3. À mon école, les technologies informatiques sont suffisamment à jour pour répondre à mes besoins (ex : correcteur grammatical, souris adaptée, lecteur d'écran). - Choisir un -
4. Mon école a suffisamment de technologies informatiques dans les laboratoires spécialisés / centres de services pour étudiants ayant des incapacités pour répondre à mes besoins - Choisir un -
5. Mon école a suffisamment de technologies informatiques dans les laboratoires informatiques destinés à tous les étudiants pour répondre à mes besoins Non Applicable
6. À mon école, le programme de prêt de technologies informatiques répond à mes besoins - Choisir un -
7. Les subventions pour les technologies informatiques servant à mon utilisation personnelle répondent à mes besoins (ex : gouvernement, fondation, centre de réadaptation, programme de prêts) - Choisir un -
8. À mon école, le soutien technique fourni pour les technologies informatiques répond à mes besoins

- Choisir un -

9. Lorsque je rapporte aux membres du personnel de mon école des problèmes reliés à l'accessibilité des technologies informatiques, ils agissent rapidement pour les résoudre (ex : ne peut voir la présentation PowerPoint, ne peut écouter un vidéo clip, besoin d'un correcteur grammatical pour une rédaction)

- Choisir un -

10. À mon école, il y a au moins un membre du personnel qui possède une expertise en matière de technologies informatiques adaptées (ex : possède des connaissances sur les logiciels de lecture d'écran, garde ses connaissances à jour sur les plus récents modèles de claviers adaptés)

- Choisir un -

11. La disponibilité du soutien technique lorsque je ne suis pas à l'école répond à mes besoins (ex : l'assistance technique de l'école / vendeurs)

- Choisir un -

12. Je sais comment utiliser de manière efficace les technologies informatiques dont j'ai besoin

- Choisir un -

13. La formation offerte par mon école sur l'utilisation des technologies informatiques répond à mes besoins

- Choisir un -

14. À mon école, un soutien informel est disponible au besoin pour m'indiquer comment utiliser les technologies informatiques

- Choisir un -

15. La formation sur l'utilisation des technologies informatiques offerte hors du campus répond à mes besoins

- Choisir un -

16. Lorsque les enseignants utilisent le cyber-apprentissage, il m'est accessible (ex : PowerPoint en classe, notes de cours sur Internet, CD-ROMs, WebCT)

- Choisir un -

17. Je n'ai pas de difficultés lorsque les enseignants utilisent le cyber-apprentissage pour les tests et examens (ex : tests sur WebCT)

- Choisir un -

18. Les cours à distance offerts par mon école me sont accessibles

- Choisir un -

19. Je suis en mesure d'utiliser facilement les technologies informatiques que j'amène en classe (ex : je peux les brancher)

- Choisir un -

20. Je me sens à l'aise d'utiliser les technologies informatiques nécessaires en classe

- Choisir un -

21. À mon école, les services en ligne me sont accessibles (ex : inscription, formulaire d'aide financière par Internet)

- Choisir un -

22. L'accessibilité du système informatique de la bibliothèque répond à mes besoins (ex : répertoire, bases de données, CD-ROMs)

- Choisir un -

23. Mes technologies informatiques personnelles sont suffisamment à jour pour répondre à mes besoins

- Choisir un -

24. À mon école, l'accès physique aux technologies informatiques répond à mes besoins (ex : table réglable, porte assez large)

- Choisir un -

25. Les sites Web de mon école me sont accessibles

- Choisir un -

26. La disponibilité du matériel de cours en format électronique répond à mes besoins (ex : Word, PDF, MP3)

- Choisir un -

POSITIVES Scale (Postsecondary Information Technology Initiative Scale) Word Version

For all statements that follow, rate your level of agreement using the following scale.

1 = Strongly Disagree
2 = Moderately Disagree
3 = Slightly Disagree
4 = Slightly Agree
5 = Moderately Agree
6 = Strongly Agree

N/A = Not Applicable

Do not spend too much time on any one statement. Simply give the answer which best describes the general situation. Answer all items. If an item is not applicable to you, respond with not applicable. Put a number beside each item.

1. My school has enough computers with internet access to meet my needs:
2. The hours of access to computer technologies at my school meet my needs:
3. At my school, computer technologies are sufficiently up to date to meet my needs (e.g., grammar checking, adaptive mouse, software that reads what is on the screen):
4. There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs:
5. The availability of computer technologies in my school's general use computer labs meets my needs:
6. My school's loan program for computer technologies meets my needs:
7. Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program):
8. The technical support provided at my school for computer technologies meets my needs:
9. When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues (e.g., cannot see the PowerPoint presentation, cannot hear a video clip, need a grammar checker to write an essay):
10. There is at least one person on staff at my school who has expertise in adaptive ICTs (e.g., knowledgeable about software that reads what is on the screen, keeps up to date with the latest in adapted keyboards):
11. The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support):
12. I know how to effectively use the computer technologies that I need:
13. Training provided by my school on how to use the computer technologies meets my needs:

14. Informal help is available at my school to show me how to use computer technologies if I need this:
15. Training available off campus on how to use computer technologies meets my needs:
16. When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT):
17. I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT):
18. Distance education courses offered by my institution are accessible to me:
19. If I bring computer technology into the classroom I am able to use it (e.g., can plug it in):
20. I feel comfortable using needed computer technologies in the classroom:
21. My school's interactive online services are accessible to me (e.g., registering, financial aid applications on the web):
22. The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs):
23. My personal computer technologies are sufficiently up-to-date to meet my needs:
24. The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway):
25. My school's web pages are accessible to me:
26. The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3):

Échelle POSITIVES (Postsecondary Information Technology Initiative Scale) Version Word

Pour chacun des énoncés suivants, indiquez votre degré d'accord à l'aide de l'échelle suivante.

1 = Fortement en désaccord
2 = Modérément en désaccord
3 = Légèrement en désaccord
4 = Légèrement en accord
5 = Modérément en accord
6 = Fortement en accord

N/A = Non Applicable

Indiquez la réponse qui vous vient spontanément et qui décrit le mieux votre situation. Répondez à chaque question. Si un item ne s'applique pas, inscrivez "Non applicable".

1. Mon école a suffisamment d'ordinateurs avec accès à l'Internet pour répondre à mes besoins:
2. Les heures d'accès aux technologies informatiques à mon école répondent à mes besoins:
3. À mon école, les technologies informatiques sont suffisamment à jour pour répondre à mes besoins (ex : correcteur grammatical, souris adaptée, lecteur d'écran):
4. Mon école a suffisamment de technologies informatiques dans les laboratoires spécialisés / centres de services pour étudiants ayant des incapacités pour répondre à mes besoins:
5. Mon école a suffisamment de technologies informatiques dans les laboratoires informatiques destinés à tous les étudiants pour répondre à mes besoins:
6. À mon école, le programme de prêt de technologies informatiques répond à mes besoins:
7. Les subventions pour les technologies informatiques servant à mon utilisation personnelle répondent à mes besoins (ex : gouvernement, fondation, centre de réadaptation, programme de prêts):
8. À mon école, le soutien technique fourni pour les technologies informatiques répond à mes besoins:
9. Lorsque je rapporte aux membres du personnel de mon école des problèmes reliés à l’accessibilité des technologies informatiques, ils agissent rapidement pour les résoudre (ex : ne peut voir la présentation PowerPoint, ne peut écouter un vidéo clip, besoin d’un correcteur grammatical pour une rédaction):
10. À mon école, il y a au moins un membre du personnel qui possède une expertise en matière de technologies informatiques adaptées (ex : possède des connaissances sur les logiciels de lecture d'écran, garde ses connaissances à jour sur les plus récents modèles de claviers adaptés):
11. La disponibilité du soutien technique lorsque je ne suis pas à l'école répond à mes besoins (ex : l'assistance technique de l'école / vendeurs):

12. Je sais comment utiliser de manière efficace les technologies informatiques dont j'ai besoin:
13. La formation offerte par mon école sur l'utilisation des technologies informatiques répond à mes besoins:
14. À mon école, un soutien informel est disponible au besoin pour m'indiquer comment utiliser les technologies informatiques:
15. La formation sur l'utilisation des technologies informatiques offerte hors du campus répond à mes besoins:
16. Lorsque les enseignants utilisent le cyber-apprentissage, il m'est accessible (ex : PowerPoint en classe, notes de cours sur Internet, CD-ROMs, WebCT):
17. Je n'ai pas de difficultés lorsque les enseignants utilisent le cyber-apprentissage pour les tests et examens (ex : tests sur WebCT):
18. Les cours à distance offerts par mon école me sont accessibles:
19. Je suis en mesure d'utiliser facilement les technologies informatiques que j'amène en classe (ex : je peux les brancher):
20. Je me sens à l'aise d'utiliser les technologies informatiques nécessaires en classe:
21. À mon école, les services en ligne me sont accessibles (ex : inscription, formulaire d'aide financière par Internet):
22. L'accessibilité du système informatique de la bibliothèque répond à mes besoins (ex : répertoire, bases de données, CD-ROMs):
23. Mes technologies informatiques personnelles sont suffisamment à jour pour répondre à mes besoins:
24. À mon école, l'accès physique aux technologies informatiques répond à mes besoins (ex : table réglable, porte assez large):
25. Les sites Web de mon école me sont accessibles:
26. La disponibilité du matériel de cours en format électronique répond à mes besoins (ex : Word, PDF, MP3):

POSITIVES Scale (Postsecondary Information Technology Initiative Scale) PDF Version

For all statements, rate your level of agreement using the following scale:

1	2	3	4	5	6	[N/A]
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	Not Applicable

Do not spend too much time on any one statement. Simply give the answer which best describes the general situation. Answer all items. If an item is not applicable to you, respond with not applicable.

1. _____ My school has enough computers with internet access to meet my needs
2. _____ The hours of access to computer technologies at my school meet my needs
3. _____ At my school, computer technologies are sufficiently up to date to meet my needs (e.g., grammar checking, adaptive mouse, software that reads what is on the screen)
4. _____ There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs
5. _____ The availability of computer technologies in my school's general use computer labs meets my needs
6. _____ My school's loan program for computer technologies meets my needs
7. _____ Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program)
8. ____ The technical support provided at my school for computer technologies meets my needs
9. ____ When I approach staff at my institution with problems related to the accessibility of computer technologies on campus they act quickly to resolve any issues (e.g., cannot see the PowerPoint presentation, cannot hear a video clip, need a grammar checker to write an essay)

10. ____ There is at least one person on staff at my school who has expertise in adaptive ICTs (e.g., knowledgeable about software that reads what is on the screen, keeps up to date with the latest in adapted keyboards)
11. ____ The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support)
12. ____ I know how to effectively use the computer technologies that I need
13. ____ Training provided by my school on how to use the computer technologies meets my needs
14. ____ Informal help is available at my school to show me how to use computer technologies if I need this
15. ____ Training available off campus on how to use computer technologies meets my needs
16. ____ When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT)
17. ____ I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT)
18. ____ Distance education courses offered by my institution are accessible to me
19. ____ If I bring computer technology into the classroom I am able to use it (e.g., can plug it in)
20. ____ I feel comfortable using needed computer technologies in the classroom
21. ____ My school’s interactive online services are accessible to me (e.g., registering, financial aid applications on the web)
22. ____ The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs)
23. ____ My personal computer technologies are sufficiently up-to-date to meet my needs
24. ____ The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway)
25. ____ My school’s web pages are accessible to me
26. ____ The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3)

Échelle POSITIVES (Postsecondary Information Technology Initiative Scale) Version PDF

Pour chacun des énoncés suivants, indiquez votre degré d'accord à l'aide de l'échelle suivante:

1	2	3	4	5	6	[N/A]
Fortement en désaccord	Modérément en désaccord	Légère-ment en désaccord	Légère-ment en accord	Modérément en accord	Fortement en accord	Non Applicable

Indiquez la réponse qui vous vient spontanément et qui décrit le mieux votre situation. Répondez à chaque question. Si un item ne s'applique pas, inscrivez "Non applicable".

1. _____ Mon école a suffisamment d'ordinateurs avec accès à l'Internet pour répondre à mes besoins
2. _____ Les heures d'accès aux technologies informatiques à mon école répondent à mes besoins
3. _____ À mon école, les technologies informatiques sont suffisamment à jour pour répondre à mes besoins (ex : correcteur grammatical, souris adaptée, lecteur d'écran)
4. _____ Mon école a suffisamment de technologies informatiques dans les laboratoires spécialisés / centres de services pour étudiants ayant des incapacités pour répondre à mes besoins 5. _____ Mon école a suffisamment de technologies informatiques dans les laboratoires informatiques destinés à tous les étudiants pour répondre à mes besoins
6. _____ À mon école, le programme de prêt de technologies informatiques répond à mes besoins
7. _____ Les subventions pour les technologies informatiques servant à mon utilisation personnelle répondent à mes besoins (ex : gouvernement, fondation, centre de réadaptation, programme de prêts)
8. ____ À mon école, le soutien technique fourni pour les technologies informatiques répond à mes besoins
9. ____ Lorsque je rapporte aux membres du personnel de mon école des problèmes reliés à l’accessibilité des technologies informatiques, ils agissent rapidement pour les résoudre (ex : ne peut voir la présentation PowerPoint, ne peut écouter un vidéo clip, besoin d’un correcteur grammatical pour une rédaction)

10. ____ À mon école, il y a au moins un membre du personnel qui possède une expertise en matière de technologies informatiques adaptées (ex : possède des connaissances sur les logiciels de lecture d'écran, garde ses connaissances à jour sur les plus récents modèles de claviers adaptés)
11. ____ La disponibilité du soutien technique lorsque je ne suis pas à l'école répond à mes besoins (ex : l'assistance technique de l'école / vendeurs)
12. ____ Je sais comment utiliser de manière efficace les technologies informatiques dont j'ai besoin
13. ____ La formation offerte par mon école sur l'utilisation des technologies informatiques répond à mes besoins
14. ____ À mon école, un soutien informel est disponible au besoin pour m'indiquer comment utiliser les technologies informatiques
15. ____ La formation sur l'utilisation des technologies informatiques offerte hors du campus répond à mes besoins
16. ____ Lorsque les enseignants utilisent le cyber-apprentissage, il m'est accessible (ex : PowerPoint en classe, notes de cours sur Internet, CD-ROMs, WebCT)
17. ____ Je n'ai pas de difficultés lorsque les enseignants utilisent le cyber-apprentissage pour les tests et examens (ex : tests sur WebCT)
18. ____ Les cours à distance offerts par mon école me sont accessibles
19. ____ Je suis en mesure d'utiliser facilement les technologies informatiques que j'amène en classe (ex : je peux les brancher)
20. ____ Je me sens à l'aise d'utiliser les technologies informatiques nécessaires en classe
21. ____ À mon école, les services en ligne me sont accessibles (ex : inscription, formulaire d'aide financière par Internet)
22. ____ L'accessibilité du système informatique de la bibliothèque répond à mes besoins (ex : répertoire, bases de données, CD-ROMs)
23. ____ Mes technologies informatiques personnelles sont suffisamment à jour pour répondre à mes besoins
24. ____ À mon école, l'accès physique aux technologies informatiques répond à mes besoins (ex : table réglable, porte assez large)
25. ____ Les sites Web de mon école me sont accessibles
26. ____ La disponibilité du matériel de cours en format électronique répond à mes besoins (ex : Word, PDF, MP3)