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ICTs: Tools for Universal Design for Instruction



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In this report, the Adaptech Research Network, Dawson College, Collège Montmorency, and Cégep André-Laurendeau present the nine principles of the concept of universal design for instruction. According to the responses obtained in the study on the use of information and communication technologies (ICTs) by students with learning disabilities (LDs) in Quebec colleges, the authors propose recommendations connected to this concept.

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The Issue

In the past few years, we have seen a growing diversification of the Quebec student population. It varies in terms of disabilities involving physical, motor, or neurological disabilities, and also in terms of cultures, languages, and age groups.

As well, there are increasingly more poor readers in Quebec colleges. These include students with a variety of learning disabilities (LDs). Such disabilities are of neurological origin characterized by difficulties related to reading, writing, organization, or mathematics. LDs affect 4 – 5% of the Quebec college population. Among LDs is dyslexia, a learning disability involving reading and writing that is the one most frequently reported in colleges.

In view of this reality, it is essential that teachers develop pedagogies that meet the needs of these various skills and learning styles. In this regard, the concept of universal design for instruction provides new and effective solutions that will benefit everyone.

It is in this context that the Adaptech Research Network, Dawson College, *Collège Montmorency*, and *Cégep André-Laurendeau* recently completed a three-year study entitled [Les cégepiens ayant des troubles d'apprentissage face aux TIC](#). The study, subsidized by the *Fonds de recherche du Québec – Société et culture* (FRQSC) and the *Ministère de l'Éducation, du Loisir et du Sport* (MELS), examines the use of information and communication technologies (ICTs) by college students with LDs.

What is universal design for instruction?

Invented in the 1980s in architecture and design, the concept of universal design promotes the idea that design of products and environments are to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design (or at extra cost) ([Story et al., 1998](#)). For example, large screen monitors were originally designed for people with visual impairments, but today they are used by many people who do not have a visual impairment, including those who work with spreadsheets such as Excel ([Barile et al., 2012](#)).

[Universal design for instruction](#), or UDI, involves the creation of environments and study programs that address all students, regardless of their abilities or learning styles. From among several proposed solutions, students can choose the ones that best match their styles of appropriating acquired competencies. This concept is beginning to prove itself in the school environment and is increasingly attracting researchers, educators, and administrators. Table 1 presents the nine principles of universal design for instruction along with examples that would ideally be applied by all.

Table 1 - The Nine Principles of Universal Design for Instruction

Principles	Examples of application by teachers and establishments
<p>1. Equitable Use The course does not disadvantage any group of students.</p>	<ul style="list-style-type: none"> ■ Provide materials and lecture notes online before each class. ■ Provide the syllabus before the start of the semester so that all students can determine if the course suits them. ■ Ensure that Web pages and course management systems are usable for all students. (Some may not be compatible with screen readers; ensure that the layout of the Web site pages is simple and that the images have alternative text.) ■ Use various presentation methods for the teaching material (lectures, peer teaching, etc.).
<p>2. Flexibility in Use The course is designed to adapt to several types of abilities and to take into account student differences.</p>	<ul style="list-style-type: none"> ■ Offer a greater diversity of course choices online. ■ Allow all students to use various grammar and spell checkers. ■ Provide additional time for assignments for all students when they request it (and not only for students with disabilities).
<p>3. Simple and Intuitive Use</p>	<ul style="list-style-type: none"> ■ Make sure the control buttons on the equipment used in science are labelled with simple text or symbols and are easy to understand. ■ Include clear instructions in plain language on exam copies

Instructions are easy to understand and tools are easy to use.

and repeat instructions.

- If you are preparing a handout of lecture notes for your students, include a table of contents enabling students to readily find what they are looking for; and choose a clear structure (e.g., divisions into chapters and sections).

4. Perceptible Information

Necessary information is communicated effectively, in a way that it can be understood by all students regardless of their sensory abilities.

- Make sure the videos viewed in class are subtitled (e.g., applications like Camtasia allow filming what is on the screen and adding subtitles, useful for creating videos on the use of ICTs relevant to the course); or that transcripts/detailed descriptions of these videos are available.
- Ensure that all students have understood your instructions by asking them questions and giving examples.
- For slideshows, use a large font size and choose a good colour contrast between slide text and background.
- Use various types of sources for the same information (e.g., video, Web site, popularization text).

5. Tolerance for Error

Possible variations in the pace of learning and abilities of students are expected. The risk of errors due to accidental actions is minimized.

- Ensure that online exams allow students who accidentally press a key to go back to correct their mistake.
- Suggest that students submit a draft or work plan of their assignment in order to get comments and advice before submitting their work.
- Offer students many opportunities for formative evaluation, such as practice tests online or exercises to do at home.
- Frequently remind students of deadlines for assignments and evaluations to minimize oversights.
- Allow students to make drafts in class on a computer so that they can change or revise without constantly having to erase and rewrite their text.

6. Low Physical Effort

- Allow students to use different methods to take notes in class (e.g., laptop, tablet, digital recorder).

■

<p>The course minimizes physical effort not essential to the learning objectives.</p>	<ul style="list-style-type: none"> ■ Allow students to submit their work online (e.g., by means of the course management system, by email). ■ Allow students to communicate with you through various means (e.g., email, instant messaging) depending on the circumstances (e.g., during a snowstorm).
<p>7. Size and Space for Approach and Use The space is organized so that all students, regardless of their size or mobility, have adequate space.</p>	<ul style="list-style-type: none"> ■ Ensure that the wireless access zones in schools have tables, chairs, and appropriate space for everyone, including people who use wheelchairs, guide dogs, strollers, etc. ■ Always face the class when you talk to students. (Do not speak and write on the board at the same time.) ■ Ensure that students at the back of the class can see what is written on the blackboard or screen (e.g., by adjusting the projector).
<p>8. A Community of Learners The environment promotes interaction and communication between students and teachers.</p>	<ul style="list-style-type: none"> ■ Create online communities (via Skype or other software) for communication between students and between students and teachers. ■ Give students the choice of working alone or in a group. (Do not impose a single option.) ■ Set up study groups for students who need help.
<p>9. Instructional Climate The environment is conducive to learning and to the inclusion of all students</p>	<ul style="list-style-type: none"> ■ Do not always ask the same students to answer questions in class. ■ Show openness to all discussion with all students. ■ Diversify topics discussed in class as well as presentation methods (e.g., discuss the role of women in the discipline, discuss multiple gender identities [and not only the man/woman distinction] with PowerPoint presentations, speakers, videos, discussions). ■ Invite speakers to present different current perspectives on topics taught. ■ Use references or examples from Quebec and Canada when the course material comes from the United States.

ICTs in colleges

Students with learning disabilities (LDs) are increasingly faced with the extensive and varied use of new technologies. In the educational environment, the attraction young people have for ICTs has been used to transform these into tools that encourage and facilitate learning, and that also maximize the impact on academic success. The teachers have access to these tools to present their courses, to evaluate learning, and to make the instructional documents accessible at all times. Students use them to study and to reinforce or expand their knowledge.

For several years now, ICTs have invaded all educational projects in Quebec postsecondary institutions. For the effective transfer of ICTs to learning and teaching activities, however, it is essential that several conditions are met, including positive attitudes of teachers and students.

Studies have focused on the possible impact of these new technologies on the academic success of certain types of already fragile populations; consequently, [Karsenti et al., \(2005\)](#) studied the case of underprivileged boys. They concluded that the use of ICTs in the classroom by teachers increases student motivation, especially that of boys (which refers to the principle of Principle 9 – Instructional Climate). They also observed that ICTs seemed to develop the methodological and intellectual competencies of students.

Practical Applications

The Context

In our study, a total of 217 college students (124 women, 93 men, mean age of 20.24 years) responded to at least one of the five open-ended questions in our questionnaire. Of these students, 112 were English-speaking, 104 were French-speaking, and one did not specify a language of study. Seventy-eight had an LD and 139 did not have one.

The questionnaire was administered online during the 2011 winter semester. It consists of 23 questions on the use of ICTs in Quebec colleges ([Nguyen et al., 2012](#)). Five open-ended questions are analyzed and reported in the tables that follow. Participants could give more than one answer, and percentages represent the distribution of respondents who provided a response in each category. Recommendations at the end of each table are presented in conjunction with the principles of universal design for instruction.

The Results

List three examples where your teacher used computer technologies effectively

Answer Category	% of respondents	Examples of answers
Use of ICTs in teaching the course (e.g., PowerPoint, interactive whiteboard, Excel)	With LDs : 80.0% Without LDs : 77.5%	Microsoft Word or PowerPoint for course notes; Course notes put online in advance
Use of ICTs in reinforcing learning (e.g., videos, YouTube, Web sites, images, forums, exercises online)	With LDs : 56.5% Without LDs : 70.5%	The teacher teaches students how to use Excel to create spreadsheets; Presentation of relevant videos; MP3 audio tracks to listen to the text at the same time as you are reading it
Use of ICTs for submitting assignments and for access to information (e.g., email, course management system)	With LDs : 31.0% Without LDs : 33.5%	Submitting assignments on DECclic work; Statements on assignments and grades of evaluations on the Internet

Principle 1 – Equitable Use recommends equitable materials and tools for use by everyone.

List three examples where your teacher used computer technologies ineffectively

Answer Category	% of respondents	Examples of answers
Inadequate use of technologies.	With LDs : 30.0% Without LDs : 40.5%	The teacher recommends sites that do not work; The teacher only reads the PowerPoint word by word.
Limited knowledge of ICTs by teachers (e.g., slow in making them work, do not know how to use ICTs, do not provide sufficient	With LDs : 26.0%	New teacher who tries to use a computer because it is required but

instructions to students on the use of ICTs necessary for their assignments)	Without LDs : 27.5%	who does not know how to use it, which slows down the course.
Technical difficulties (e.g., obsolete computer equipment and software, software incompatibility)	With LDs : 30.0% Without LDs : 40.5%	Laptop that will not connect to a projector; DECclic II examinations that accept only certain formatting as a correct answer (e.g., 2,37 = mistake and 2.37 = correct answer).

Teachers must put into practice Principle 8 – A Community of Learners and Principle 9 – Instructional Climate. When students are encouraged to share their knowledge of ICTs, teachers will no longer feel criticized or embarrassed and everyone will feel involved in class.

List three obstacles (things that make it harder) to using computer technologies for school work

Answer Category	% of respondents	Examples of answers
Inadequate resources and infrastructure	With LDs : 37.5% Without LDs : 52.5%	Some rooms do not have an Internet connection; Non-functional equipment; Not enough connection sockets; Internet slow.
High cost of ICTs or limited accessibility of ICTs	With LDs : 23.5% Without LDs : 24.5%	High cost of software; Insufficient availability of required software and the unaccommodating schedules of the premises where the software is available.
Incompatibility between the software available at school and at home	With LDs : 9.0% Without LDs : 22.5%	The different versions of the programs available change their method of use.

In order to apply Principle 4 – Perceptible Information, teachers should ensure the availability of various formats of course materials in accordance with student requests (e.g., paper, PDF, or PowerPoint versions). Schools should modernize their IT infrastructure (for example, they should improve the wireless network and increase the number of outlets installed at different heights). The institution’s Web site should be accessible and include a diagram showing the location of available resources (Internet sockets, computers, and the software installed on them, printers, etc.). Technologies should be more available and cheaper, and there should be an adequate number of computers and software applications (Principle 1 – Equitable Use).

In regard to the high cost of ICTs, we should point out that there are already some adaptive ICTs that are free or inexpensive and that are an interesting alternative to high-end ICTs. Adaptech set up a database of these resources that are available online [here](#). Adaptech has also produced a series of video clips to explain how some of these ICTs in its database work. You can watch these videos [here](#).

List three facilitators (things that make it easier) to using computer technologies for school work

Answer Category	% of respondents	Examples of answers
ICTs enable quick and easy access to the necessary information	With LDs : 44.5% Without LDs : 63.0%	Easier information search; Faster note taking; Fast and efficient data sharing and team work.
Training on ICTs	With LDs : 16.5% Without LDs : 21.5%	Support from computer literate teachers; In class, teachers provide examples of the use of computer technologies connected to the assignments to be done; Availability of technicians to support us.
Sufficient resources and adequate infrastructure	With LDs : 13.5% Without LDs : 18.5%	Sufficient flexible time slots for the computer labs.

Access to grammar and spell checkers	With LDs : 22.5% Without LDs : 13.0%	Antidote is available throughout the school, which makes it easier to correct my texts.
Updated ICTs (at school and at home)	With LDs : 13.5% Without LDs : 17.5%	No viruses, no lags; Have a laptop with a good battery.
Positive attitude of teachers towards ICTs	With LDs : 9.5% Without LDs : 13.5%	Being able to bring your laptop to class; Being able to record the teacher with his consent.

The application of Principle 4 – Perceptible Information helps to eliminate the difference between the levels of knowledge of groups with respect to ICTs (e.g., assignment instructions should be accompanied by illustrations and diagrams that explain the use of the ICTs required for completion of the assignment). ICTs that are easy to use should be available to all students, regardless of the language they speak, their level of education, or the fact that they have or do not have an LD.

If computer technologies could do anything to help you succeed more easily in Cegep, what would they do?

Answer Category	% of respondents	Examples of answers
Automatic correction and revision	With LDs : 53.0% Without LDs : 48.0%	ICTs would be better at correcting spelling mistakes to save us time to enable us to put better content; ICTs would tell me why I have a mistake and what to do to avoid this error.
	With LDs :	All school data should be

General access to course material and notes online	19.0% Without LDs : 12.0%	computerized and stored in a safe place on Cegep Web sites (lecture notes, online exams, submission of assignments via email).
Flexibility, portability, and transportability of files thanks to ICTs	With LDs : 7.0% Without LDs : 15.0%	I would like classes to be recorded in MP3 format so that I can listen to them when I go to school or am at home.
Greater availability of functional equipment and updated software	With LDs : 6.5% Without LDs : 14.0%	The school would provide laptops with all the programs and tools needed to understand them; ICTs would change less often, would be less expensive and have no licences or copyright.
Better sense of organization/time management	With LDs : 9.5% Without LDs : 13.5%	ICTs would help us to be organized in our studies and would tell us what to study; The technology would create schedules that would enable us to stay focused on school work.

Applying Principle 1 – Equitable Use would enable the promotion of ICTs as learning tools for all, without distinction of individual needs (e.g., everyone would be able to use grammar and spell checkers). These tools should be made available because they are essential to “sustainable education.” Principle 2 – Flexibility in Use could guide ICT sellers and developers, helping them to understand the necessity of creating ICTs that are flexible, portable, and that take into account the characteristics of users.

Conclusion

Our results and student responses show that it is as important to promote general purpose ICTs (e.g., Microsoft Office Suite, PDF files, smart phones) as it is to promote specialized ICTs (e.g., Kurzweil, Dragon Naturally Speaking) because they can improve grammar, spelling, and a sense of organization. They can thus increase the academic success of ALL students, not just those with LDs!

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