

## **Information and Communication Technology for French and English Speaking Postsecondary Students with Disabilities: What are Their Needs and How Well are These Being Met?**

**Catherine S. Fichten,<sup>a,b,c,d</sup> Mai N. Nguyen,<sup>a</sup> Jennison V. Asuncion,<sup>a</sup> Maria Barile,<sup>a</sup>  
Jillian Budd,<sup>a</sup> Rhonda Amsel,<sup>c</sup> Eva Libman,<sup>c,d</sup>  
Adaptech Research Network / Réseau de Recherche Adaptech,<sup>a</sup> Dawson College,<sup>b</sup>  
McGill University,<sup>c</sup> SMBD - Jewish General Hospital - Montreal<sup>d</sup>**

### **Abstract**

*This study evaluates how well information and communication technology (ICT) related needs of students with various disabilities are met at school, at home, and in e-learning contexts. Results are based on the POSITIVES Scale, a 26 item objective measure of how well the ICT related needs of these students are met. The sample consists of 131 students from French and 1202 students from English language universities and junior/community colleges with various disabilities from across Canada. Although the results generally show more favourable than unfavourable scores, these are affected by the nature of students' disabilities and by context: home or school. Generally, both groups had similar views about circumstances where their needs were poorly met and about what worked well. The findings suggest that linguistic and policy considerations have an impact on how well the ICT related needs of students with different disabilities are met in different parts of Canada.*

Canadian university and junior/community college students with disabilities, as their nondisabled peers, must be able to utilize a variety of general use software (e.g., Microsoft Office). In addition, students who have a disability may also require use of adaptive software (e.g., text-to-speech, speech-to-text, magnification) and adaptive hardware (e.g., an adapted mouse). All students, including those with disabilities, need to be able to access the e-learning used by faculty (Abrami et al., 2006), such as PowerPoint in class, threaded discussions, and a large variety of different types of e-learning used in teaching courses in the classroom, online, or in a combination of both (Fichten et al., 2009). This allows students with disabilities to participate, alongside their non-disabled peers, in the learning experience.

Canada has two official languages, English and French, with the majority of French speaking Canadians living in Québec. Indeed, the mother tongue of approximately 80% of Québec's population is French (Institut national de santé publique du Québec, 2009). This poses an additional challenge to Canadian students because linguistic and cultural factors likely impose important differences on the types of information and communication technology (ICT) related experiences of English and French speaking postsecondary students. For example, most of the general use and adaptive software and hardware were developed either in the United States or England. Thus, these work mainly in English. French translations, if these are available at all, are usually at least one version behind. Because the French speaking population of Canada, numbering between 8 and 9 million, is relatively small compared to Canada's, the United States', and Britain's English speaking populations, there are relatively few ICTs, particularly adaptive ICTs for persons with disabilities that function in French. France and other French speaking countries do not have the same level of ICT maturity as English speaking countries (e.g., NationMaster, 2009). Nevertheless, many ICTs, although they have an English interface, can work in French as well, and one excellent writing aid, Antidote, was developed in Québec and works only in French.

In addition, there are cultural and ICT related policy differences which are likely to affect the ICT experiences of postsecondary students with disabilities as well. For example, learning disabilities are not as well known among Québec's French speaking population as in the remaining nine English speaking provinces of Canada (Chouinard & Déry, 2008; Mimouni & King, 2007). Therefore, teachers, parents, counsellors, and educators are not likely to recognize students with this disability, resulting in lower levels of identification and remediation (Chouinard & Déry, 2008; King, Mimouni, & Courtemanche, 2006; Mimouni & King, 2007) and, possibly, specialized ICT use. Moreover, several popular software packages used by students with learning disabilities (e.g., Write: OutLoud, WordTalk) are available only in English. There are also some differences between the extent of e-learning and computer use between English and French speaking colleges and universities (Fichten, Asuncion, Robillard, Fossey, & Barile, 2003) as well as public schools (Statistics Canada, 2009a); there is more extensive educational use of computers in English speaking provinces. Moreover, students with different disabilities need different types of adaptive technologies to allow them to use needed ICTs, and there may be linguistic and policy related differences in the extent to which needed adaptations are available—and provided or subsidized by government programs—for school or home use. All of this diversity provides good reason to believe that there are differences in how well the ICT related needs of English and French speaking college and university students with different disabilities are being met.

In other related papers, we present information on the development and validation of the main measure used in this investigation, both in English (Fichten, Asuncion, Nguyen, Budd, & Amsel, 2010) and French (Fichten, Nguyen, & Budd, 2010) as well as on the overall findings of the investigation, based on participants from English and French speaking schools combined (Fichten, Asuncion, Budd, et al., 2010). Because we believe that language related issues are important in obtaining a comprehensive picture of how well students' ICT related needs are met, in the present investigation we (a) provide information on how well the ICT related needs of Canadian students with various disabilities who are attending English or French speaking universities and junior/community colleges are met and (b) explore the types of adaptations used by students with different disabilities enrolled in English and French language postsecondary institutions.

## Method

### Participants

A convenience sample of 1333 students with various disabilities (880 females, 449 males, 4 did not specify; mean age = 28.08,  $SD = 9.42$ , range = 18–64, median = 24) from 141 different Canadian universities and junior/community colleges completed a web-based questionnaire battery. One hundred and thirty-one (89 females and 42 males) attended French language schools, mainly in Québec, and 1202 (791 females, 407 males, 4 did not specify) attended English language schools. Most participants attending English language schools were going to school in provinces other than Québec. There were no participants from Canada's three territories.

There was no significant difference on age between students from English and French schools,  $t(1324) = 1.11$ ,  $p = .269$ ; approximately two-thirds of both samples were women (English speaking = 66%, French speaking = 68%), and slightly less than one-third were enrolled in a junior/community college and slightly more than two-thirds in a university (27% and 74% in English language schools, respectively, and 30% and 70% in French language schools, respectively). It should be noted that students in French language schools, most living in Québec, are under-represented as the population of Québec makes up 23% of Canada's population (Statistics Canada, 2009b). On the other hand, the proportion of postsecondary students with disabilities in Québec is substantially lower than in all other provinces (Fichten et al., 2003).

### Measures

**Demographic questions.** These include objective questions related to sex, age, postsecondary institution name, and the nature of students' disabilities/impairments. The information provided allowed us to look up the characteristics of students' schools to determine college/university status. We have used most of these questions in previous studies.

**Disabilities.** We provided a list of 13 disabilities/impairments and asked students to indicate as many as applied to them. These are presented in Table 1.

**POSITIVES Scale** (Postsecondary Information Technology Initiative Scale; Fichten, Asuncion, Nguyen, et al., 2010; Fichten, Nguyen, et al., 2010). This objective measure concerning how well students' ICT related needs are being met uses 6-point Likert scaling (1 = *strongly disagree*, 6 = *strongly agree*) where students indicate their level of agreement with each of 26 positively worded items. The measure 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. Subscale 1 is concerned with ICTs used by students at school, Subscale 2 is concerned with availability and accessibility of ICTs for home use, and Subscale 3 is concerned with ICTs used by professors in their teaching. Reliability and validity were shown by the Scale's authors to be excellent for both English and French speaking students. Four-week test-retest reliabilities for the three subscales range from .72 to .84. The reliability of the total score is .80 for English and .85 for French speaking students. Cronbach's alpha, a measure of internal consistency, ranges from .79 to .91 for the three subscales and is .94 for the total score for both groups of participants. Because of the research questions, only subscales are used in this investigation.

**Table 1**  
***Language and Disabilities of Participants: Single Versus Multiple Disabilities***

Students' Reporting Multiple and Single Disabilities					All Students Who Reported Each Disability				
Type of disability/impairment	English Schools		French Schools		Type of disability/impairment	English Schools		French Schools	
	<i>n</i>	%	<i>n</i>	%		<i>n</i>	%	<i>n</i>	%
Single disabilities/impairments	805	67%	75	57%	All participants reporting each disability <sup>1</sup>				
Totally blind	16	1%	1	1%	Totally blind	23	2%	1	1%
Low vision	50	4%	9	7%	Low vision	96	8%	16	12%
Deaf	9	1%	5	4%	Deaf	14	1%	5	4%
Hard of hearing	33	3%	8	6%	Hard of hearing	74	6%	15	11%
Speech/communication impairment	2	0%	0	0%	Speech/communication impairment	35	3%	9	7%
Learning disability/ADD/ADHD	364	30%	19	15%	Learning disability/ADD/ADHD	561	47%	36	27%
Mobility impairment	32	3%	17	13%	Mobility impairment	124	10%	45	34%
Limitation in the use of hands/arms	42	3%	3	2%	Limitation in the use of hands/arms	140	12%	29	22%
Medically related/health problem	58	5%	7	5%	Medically related/health problem	224	19%	29	22%
Psychological/psychiatric disability	171	14%	1	1%	Psychological/psychiatric disability	410	34%	18	14%
Neurological impairment	23	2%	4	3%	Neurological impairment	92	8%	15	11%
PDD	5	0%	1	1%	PDD	14	1%	2	2%
Other	0	0%	0	0%	Other	4	<1%	0	0%
Multiple disabilities/impairments	397	33%	56	43%					
Total number of students	1202		131		Total disabilities reported by the students	1811		220	

<sup>1</sup> 1202 students from English schools reported 1811 disabilities; 131 French speaking participants reported 220 disabilities. Participants reporting a disability may have more than one impairment.

## Procedure

Participants completed the web-based questionnaire battery in spring 2007. They were recruited through email discussion lists dealing with Canadian postsecondary education and disability. 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) of their choice to read the consent form and complete the questionnaire. The consent form provided information about the study and the \$10 honorarium. The "I consent" button brought participants to the online questionnaire, which took approximately 10 minutes to complete.

## Results

### *Sample Characteristics*

Table 1 shows that the 1202 students from English language schools reported 1811 disabilities ( $M = 1.51$  disabilities/student) and that the 131 French speaking students reported a total of 220 disabilities ( $M = 1.68$  disabilities/student). The number of disabilities reported reflect the fact that 397 students from English language and 56 from French language schools checked at least two disabilities. Of those attending English language schools, 33% reported more than one disability: 22% reported two, 7% reported three, and 4% reported four or more. Of those attending French language schools, 43% reported more than one disability: 26% indicated two, 13% indicated three, and 4% indicated four or more disabilities.

It can be seen in Table 1 that the most common disability reported by students attending English language institutions was a learning disability (LD) with or without attention deficit or attention deficit hyperactivity disorder (47% of students indicated this), followed by a psychological/psychiatric disability (34%), and a medically related/health problem (19%). For students attending French language schools the results were somewhat different; for them, mobility impairment was the most common (34%). This was followed in rank order by a learning disability (27%) and a medically related/health problem (22%). These figures may reflect the poor recognition of LD among students attending French language schools.

### *Software/Hardware Used*

*Students with learning disabilities vs. mobility impairments.* Because there are sufficient numbers of students (i.e., a minimum of 15 students) from French and English language schools in two groups only (LD and mobility impairment), we present comparative information only for these groups. Table 2 shows that students with LD are most likely to use software that improves writing quality as well as scanning and optical character recognition. Students attending English schools also indicated using alternative mice as well as dictation software—technologies traditionally considered useful primarily to students with visual and neuromuscular impairments (Ofiesh, Rice, Long, Merchant, & Gajar, 2002). The same trend was evident among students with a mobility impairment, and these students were also likely to use a large screen monitor.

**Table 2**  
**Adaptive Computer Technologies Used by Students from English and French Speaking Schools**

	<sup>1</sup> Learning disability/ ADD/ADHD		<sup>1</sup> Mobility impairment		Whole sample	
	Eng.	Fr.	Eng.	Fr.	Eng.	Fr.
Total <i>n</i>	364	19	32	17	1202	131
Software that improves writing quality	76%	95%	47%	41%	66%	58%
Software that reads what is on the screen	8%	0%	3%	12%	15%	12%
Scanning and optical character recognition	34%	16%	6%	0%	24%	9%
Dictation software	21%	0%	22%	0%	17%	5%
Software that enlarges what is on the screen	1%	0%	0%	0%	3%	5%
Large screen monitor	3%	0%	6%	6%	8%	8%
Alternative mouse	21%	5%	6%	0%	17%	11%
Adapted keyboard	4%	0%	3%	6%	11%	11%
Refreshable Braille display	0%	0%	0%	0%	2%	1%

<sup>1</sup>Only participants with a single disability are included.

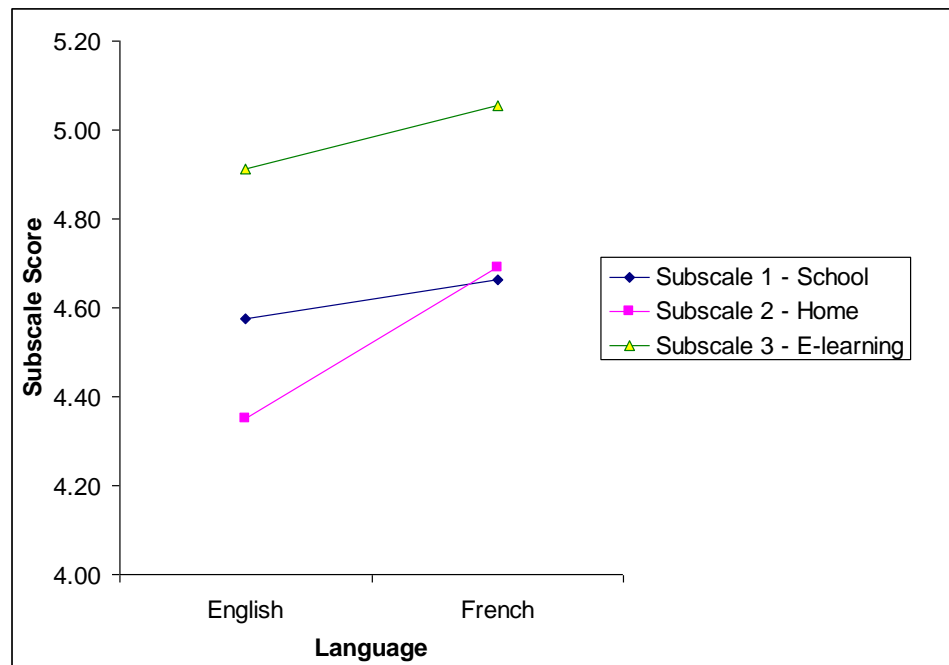
*English vs. French speaking students.* English speaking students were substantially more likely to use scanning and optical character recognition as well as dictation software than French speaking students. Overall, the chi-square test indicated that students from French schools (131 students used 161 different technologies) were generally less likely than those from English schools (1202 students used 2007 different technologies) to use information and computer technologies,  $X^2(1,133) = 6.23, p = .013$ . The number of technologies reported reflect the fact that many students checked at least two different technologies.

### *How Well Students' ICT Related Needs are Being Met in Different Contexts*

*Meeting students' needs on and off campus and when using e-learning.* To examine whether students from French and English schools differed, overall, on how well their ICT related needs were met at home, at school, and in e-learning contexts we carried out a mixed design analysis of variance (ANOVA) comparison (2 Language x 3 Subscale [Subscale 1 - School, Subscale 2 - Home, Subscale 3 - E-learning]). Results indicated significant Language,  $F(1,1026) = 4.53, p = .034$ , and Subscale main effects,  $F(2,2052) = 47.16, p < .001$ , as well as a significant interaction,  $F(1,1026) = 3.52, p = .030$ . Higher scores indicate that students' needs were better met. Best seen in Figure 1, this shows that Subscale 3 had the highest scores for both language groups, and that while English and French speaking students had relatively similar scores on Subscale 1, French speaking students had relatively higher scores than English speaking students on Subscale 2.

*Language vs. culture/policy considerations.* Given the significant findings on Language for Subscale 2, we wanted to see whether the findings reflected the language of schools (English vs. French) or the policies of French language institutions (located mainly in Québec) and English language institutions (located mainly outside Québec). Therefore, we carried out an ANOVA on the Subscale 2 scores of students included in the present sample as well as of small samples of French language and English language students who attended bilingual schools (2 Location [Québec, Outside Québec] x 2 Language of Education [English, French]). The results showed no significant interaction and a significant main effect only for Location, with higher scores for Québec students, be they enrolled in English (Outside Québec  $M = 4.30, SD = 1.21$ ; Inside Québec  $M = 4.64, SD = 1.19$ ) or French language schools (Outside Québec  $M = 3.92,$

Figure 1



$SD = 1.49$ ; Inside Québec  $M = 4.75$ ,  $SD = 1.080$ ),  $F(1,1102) = 4.48$ ,  $p = .040$ . This suggests that it is Québec's policies, rather than language, which likely accounts for differences on Subscale 2.

*Meeting the needs of students with and without learning disabilities at French and English language colleges and universities.* As noted earlier, LDs are only now becoming recognized by the French speaking population of the province of Québec. This fact, plus the large numbers of students with LD, allowed us in subsequent analyses to compare the scores of students with and without LD from English and French language schools. In addition, our previous analyses suggested that students' ICT related needs are better met in colleges than in universities for all three subscales (Fichten, Asuncion, et al., 2010). Therefore, we first carried out a series of  $t$  tests to compare the scores of college and university students on each of the three subscales, as well as to compare the scores of students with and without LD, and those of students enrolled in English and French schools.

Results showed that, overall, college students generally had higher scores than university students on all three subscales,  $t(1275) = 3.29$ ,  $p = .001$ ;  $t(1091) = 1.80$ ,  $p = .072$ ; and  $t(1285) = 2.27$ ,  $p = .023$  (although only the comparisons on subscales 1 and 3 were significant). Students with LD had lower scores on subscales 2 and 3 than students without LD,  $t(1096) = 2.05$ ,  $p = .040$  and  $t(1289) = 3.30$ ,  $p = .001$ , respectively. Students from French language schools had higher Subscale 2 scores than their counterparts from English language schools,  $t(1096) = 3.12$ ,  $p = .002$ .

To examine links between language, type of school, and disability type we next conducted a series of 3-way ANOVA comparisons as follows: 2 Language of School (English, French) x 2 Type of School (Junior/Community College, University) x 2 Disability (Learning Disability, No Learning Disability) on the three POSITIVES Scale subscales.

The means presented in Table 3 and test results show that for subscales 1 and 2 there was only a trend toward significance for the 3-way interactions,  $F(1,1289) = 3.01$ ,  $p = 0.083$  and

**Table 3**  
***How Well the ICT Related Needs of Students With and Without Learning Disabilities are Met in English and French Universities and Colleges***

Type of School	Language of School	Disability	POSITIVES Scale								
			Subscale 1			Subscale 2			Subscale 3		
			<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
College											
	English	LD	4.79	0.98	143	4.40	1.20	130	4.97	0.85	136
		Non-LD	4.84	0.97	178	4.55	1.12	149	5.16	0.82	175
	French	LD	4.20	1.45	13	3.75	1.55	11	4.75	1.40	13
		Non-LD	4.85	0.93	24	4.87	0.87	20	5.38	0.71	24
University											
	English	LD	4.60	1.04	401	4.24	1.25	342	4.90	0.87	398
		Non-LD	4.54	1.04	433	4.32	1.20	358	5.00	0.82	450
	French	LD	4.96	0.57	22	4.79	1.00	22	4.92	0.72	22
		Non-LD	4.71	0.98	63	4.81	1.08	61	5.17	0.85	69

$F(1,1085) = 3.30, p = .069$ , respectively. In addition, for Subscale 1, both the Type of School x Language of School interaction,  $F(1,1269) = 5.59, p = .015$ , as well as the Type of School x Disability interaction,  $F(1,1269) = 4.95, p = .026$ , were significant. When scores were broken down for students with and without LD in colleges and universities, test results showed that for students with LD, the 2-way interaction was significant,  $F(1,579) = 6.44, p = .011$ . This indicates that for college students, the needs of students from English schools were relatively better met than those from French schools, while the reverse was true for university students. For students without LD, the 2-way interaction was not significant, nor were there any significant main effects.

For Subscale 2 all three 2-way interactions were significant: Type x Language,  $F(1,1085) = 5.85, p = .016$ ; Type x Disability,  $F(1,1085) = 5.95, p = .015$ ; and Language x Disability,  $F(1,1085) = 4.38, p = .037$ , as was the main effect of Disability,  $F(1,1085) = 5.85, p = .016$ , indicating lower scores for students with than without LD. The interactions also showed that among students with LD, the needs of college students from English schools were relatively better met than those from French schools, while the reverse was true for university students. For students without LD, the 2-way interaction was not significant, but the significant main effect shows that students from French schools had higher scores than those from English speaking schools,  $F(1,584) = 6.84, p = .011$ .

For Subscale 3 the results showed only a significant main effect for Disability, again indicating that the needs of students without LD were better met than those with LD,  $F(1,1279) = 9.75, p = .002$ .

*Specific similarities and differences between students attending French and English language colleges and universities.* Table 4 shows mean scores and *t*-test results for all 26 POSITIVES Scale items for students enrolled in French and English language schools.



**Table 4**  
**Positives Scale Subscale and Total Scores for All English and French Speaking Participants in Ascending Order of Average Scores**

#	POSITIVES Scale Item-by-Item	English			French			t	df	Sig.		Avg.
		n	M	SD	n	M	SD					
15	<sup>3</sup> Training available off campus on how to use computer technologies meets my needs	726	3.60	1.67	66	4.09	1.48	-2.30	790	0.021		3.64
6	<sup>2</sup> My school's loan program for computer technologies meets my needs	612	3.81	1.88	77	4.49	1.57	-3.07	687	0.002*	F>E	3.89
7	<sup>3</sup> Funding for computer technologies for personal use is adequate to meet my needs (e.g., government, foundation, rehab center, loan program)	843	4.00	1.86	100	4.66	1.60	-3.40	941	0.001*	F>E	4.07
4	There are enough computer technologies in my school's specialized labs/centres for students with disabilities to meet my needs	952	4.19	1.69	99	4.24	1.74	-0.32	1049	0.752		4.19
11	The availability of technical support when I am not at school meets my needs (e.g., school IT help desk, vendor support)	961	4.20	1.56	78	4.50	1.37	-1.66	1037	0.096		4.22
13	Training provided by my school on how to use the computer technologies meets my needs	887	4.27	1.60	97	4.51	1.50	-1.36	982	0.173		4.30
5	The availability of computer technologies in my school's general use computer labs meet my needs	1136	4.46	1.63	117	4.64	1.56	-1.17	1251	0.241		4.47
14	Informal help is available at my school to show me how to use computer technologies if I need this	1043	4.54	1.46	108	4.52	1.51	0.12	1149	0.901		4.54
19	If I bring computer technology into the classroom I am able to use it (e.g., can plug it in)	1035	4.57	1.48	98	4.67	1.68	-0.63	1131	0.530		4.58
8	The technical support provided at my school for computer technologies meets my needs	1047	4.58	1.47	106	4.64	1.36	-0.43	1151	0.665		4.58
20	I feel comfortable using needed computer technologies in the classroom	1008	4.62	1.54	111	4.67	1.59	-0.28	1117	0.783		4.63
18	Distance education courses offered by my institution are accessible to me	659	4.71	1.56	56	4.66	1.65	0.22	713	0.826		4.70
17	I have no problems when professors use eLearning for tests and exams (e.g., quizzes in WebCT)	839	4.69	1.57	87	4.86	1.64	-0.95	924	0.343		4.71
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)	881	4.71	1.43	80	4.79	1.41	-0.45	959	0.655		4.72
23	My personal computer technologies are sufficiently up-to-date to meet my needs	1171	4.76	1.53	126	4.76	1.50	-0.04	1295	0.970		4.76
1	<sup>5</sup> My school has enough computers with internet access to meet my needs	1168	4.81	1.46	126	5.10	1.34	-2.15	1292	0.032		4.84
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)	1096	4.89	1.45	107	4.91	1.31	-0.09	1201	0.927		4.89
2	<sup>2</sup> The hours of access to computer technologies at my school meet my needs	1144	4.86	1.47	125	5.29	1.16	-3.11	1267	0.002*	F>E	4.91
24	<sup>4</sup> The physical access to computer technologies at my school meets my needs (e.g., adjustable table, wide enough doorway)	868	4.97	1.44	94	4.35	1.83	3.83	960	0.000*	E>F	4.91
16	When professors use eLearning, it is accessible to me (e.g., PowerPoint in the classroom, course notes on the web, CD-ROMs, WebCT)	1050	4.97	1.30	118	5.09	1.47	-0.94	1166	0.345		4.98
10	<sup>1</sup> 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)	935	5.04	1.31	93	4.51	1.78	3.65	1026	0.000*	E>F	5.00
22	The accessibility of the library's computer systems meets my needs (e.g., catalogues, databases, CD-ROMs)	1149	5.01	1.30	122	5.16	1.16	-1.22	1269	0.224		5.02
26	The availability of electronic format course materials meets my needs (e.g., Word, PDF, MP3)	1150	5.03	1.35	123	5.11	1.40	-0.66	1271	0.511		5.04
12	I know how to effectively use the computer technologies that I need	1181	5.06	1.25	129	5.15	1.28	-0.76	1308	0.448		5.07
21	<sup>3</sup> My school's interactive online services are accessible to me (e.g., registering, financial aid applications on the web)	1149	5.35	1.05	128	5.50	1.08	-1.52	1275	0.130		5.37
25	My school's web pages are accessible to me	1190	5.51	0.94	130	5.71	0.82	-2.27	1318	0.023		5.53

Note.\* items are significant after a Bonferroni correction to the alpha level.

<sup>1</sup> English language college students, both with and without a LD, had significantly higher scores than their counterparts from French language colleges.

<sup>2</sup> French language university students, both with and without a LD, had significantly better scores.

<sup>3</sup> French language university students without a LD had significantly better scores than their English language counterparts.

<sup>4</sup> English language university students without a LD had significantly better scores than French language university students without a LD.

<sup>5</sup> English language college students with a LD had significantly higher scores than French language college students with a LD. The reverse was true for students without a LD.

Because of the number of *t* tests conducted, we applied a Bonferroni correction to the alpha level. Thus, only items with a significance level of .002 or better can be considered significant. The significant findings show three items favouring students from French language schools and two favouring students from English language schools.

Because college and university students with and without LD differed on some POSITIVES subscales, we also examined scores of students with and without LD from colleges and universities separately. A Bonferroni correction to the alpha level was again applied.

For college students, the results showed the same two significant findings for students both with and without LD. Of these four significant findings, three favoured English college students. Whether they had LD or not, English college students were more likely to indicate that there was someone on campus with expertise in adaptive technology (item 10) than their French college counterparts. When it came to the item dealing with sufficient numbers of computers with internet access (item 1), students with LD from English language colleges had significantly higher scores than their French language counterparts, whereas the reverse was true for college students with disabilities other than LD.

For university students, the findings were quite different and overwhelmingly favoured students from French schools. French university students, both with and without LD, had significantly higher scores than their English counterparts for hours of access to ICTs (item 2) and adequacy of the school's ICT loan program (item 6). French language university students without LD also had significantly higher scores than English university students on items dealing with funding for ICTs for home use (item 7), training available off-campus (item 15), and the accessibility of interactive online services (item 21). English university students without LD had significantly higher scores than their French language counterparts on one item only: physical access to computer technologies (item 24). The same was true for English students with LD who had significantly higher scores than their counterparts from French schools on the item dealing with sufficient number of computers with internet access (item 1).

The scores in Table 4 also indicate that although all items have values that are more favourable than unfavourable (i.e., scores > 3.5 on the 6-point scale of agreement), the most problematic item for both English and French speaking students was access to training on how to use computer technologies. Also problematic were items that deal with the availability of adapted computers at school in general use and specialized computer laboratories as well as those available through the school's loan program. In addition, students also indicated problems with funding for computer technologies for personal use and poor technical support when the student is not at school.

On the other hand, results in Table 4 also show that both English and French language groups felt their school's web pages are accessible, that they can effectively use the computer technologies they need, that needed electronic format course materials are available, and that the school's library and interactive online services (e.g., registering, financial aid applications on the web) are generally accessible.

## **Discussion**

### *Key Findings*

*Sample characteristics.* Consistent with others' findings, a large proportion of students from English language institutions reported having LD (e.g., Stodden, 2005). In addition, approximately one-third of the English speaking 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 also noteworthy that students from English and French language schools had different disabilities. For example, while close to half of the participants from English schools reported having LD, only about a quarter of French speaking students indicated having this disability. Instead, the most common disability among students from French language schools was a mobility impairment. This is not surprising given the lack of recognition, until recently, of LDs in Québec by government, psychologists, parents, and students (Wolforth, 2009, 2010) and the disproportionate financial and academic supports afforded to Québec students with “major functional limitations” (i.e., mobility impairment, visual, and hearing impairments; Fiset, 2003), but not to students with LD. Indeed, Daniel Fiset who, until recently, coordinated services for junior/community college students with disabilities in the Eastern half of the province of Québec once said, “Learning disability is an English disease, but the French are catching it” (personal communication, 2004). Studies are currently ongoing in Québec to delineate the extent and the nature of LD and psychological/psychiatric disabilities in Québec’s colleges and universities and to make recommendations to the government about how best to deal with these (St-Onge, 2010; Wolforth, 2009, 2010). This clearly suggests, however, that there is work ahead to assure that French speaking students with LD are provided with the same level of support as their English speaking peers.

It is also interesting that over a third of both language groups reported more than one disability, a finding similar to those of earlier investigations (e.g., Asuncion, Fichten, Fossey, & Barile, 2002; Sharpe, Johnson, Izzo, & Murray, 2005). This implies that ICTs need to be operable together (e.g., a student with a mobility impairment who needs to use voice recognition software must be able to use all functions of a piece of learning software without needing to use a mouse) and that conflicts between different adaptive technologies meant to support people with different disabilities need to be avoided. Such findings also suggest that rehabilitation and ICT subsidy programs which focus on a single disability may not provide the best supports for their clientele.

*Software and hardware used.* The results suggest that the most popular type of software used by students from both English and French language schools is software that improves writing quality. This includes software such as spelling and grammar checkers, word prediction and mind mapping software, and specialized software which assists students with LD. Text-to-speech software, which reads what is on the screen; large screen monitors; alternative mice; and adapted keyboards are also popular forms of computer technologies that students used. We found that dictation software as well as scanning and optical character recognition appear to be underutilized by students from French language schools. In addition, students from English language schools were substantially more likely than their French speaking counterparts to use ICTs to do their school work.

*How well students’ ICT related needs are being met.* In spite of the more extensive use of computer and information technologies by students from English language schools, the findings show that students from English and French language schools had relatively similar scores when it came to how well their ICT related needs are met at school and for e-learning. With respect to the availability and accessibility of ICTs for home use, however, students from French language schools clearly had the advantage. This finding could reflect linguistic/cultural factors or social policy, since most of the sample from French language schools originated in Québec while most of those from English language schools came from the rest of Canada. For example, LD is not recognized by the Québec Ministry of Education in the same way as most

other disabilities. Therefore, we carried out a series of supplementary analyses. These suggest that the higher scores of students from French language schools is an artifact of provincial policies, rather than of language or culture, as students from both English and French schools in Québec felt they got better support for home based ICTs than did students from the rest of Canada.

*Students with and without LD from French and English language colleges and universities.* The results show that, overall, college students generally perceive that their ICT related needs are being better met than university students. Students from French language schools have higher scores than their counterparts from English language schools when it comes to ICTs for home use. Finally, students who do not have LD had higher scores than those who do, especially when it comes to ICTs for home use and e-learning.

When we examined school type, language, and disability in one analysis we found that these findings need to be qualified in several ways. For example, the school based ICT related scores of students with LD from English language colleges were relatively higher than those from French schools, while the reverse was true for university students. This was not the case for students who did not have LD.

With respect to ICTs for home use, here as well, the needs of students with LD who attended English colleges were relatively better met than those from French colleges. The reverse, however, was true for university students. For students who did not have LD, scores were higher for those from French than from English schools. As for how well students' e-learning needs are met, the findings show only that the needs of students without LD are better met than those of students with this disability.

*Specific ICT related needs.* Consistent with data from other researchers (Sharpe et al., 2005), our results show more favourable than unfavourable scores for both language groups. 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. This suggests that IT decision makers might wish to review their "current state" in both areas in consultation with their end-users with disabilities. Problems related to the accessibility of computers in campus computer labs have been noted as an issue of concern since the mid 1990s (Armstrong, Lewis, Turingan, & Neault, 1997). In addition, issues related to training on ICTs, both on and off campus, had relatively 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 from both English and French language schools felt that the school's web pages are accessible, that they can effectively use the computer technologies they need, 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.

### *Limitations*

It should be noted that the sample is neither random nor fully representative of the populations studied. In addition, students self-identified as having a disability. Second, given the nature of participant recruitment and self-selection biases, students who read online discussion lists, had experience using e-learning, or were power-users of ICTs are overrepresented. In addition, while e-mail based discussion lists were used to recruit a large proportion of the English sample, 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. In addition, the number of students from French language and bilingual schools outside Québec are poorly represented. In addition, students from French language schools, most living in Québec, are likely to be underrepresented given the population of Québec and the rest of Canada (Statistics Canada, 2009b). Whatever the reason, it is important to note that the French and English speaking samples have somewhat different compositions. Equally troubling is that calculating a “return rate” was impossible because of the manner in which participants were recruited.

On the other hand, most available indices suggest that our study’s samples have characteristics which resemble the realities of students with disabilities in Canadian postsecondary education. For example, the samples contain more females than males, students are older than typical postsecondary samples, and the proportions of students with different disabilities reflect the realities of many postsecondary institutions (Gagné & Tremblay, 2009; Horn, Berkold, & Bobbitt, 1999).

It should also be noted that in several *t* tests the sample sizes differ greatly. This can affect the reliability of the estimates. Also, some ANOVA tests were nonorthogonal due to unequal and disproportionate sample sizes, and the results should be interpreted with some caution.

Future research needs to evaluate POSITIVES Scale findings based on students with different disabilities at different educational levels from different countries and linguistic communities. Nondisabled comparison groups should also be used. In addition, studies need to administer the POSITIVES Scale in formats other than an online version (e.g., in a Microsoft Word file, paper version) as this would likely attract the participation of students who may not be heavy ICT users, those not comfortable filling out online surveys, and those who do not monitor e-mail discussion lists. This would also increase the representativeness of new samples.

### *Implications for Future Research and Recommendations for Practice*

Ensuring that the ICT related needs of students with all types of disabilities are being met needs to become an institutional priority for colleges, universities, tutoring centres, and rehabilitation facilities. Based on our findings, a key area involves an emphasis on understanding the current state and improving the degree and availability of training on ICTs directed at students with disabilities. The same holds true for technical support. Assessing and improving, where required, the availability of adapted computer technologies in mainstream computer labs is another, equally important, activity. Reviewing what training is available to all students on how to use campus ICTs and assuring that this training is accessible to students with disabilities (e.g., providing electronic text copies of lab handouts in Word, organizing dedicated sessions for students with disabilities) is a useful exercise that would help address the training issue. We also found that help from adaptive computer technology vendors and from postsecondary institution help lines is not adequate to meet students’ needs. Again, here, at least for school based ICTs, one recommendation is to provide additional training to enable help line staff to answer basic questions that students with disabilities might have. Help desk staff could also be armed with references to resources where they could direct students in situations where they, themselves, do not have the answers. Exploiting universal instructional strategies, which propose that instruction be accessible to all students, and products that are usable by all students be purchased whenever possible, without the need for adaptations, would go a long way toward removing access problems (McGuire, Scott, & Shaw, 2003; Scott, McGuire, & Foley, 2003; Shaw, 2002). Implementing the recommendations derived from the present research would 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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### **Authors' Notes**

Correspondence concerning this article should be addressed to Catherine S. Fichten, Dawson College, 3040 Sherbrooke St. West, Montreal, QC, Canada, H3Z 1A4.

Email: [catherine.fichten@mcgill.ca](mailto:catherine.fichten@mcgill.ca)

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