

# Benefits and challenges



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of using laptops in elementary  
and secondary school:

Results of the second investigation at  
the Eastern Townships School Board

Summary of main results

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Simon **Collin**

With the collaboration of  
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# Abstract

**T**his second investigation of teachers and students at the Eastern Townships School Board had eight research objectives. It aimed to determine, according to the perceptions of the teachers and students, the impacts of information and communication technologies (ICT) on students': (1) writing skills, (2) creativity, (3) communication and cooperation, (4) effective work methods, and (5) capacity to exercise critical judgment. Another aim was to identify the main (6) benefits and (7) challenges of regular use of technologies in the classroom, as well as (8) the equipment and access available to teachers and students at the school board. In all, 2,712 students (from grades 3 to 11) and 389 teachers participated in this questionnaire survey. The results reveal that ICT have had a major impact on the students, particularly in their skills and competencies (writing, creativity, work methods, communication and cooperation, critical judgment, etc.). The results also highlight how the teachers in this school board have succeeded, through their pedagogical strategies and other teaching activities, in giving technology a central role in the writing process. Technologies have enabled both teachers and students to write better, more, and with more inspiration. Besides the substantial impacts on writing, the results also show the main benefits of using technologies in the classroom, as underscored by the teachers and students: academic motivation, access to extensive information, a wide variety of available resources, the potential for individualized learning, and greater feelings of competence, to name only a few. The integration of ICT into education comes with certain problems, however. The two biggest challenges for teachers and students were the equipment and classroom management. This report concludes with a list of twelve recommendations.

# 1. Introduction

This research project began with a meeting in the fall of 2009 between Ron Canuel, former Director General of the Eastern Townships School Board,<sup>1</sup> and Professor Thierry Karsenti of the *Université de Montréal*, holder of the Canada Research Chair on Information and Communication Technologies (ICT) in Education. At this meeting, the first of many, it was agreed to set up a research project that responded to both the scientific objectives of the Canada Research Chair on ICT and the constant concern of the Eastern Townships School Board to find ways to maximize the academic success of students throughout the region. After a number of discussions with the school board administration and school principals, it was decided to launch a study with the aim of gaining a better understanding of the benefits and challenges of using laptops in primary and secondary schools in the Eastern Townships School Board.

Following this first investigation, which was widely disseminated in February 2011, an official partnership was set up between the Canada Research Chair and the Eastern Townships School Board. Under this partnership, the current General Director of the Eastern Townships School Board, Chantal Beaulieu, and the Research Chair team decided to conduct a second investigation. It would focus not only on the benefits and challenges of using technologies in the classroom, but also on the impacts of these technologies on certain of the students' competencies and skills. This second investigation, conducted in partnership with the Canada Research Chair on ICT in Education and the Eastern Townships School Board, also marks the ten years since this school board became the first in Canada and in North America to provide its students with laptops on such a large scale.

In the last ten years, over 8,000 laptops have been handed out at the school board, mainly to students

in grades 3 to 11. In addition, it is worth mentioning that all the teachers, technicians, and education support staff were provided with laptops, as well as students with learning problems. This study was therefore the product of an exemplary collaboration between a group of elementary and secondary teachers and a university research community.

The Eastern Townships School Board appeared to provide a highly favourable setting for a study on the benefits and challenges of using laptops in elementary and secondary school. In fact, the student dropout rate stood at 42% ten years ago, and the board was ranked 67th out of 69 boards across the province of Quebec. This pitiful performance forced the entire education community at the Eastern Townships School Board, including directors, school principals, teachers, and commissioners, to undergo a major rethinking of how their students were being taught. They then did what no other school board in Quebec or in Canada had ever done before: they bought 4,500 laptop computers and gave one to each student, from grades 3 to 11. Now, ten years after changing its pedagogical approach along with this wide-scale technological implementation, the school board has leapt from 67th to 23rd position in the province. In addition, the dropout rate has been cut almost in half, from 39.4% to 22.1%. This is one of the most dramatic improvements in dropout rate among all Canadian school boards. Furthermore, far from being resolved, the dropout problem has been getting worse in Quebec over the last ten years. In this respect, Quebec has shown the worst performance in Canada, according to Statistics Canada (Gilmore, 2010). In concrete terms, about 35% of boys and 23% of girls drop out of the public school system, according to the *Ministère de l'Éducation, du Loisir et du Sport du Québec* (Quebec's department of education, recreation and sport – MELS – 2010). The MELS also reported in 2000 that 26% of youths enrolled in public secondary schools left without graduating. In 2008, that number rose to 29%. The consequenc-

1 He is currently Chief Executive Officer of the Canadian Education Association (CEA).

es of this mass abandonment of schools will be devastating, for both the youths and society as a whole. The Canadian Council on Learning (2011), an independent group, attempted to calculate the costs. For Quebec, it would cost around 1.3 billion dollars in terms of lost taxes and other contributions, increased provision of health and social services, and higher crime rates. Against this background of climbing dropout rates throughout Quebec, the opposite trend has emerged at the Eastern Townships School Board. Although this study did not aim to establish a correlation between improved academic outcomes and the use of technologies in class, we considered it particularly relevant to seek a better understanding of the role of widespread integration of ICT into education.

Finally, we must mention that the team of the Canada Research Chair on ICT in Education (Prof. Thierry Karsenti, Prof. Simon Collin, Ariane Dupuis, Prof. Stéphane Villeneuve, Gabriel Dumouchel, Jean-Philippe Robin, and Sophie Goyer), supported by the *Centre de recherche interuniversitaire sur la formation et la profession enseignante* (CRIFPE), has the expertise to conduct this rigorous study. The CRIFPE has received the Whitworth Research Collaboration Award from the Canadian Education Association (CEA) for excellence in Education Research, as well as the *Prix de reconnaissance de l'Association des doyens et directeurs pour l'étude et la recherche en éducation au Québec* (ADEREQ) in recognition of its outstanding contribution through its achievements and its support for education research and outreach. Let us recall that the Canada Research Chair Program stands at the center of a national strategy to make Canada a leading country in research and development. Canada's chairholders strive for research excellence in the natural sciences, engineering, health sciences, humanities, and social sciences. The goal is to improve our depth of knowledge and quality of life and to strengthen Canada's international competitiveness. The chairholders work with teams of outstanding researchers who are acknowledged by their peers as leaders in their field.

This preliminary report presents the results of a study conducted from March to November 2012. The research objectives are presented (Section 2), followed by the theoretical framework and the scientific relevance of investigating a “one laptop per child” program (Section 3), and the data collection and analysis methods (Section 4). The results are presented in Section 5, grouped under eight distinct themes:

- 5.1 The equipment and access available to teachers and students at the Eastern Townships School Board
- 5.2 The role of ICT on students' writing skills
- 5.3 The role of technologies on students' capacity to be creative
- 5.4 The role of technologies on students' capacity to communicate and cooperate
- 5.5 The role of technologies on students' capacity to work effectively
- 5.6 The role of technologies on students' capacity to exercise critical judgment
- 5.7 The main benefits of ICT for students and teachers
- 5.8 The main challenges for students and teachers.

The conclusion is then presented (Section 6), followed by a section on directions for future research (Section 7) as well as a number of recommendations (Section 8) to conclude this preliminary summary research report.

## 2. Objectives

**T**his second investigation in teachers and students at the Eastern Townships School Board had eight objectives:

1. Determine the equipment and access available to teachers and students at the Eastern Townships School Board
2. Determine the role of ICT on students' writing skills
3. Determine the role of technologies on students' capacity to be creative
4. Determine the role of technologies on students' capacity to communicate and cooperate
5. Determine the role of technologies on students' capacity to work effectively
6. Determine the role of technologies on students' capacity to exercise critical judgment
7. Determine the main benefits of ICT for students and teachers
8. Determine the main challenges for students and teachers.

# 3. Theoretical framework and scientific relevance

5

This study was conducted in the context of emerging technologies and their increasingly widespread incorporation into education. According to Redecker (2009) and Siemens and Tittenberger in the *Handbook of Emerging Technologies for Learning* (2009), we understand “emerging technologies” to mean the most recent forms of technology, whether material (ever faster and more powerful laptops, compacts, and the more affordable iPhones and iPads, etc.) or virtual (social networks such as Facebook), microblogs (Twitter), blogs, social bookmarks (e.g., Diigo), podcasts, videocasts (e.g., YouTube), and so on. Today’s emerging technologies have sprung from two interrelated innovations: first, the appearance of Web 2.0 (O’Reilly, 2005), which constituted a move from information distribution to an interactive environment of individual publication, collaboration, sharing, and customized information (Dohn, 2009); and second, the technological progress that has made information and communication via Web 2.0 accessible anytime and anywhere, using a touch screen mobile device, a smartphone, a tablet computer, or a notebook (mini-laptop). Thus, the increasing use of technologies in education could help resolve a long-standing dilemma in ICT integration: lack of access and limited computer equipment.

Aside from their growing role in education, the use of emerging technologies to educate youth is a major societal issue. In the words of Kofi Annan, speaking at the 2005 World Summit on the Information Society, “A technological revolution is transforming society in a profound way. If har-

nessed and directed properly, information and communication technologies (ICT) have the potential to improve all aspects of our social, economic and cultural life.” They will also have an increasingly influence on how societies evolve, with significant impacts on economic, social, and professional dimensions (Redecker, 2009). [...] In terms of education, these changes have manifested in new kinds of learners. Redecker’s (2009) literature review reports nine learning patterns that are typical of today’s learners: constant use of technologies, multitasking, individualism, personalization, greater connectivity (availability anytime, anywhere), immediacy, use of various media types, engagement and work-oriented attitude, sociability, and new habits to meet new needs (e.g., computer skills to cope with exploding information). Academic success, which so far has been measured mainly in cognitive terms, appears to be increasingly determined by young people’s technocognitive skills. In other words, they must be able to master the technologies that surround them and use them to learn, instead of merely submitting or reacting to them. In fact, there is every reason to believe that the use of technologies to learn is now a key cross-cutting competency that enables youth to perform better at school, and more broadly speaking, as members of the knowledge society in which we now live. Being able to self-learn, find information, and use technological tools to communicate has become a prerequisite for successful adaptation to an ever-changing world, and for full participation as a socioprofessional (OECD, 2008). Some governments have understood this well, including the United States, which has proposed “A 21st Century Model of Learning Powered by Tech-



nology” (Atkins et al., 2010). Technologies therefore constitute a growing educational imperative. Aside from their increasing presence, therefore, emerging technologies constitute an increasingly important issue for the social and professional future of learners.

Among the notable emerging technologies used in Western education systems are the “one laptop per child” projects, which allow implementing the most advanced educational approaches (see, e.g., Bebell & Kay, 2010; BECTA, 2005a; Grimes & Warschauer, 2008; Morrison, Ross & Lowther, 2009; Spektor-Levy, Menashe, Doron & Raviv, 2010). In effect, the provision of individual laptops in class has left more traditional arrangements, such as the computer lab, in the dust. Because they mobilize considerably more of the technoeducational potential of ICT, this kind of program has been growing in popularity. Today, more and more classrooms are taking the leap to provide each child with a laptop. However, even though the “one laptop per child” approach lessens the computer accessibility problem, it is not without its own problems. In fact, this technoeducational approach brings new challenges along with new opportunities for teaching and learning, which have received little attention to date. For example, we know very little about which pedagogical uses of laptops in the classroom are more liable to foster learning (Freiman, Beauchamp, Blain, Lirette-Pitre & Fournier 2010). Moreover, studies of the long-term impacts on large population samples are almost nonexistent (Fleischer, 2012), although a handful of informative literature reviews, such as by BECTA (2005b), Penuel (2006), and Holcomb (2009) have been published.

These limitations of the “one laptop per child” innovation may be added to those of the broader area of the pedagogical integration of ICT in education. In this respect, we note that, despite the importance of ICT for society, professional life, and education, the pedagogical use of ICT at school remains an immense challenge throughout the Western world. Many studies have shown that teachers are still failing to take full advantage of ICT in their teaching practice (see Balanskat et al., 2006; Becta, 2006; Hutchison & Reinking, 2011; OCDE, 2008; Ramboll Management, 2006). This conclusion has been reached in studies conducted in both North America and Europe. Consequently, even though all education actors—including teachers, principals, and commissioners—talk positively about the educational potential of ITC, their enthusiasm appears to be based largely on intuitive or ideological arguments (Livingstone, 2012) rather than actual experience or know-how.

Let us keep in mind that the issue in the “one laptop per child” approach is not computer accessibility (because the computers are there in the classroom), but computer use as well as training and development in technoeducational skills for both teachers and students so that they can make optimal use of the equipment that is available to them. This central issue in the evolution of ICT in education is consistent with the eight study objectives presented in Section 2.

# 4. Method

**T**his study was conducted in a specific setting: the Eastern Townships School Board. Ten years ago, this school board launched a “one laptop per child” initiative throughout all the schools in its district. Over the years, more than 15,000 young people had the use of a personal laptop for the majority of their elementary and secondary school years. This is one of the rare examples in North America where a “one laptop per child” program has been maintained for this length of time (ten years and counting) and on this scale (the majority of students in a school board).

large number of teachers and students. It proved highly useful for our study, in that we were able to reach a substantial sample of respondents (over 2,700 students and almost 400 teachers).

The protocols for the individual semi-directed and group interviews with both teachers and students included revisiting the question categories from the questionnaires. From the interviews, we gathered the teachers’ and students’ perceptions of our research objectives. The group interviews were particularly useful in revealing points of consensus and dispute among the participants. They are currently under analysis, and results will be presented in a subsequent report.

As part of this research project, we also observed classroom situations to gain first-hand knowledge of the actual use of laptops in the classroom, as well as the inherent benefits and challenges. We should mention that the analysis of the videotaped observations is ongoing, and the results will be presented in a subsequent report. The present report focuses on the results of the questionnaire responses by the teachers and students.

## 4.1 Participants

In all, 2,712 students from grades 3 to 11 and 389 teachers participated in one of the many data collection steps in this study.

## 4.2 Main data collection instruments

Six main data collection instruments were used:

1. Online survey questionnaires for teachers
2. Online survey questionnaires for students
3. Individual semi-directed interviews with students
4. Individual semi-directed interviews with teachers
5. Group interviews with students
6. Videotaped classroom observations.

For purposes of this summary report, we will focus on the first two instruments, the online questionnaires. Each of the two questionnaires (teachers and students) contained 10 sections addressing the research objectives. The questions were selected and adapted from an extensive review of the literature on surveys of educational technologies. The survey had the advantage of being readily accessible by a

## 4.3 Data treatment and analysis

Because the data from the questionnaires comprise both numbers (closed responses) and texts (open-ended responses), they were subjected to both quantitative and qualitative analysis. The qualitative data (open-ended questionnaire responses and individual and group interview transcripts) were analyzed using a coding system, whereby each text segment (e.g., a sentence) was assigned, as systematically and as rigorously as possible, to a semantic category. For example, “Using a laptop in class really helped me improve my French” was assigned to the category, “positive impact of laptops on learning.” The qualitative data analysis followed a content analysis approach inspired by L’Écuyer (1990) and Huberman

and Miles (1991, 1994). Qualitative analyses were performed using QDAMiner, which is widely used for qualitative research data (see Karsenti, Komis, Depover & Collin, 2011). Quantitative data were analyzed using SPSS 20.0 and LISREL 8.8 to obtain descriptive and inferential statistics. Analyses of variance were also run to better understand the impact of ICT on teaching and learning, and results will be presented in a subsequent report.

Once we obtained the preliminary results of the qualitative and quantitative analyses of the questionnaire responses, we met with the school principals and teachers at the Eastern Townships School Board. The aim was to determine whether, and to what extent, the results agreed with their perceptions and knowledge of the situation in order to validate the obtained results. Their feedback allowed us to refine our interpretations of the results and gain a deeper understanding of the educational context.

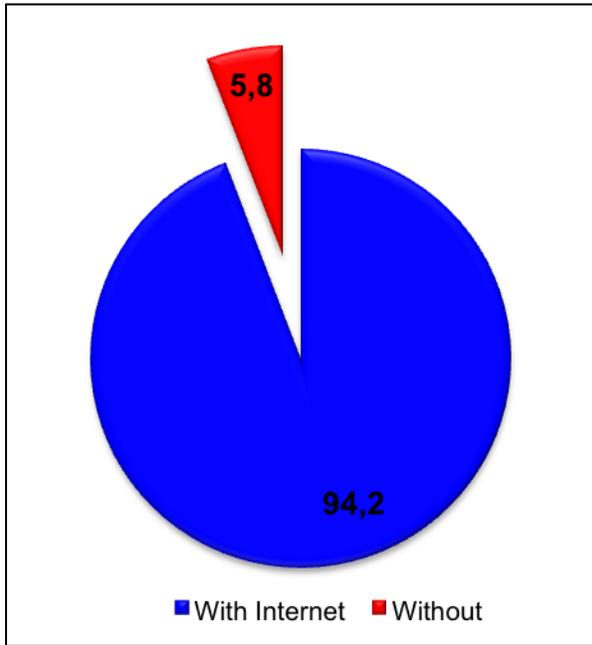
# 5. Main results

**T**he main results of the questionnaire responses by students and teachers are presented in this section. Recall that both questionnaires included closed questions, where respondents had to choose from a list of responses, and open-ended questions, such as “What are the two main benefits of the technologies that you have used...?” The questionnaire results are presented as graphics and text extracts. Video excerpts from the classroom observations, available on our website ([etsb.crifpe.ca](http://etsb.crifpe.ca)), will be presented orally during the press conference to illustrate the obtained results. The results are presented in terms of the eight study objectives, as follows:

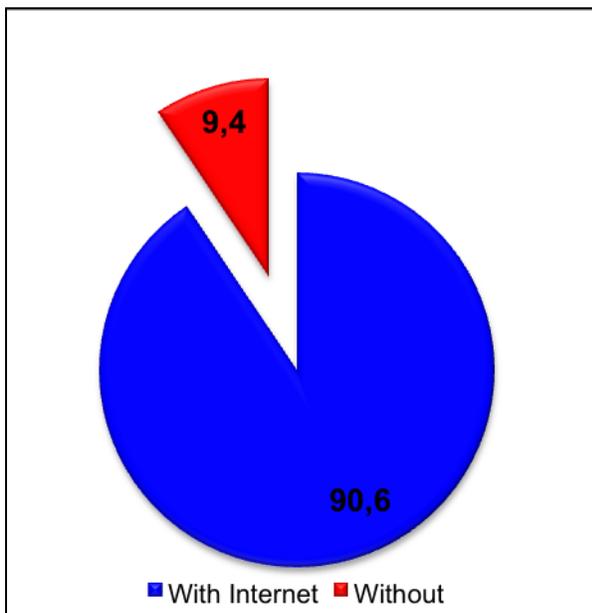
1. The equipment and access available to teachers and students at the Eastern Townships School Board
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8. Main challenges for students and teachers.

## 5.1 Technological equipment and access to internet

In terms of access and equipment, let us begin by recalling that the aim of providing “one laptop per child” is to help overcome a recurrent barrier to the pedagogical integration of ICT: lack of access to computer equipment by teachers and students. In fact, most of the students in grades 3 to 11, all the students with learning problems, all the teachers, and all the education support staff and school principals at the Eastern Townships School Board were given a laptop (for a total of over 5,000 laptops), besides mobile labs. To add to this enriched technology environment at school, access to ICT equipment was also high at home. Unsurprisingly, both teachers and students at the Eastern Townships School Board were relatively well equipped and had Internet connection at home. In fact, 94.2% of the teachers had Internet at home (Figure 1), and so did 90.4% of the students (Figure 2). This far surpasses the rates reported in recent Canada-wide surveys (e.g. Statistics Canada, 2011). Nevertheless, even though the national statistics were exceeded, we should mention that 9.6% of the students who responded did not have an Internet connection at home. In today’s so-called knowledge and information society, the school would therefore provide these students with their only opportunity for Internet access. Given the critical need for information literacy and connectedness in order to ensure the socioprofessional future of children living in Western societies (OECD, 2012), it is reasonable to conclude that the Eastern Townships School Board, through its “one laptop per child” program, is going a long way to compensate for lack of equipment and access by the technologically excluded. Finally, we note that 37% of the teachers and students had a smart phone, and 29% of the teachers and 20% of the students had acquired a tablet computer.



**Figure 1.** Rate of Internet connection at home for surveyed teachers.



**Figure 2.** Rate of Internet connection at home for surveyed students.

## 5.2 Impact of technologies on students' writing skills

Writing is a one of the basic transversal competencies in education, and it is a central condition for successful education (UNESCO, 2005). Since 1998, researcher Jacques Anis has shown how technologies (particularly word processing programs) have shaped the writing process by exempting the writer from following a set formula. In addition, several meta-analyses, for example by Goldberg, Russell and Cook (2003) and Rogers and Graham (2008), have concluded that ICT can improve the quality of students' writing. Recent empirical studies on "one laptop per child" programs (Grimes & Warschauer, 2008; Gulek & Demirtas, 2005; Morrison et al., 2009; Suhr, Hernandez, Grimes & Warschauer, 2010) have reached the same conclusion. Accordingly, in this study, we felt it was relevant to better understand how students and teachers use technologies in the writing process.

We begin by underscoring that, according to the quantitative results, paper remains the teachers' media of choice for teaching writing strategies (Figure 3). However, we note that the computer was used fairly often for preparing a first draft (71.2%) and reviewing the assignment and then making corrections (77.7%).

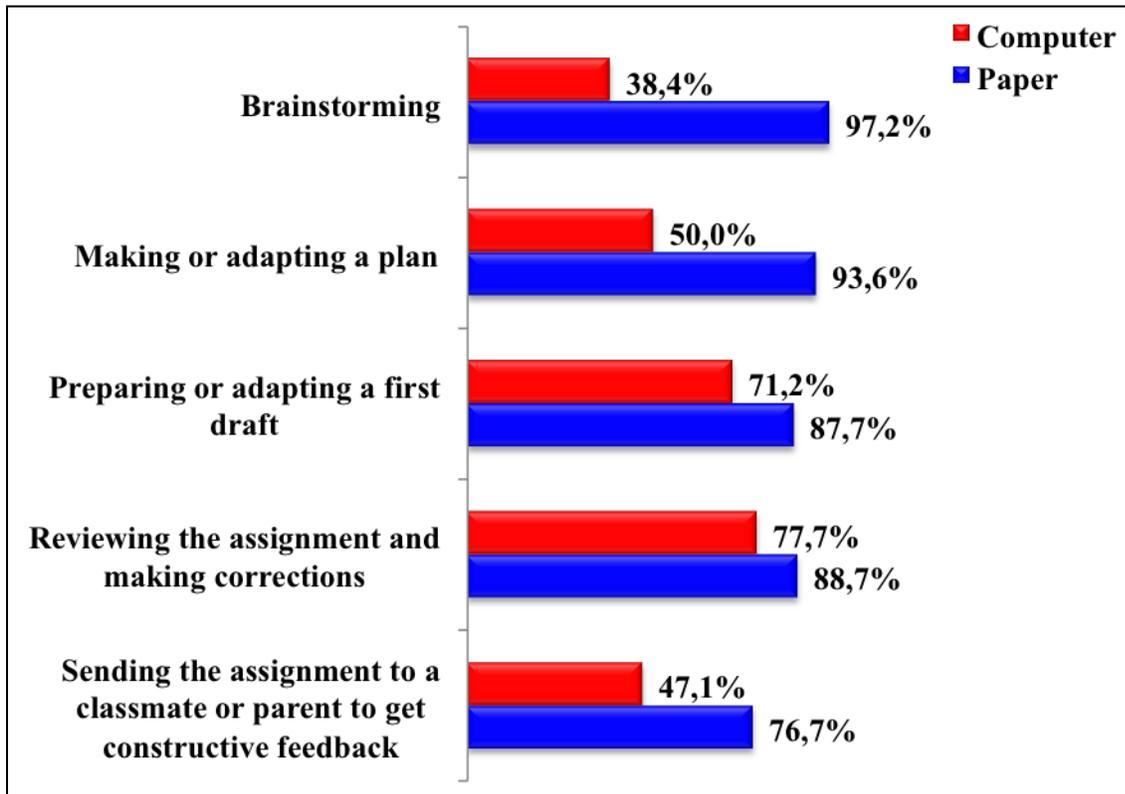


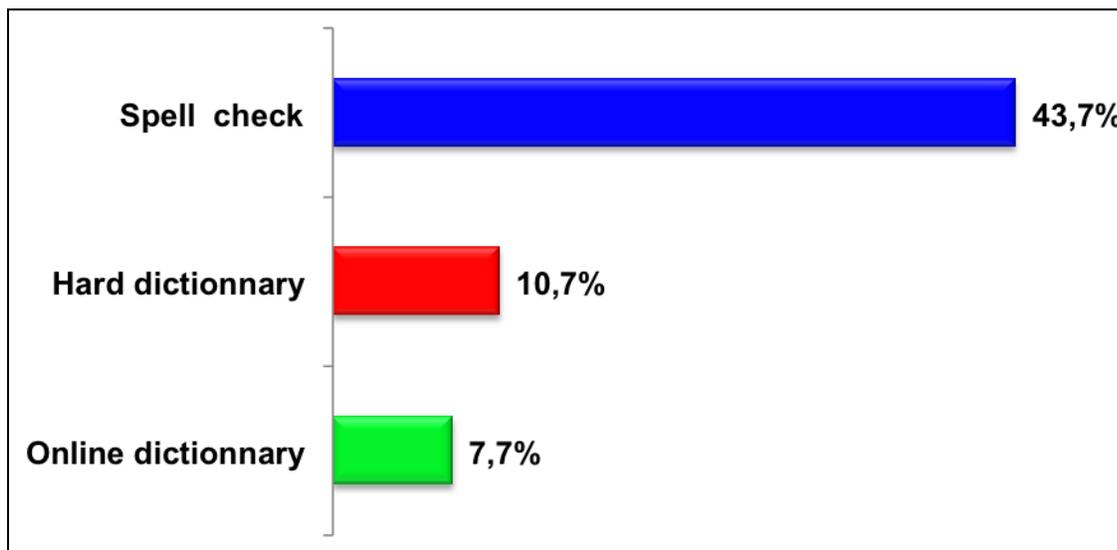
Figure 3. Teachers' perceptions of teaching writing strategies using paper or technologies.

The qualitative results shed further light on the above results, indicating that technologies and paper were combined to carry out writing activities. In fact, according to some respondents, they used technologies at different stages of the writing process. The most frequently reported example (63.3%) was when students wrote a first draft on the computer, printed it so they could correct it, and then wrote a final version on the computer. The second most reported example (24.5%) was when students wrote their first draft on paper and then reviewed it and wrote the final version on the computer. Few teachers used a computer alone, with no use of paper.

*They must print their rough copy, revise and edit using a colored marker or highlighter so I can see their thought process. Peer editing and read a-louds must be done also at this time. They go back to their laptop and make the corrections they have noted, re-read again, and then print the final copy. All copies must be handed in. (T1)*

*We write rough drafts on paper first. They use spell-check and dictionary on the laptop. (T2)*

Of the tools the students used during writing activities (Figure 4), the quantitative results show that the automatic spell check function in Word was far and away the more often reported by respondents (43.7%). Trailing considerably behind was a hard-copy dictionary (10.7%) and an online dictionary (7.7%).

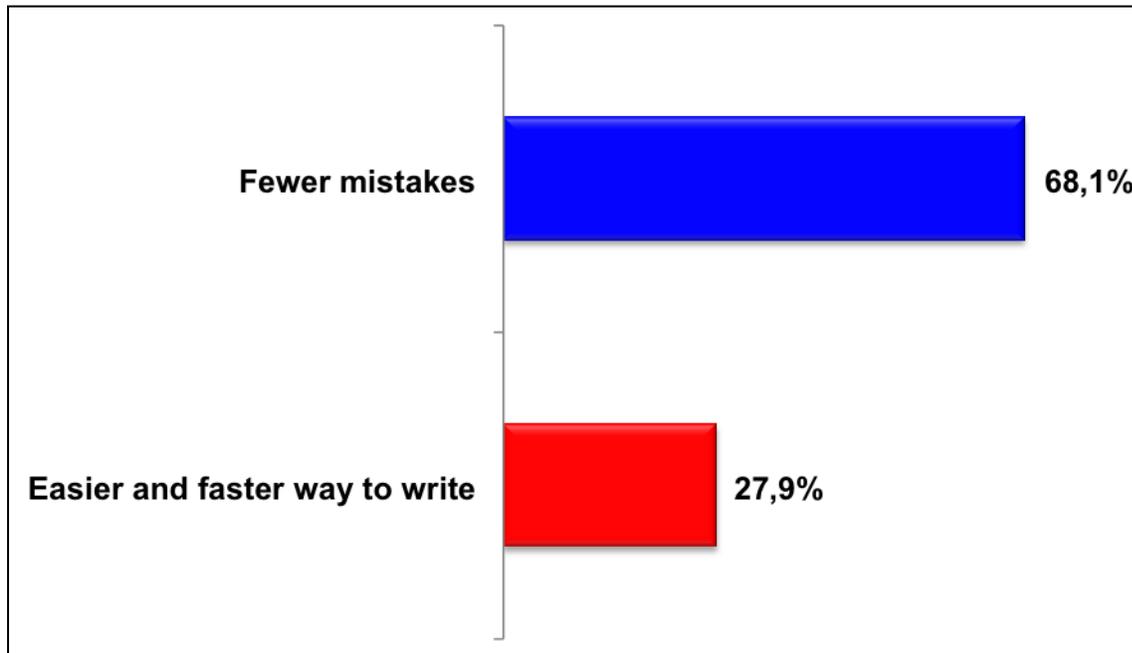


**Figure 4.** Use frequency of the main tools used during writing activities.

These results can be compared with the qualitative results on the students (Figure 5). It is noteworthy that a large majority of respondents mentioned that they made fewer mistakes when writing with the computer, thanks to the automatic spell check function, and that 27.9% said they could write faster and more easily with a computer than on paper. On this last point, we may assume that the ease with which the students wrote on the computer allowed them to spend less time producing their texts and therefore more time revising them.

*Because I'm a faster typer than writer, so I have a faster finishing rate and therefore more time to look over my work then when I'm writing it by hand where it can sometimes get messy trying not to lose my train of thought. (S1)*

*It is easier and less intimidating to correct mistakes, improve grammar and improve the flow of sentences, because there is no need to go back, erase my WHOLE paragraph, and then rewrite-it ALL. (S2)*



**Figure 5. Students' perceptions of the main benefits of writing by computer.**

Finally, we note that a minority of the students and teachers offered a convincing argument for the limitations of the automatic spell check to help them develop their writing skills.

*Because every time we made a mistake, it's the computer that corrects, it is not us, therefore, when we write with hand, we face too many difficulties in grammar, in spelling, and so on. (S3)*

*Laptops have auto-correct on word, therefore making me appear smarter than I actually am. (S4)*

These results underscore the importance of not simply encouraging students to use the automatic spell check, but also teaching them how to use such tools appropriately and in an educationally beneficial manner, and to understand their limitations (Cordier-Gauthier & Dion, 2003). This would be particularly important for younger students (Bruland & Moulin, 2006).

### 5.3 Impact of technologies on students' capacity to be creative

According to the MELS (2001), “Being creative consists essentially in using the resources and materials at one’s disposal in an imaginative way. These resources and materials may include ideas, concepts and strategies as well as objects, tools and techniques” (Québec Education Program. Secondary Cycle Two. Cross-Curricular Competencies. Page 11.). For purposes of this study, creativity refers to the development or adaptation of teaching and learning strategies using technological tools. The main result for the impact of technologies on creativity is that 80% of the surveyed students felt that they were more creative when they used technologies. Two principal reasons are proposed to explain this result. First, and in line with the above results on writing, because the technologies allowed the students to write faster and more easily, they could concentrate more on creative content.

*Yes, because writing on the computer is faster than writing by hand. In being able to write more in a shorter amount of time, I am able to expand on ideas and therefore be more creative. (S5)*

Second, Internet access allowed the students to find new examples and ideas that inspired them to develop their creativity.

*I could go on Google to see pictures of really cool pictures with a lot of colors and let my creativity just flow in my brain. (S6)*

*Like when we are writing an essay, I sometime search for “How to start the essay” When I find some good words, I usually think of better words. (S7)*

However, this second point raises the question of plagiarism, either intentional or non-intentional, involving inappropriate copy and paste practices. Although it is impossible to precisely determine the tradeoff between plagiarism and creativity, the teachers’ and students’ perceptions on this score are enlightening. In response to the question of whether their students tended to copy and paste texts from the Internet and present it as their own work (Figure 6), almost 25.4% of the teachers felt that none of their students plagiarized, according to the quantitative results. The students were more adamant (Figure 6), with 48.1% reporting that they did not copy and paste for their assignments. We may conclude that the teachers’ and students’ perceptions differ considerably on this subject. A number of hypotheses may be advanced. The first is that the students were unaware of what actually constitutes intentional plagiarism, or that the teachers overestimated the tendency in their students. In any case, less than 15% of the students, like the teachers, felt that plagiarism was a widespread problem.

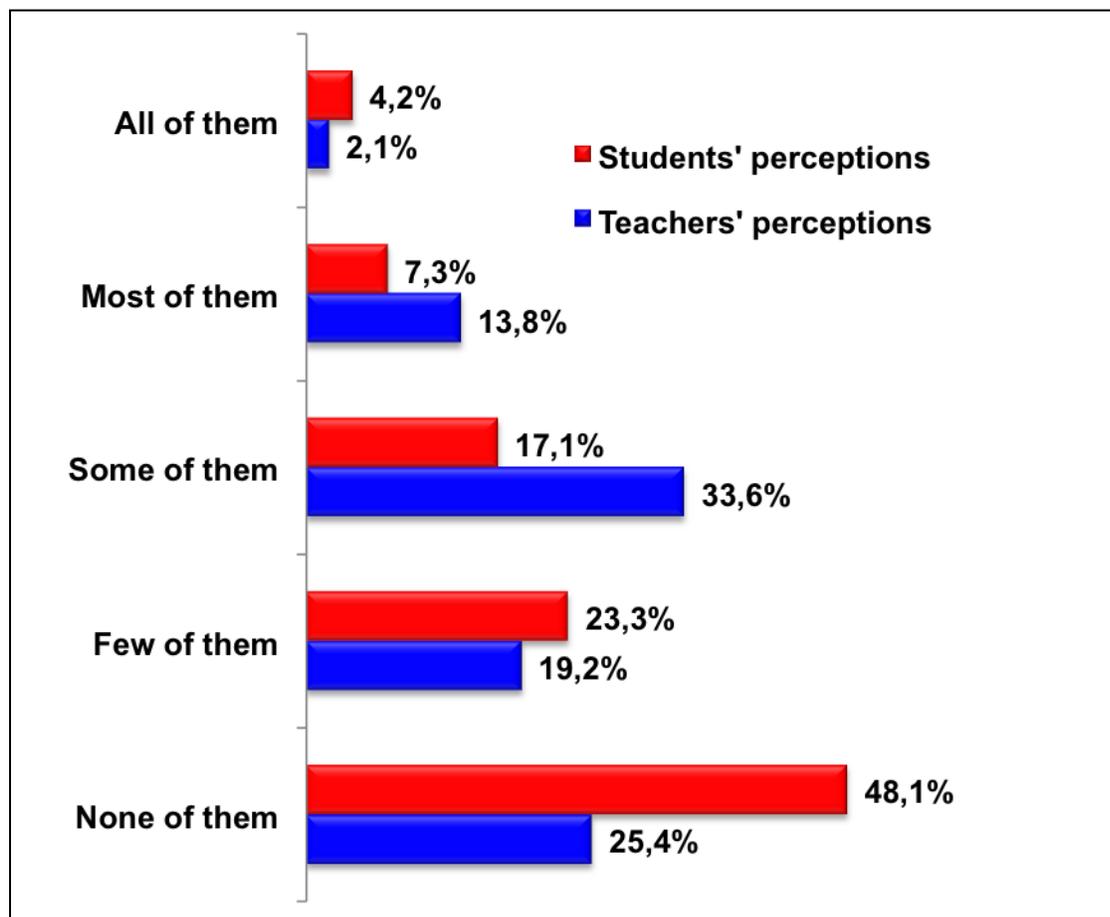


Figure 6. Teachers' and students' perceptions: percentage of students who plagiarize using technologies.

#### 5.4 Impact of technologies on students' capacity to communicate and cooperate

When the MELS (2001) made communication part of its core cross-curricular competencies under the Québec Education Program, it recognized the importance and centrality of this capacity. Creativity can be developed through current advancements in Web 2.0 technologies (Dohn, 2009). Aside from

the new communication functions that Web 2.0 has provided, it has profoundly enlarged the potential for collaboration and sharing, and consequently cooperative practices. Therefore, in this study, we consider the ability to communicate in combination with the ability to cooperate (including teamwork).

Concerning the impact of technologies on communication, we begin by emphasizing that face-to-face communication is still the preferred mode by both teachers and students, given their physical proximity at a typical school (Figure 7). To face-to-face

communication we may add other means of communication using technologies. Thus, about 40% of the students and teachers used email to communicate, mainly for managing assignments and course content (e.g., giving and submitting assignments, catching up on course work, asking and answering questions).

*On occasion where, my work was not yet completed by the end of the day, I can finished it for homework, and email it to my teacher before it becomes a day late, therefore I can keep my mark, as oppose to loosing marks for it being late. (S8)*

*When we have homework to send or if we missed a day of school we email the teacher and she sends you back all the homework and work that you need to retake at home so that your work can be done like the other people. (S9)*

The students themselves used different methods to communicate with each other. In addition to face-to-face communications at school, 66.6% of the students used Facebook to communicate with their peers “usually” or “always” and 49% used texting with similar frequency. These correspond closely to the main uses of technologies by young people across the province of Quebec (CEFRIQ, 2011, 2012).

Two purposes for communicating were reported: social (e.g., to keep in touch, socialize, plan activities) and educational (e.g., for teamwork, sending and receiving information, asking and answering questions). In addition, technologies were sometimes used to support teamwork, which is consistent with the competency of cooperation examined in this study.

*If we are apart and still need to hand in a project that is not finished, Facebook, Facetime, text messages and emails can come up handy to share and take information from our teammates even when we are not together we keep it as a team. (S10)*

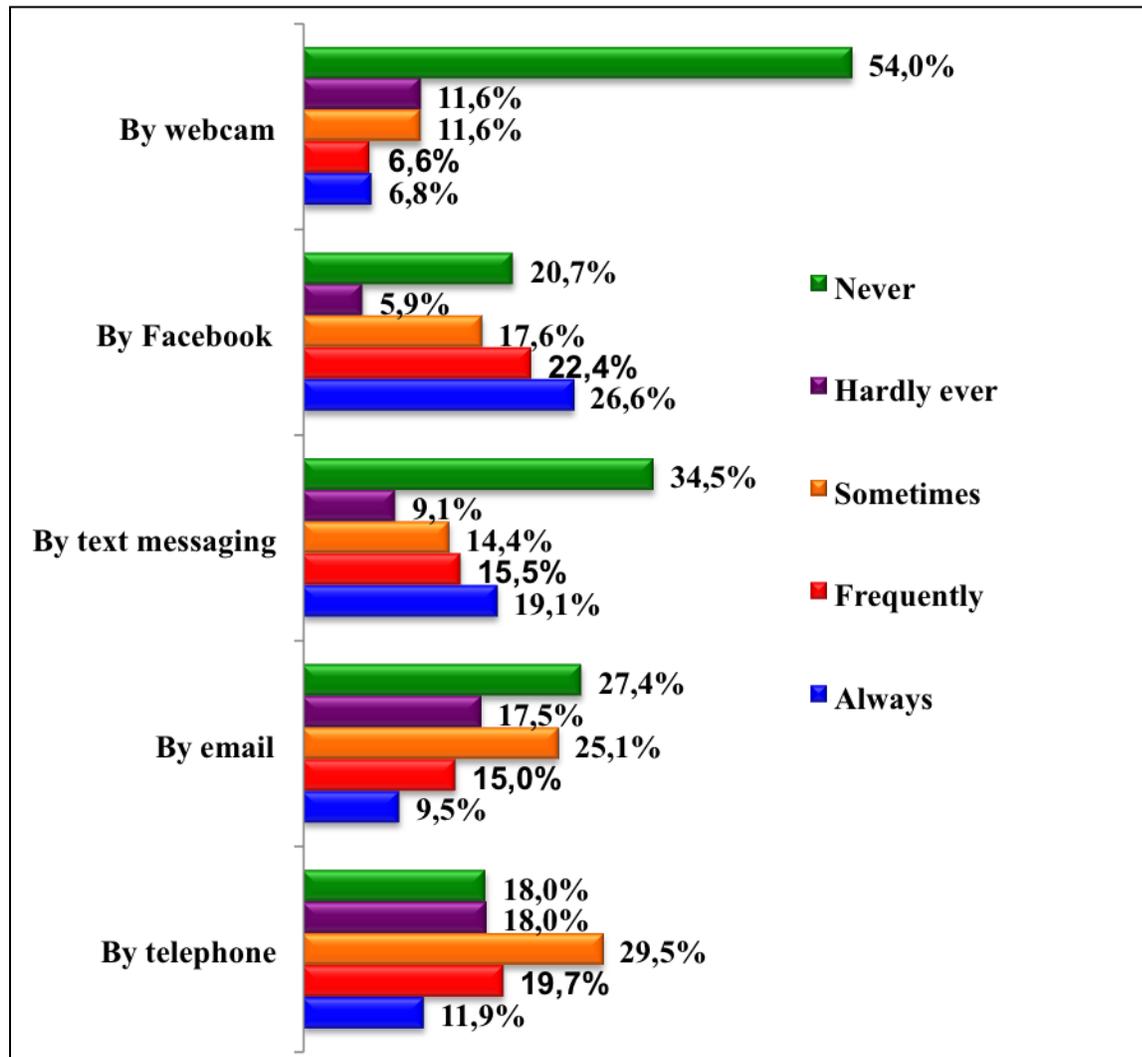


Figure 7. Students' perceptions of the frequency with which they used technologies to communicate with each other.

## 5.5 Impact of technologies on students' capacity to work effectively

As the MELS (2001) states, effective work methods involve “planning work to be done, ensuring that it is done on time, taking into account various obstacles, locating the available resources and gathering the required materials” (Québec Education Program. Secondary Cycle Two. Cross-Curricular Competencies. Page 13). Our purpose in examining this ability was simply to determine whether technologies can help develop it.

The results on effective work methods have largely been addressed above in relation to writing, communication and cooperation. Nevertheless, we would like to underscore here that the great majority of students (73.6%) felt that they “usually” or “always” worked more effectively when they used a computer to do their work, according to the quantitative results (Figure 8). Although not very enlightening in itself, this result reminds us that technologies can foster academic motivation because students perceive the learning experience as more positive and effective.

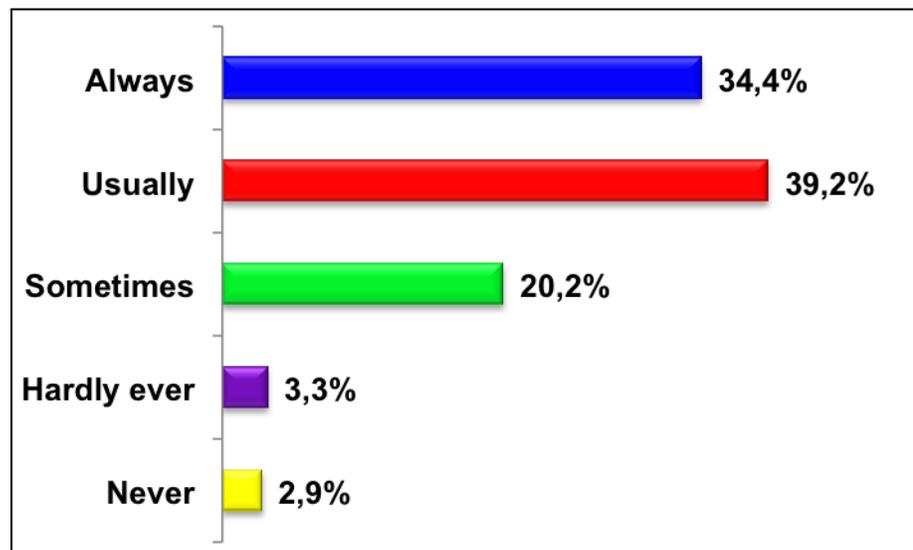


Figure 8. Students' perceptions of the usefulness of technologies for working effectively at school.

*The main advantages are that when you use a laptop at school you usually are more organized in your work therefore you always give in your work at the right time. You know where everything is without losing all your papers, notes and so on. You can always keep in touch with the teacher. (S11)*

*Work is also being done faster and more effectively because information and tools are right there when we need them the most, unlike in books. (S12)*

## 5.6 Impact of technologies on students' capacity to exercise critical judgment

In order to exercise critical judgment, according to the MELS (2001), "One must examine the issues involved, consider the information and evaluate its accuracy, and put the situation in perspective" (Québec Education Program. Secondary Cycle Two. Cross-Curricular Competencies. p. 9). For purposes of this study, and in relation to technologies, this capacity was considered mainly through perceptions of the students' ability to find information and judge its validity, which is in line with another MELS (2001) competency: "uses information and communications technologies." In this respect, we see an interesting difference in the quantitative results between the students' and teachers' responses (Figures 9 and 10). Although 62.7% of the students

felt that they were at the advanced or expert skill level in searching for information on the Internet, only 10% of teachers agreed with this perception. A similar trend was found concerning the students' ability to judge the validity of the information they found: 46.7% of the students reported that they were advanced or expert, versus 3.3% of the teachers. In fact, 78.5% of the teachers ranked their students as beginners in this skill. Our results are in line with recent studies such as the Pew Internet & American Life Project (Purcell et al., 2012) in which almost 2000 teachers participated. The authors of the report underlined that only a minority of participating-teachers rated their students' information-literacy skills as *excellent* or *very good*.

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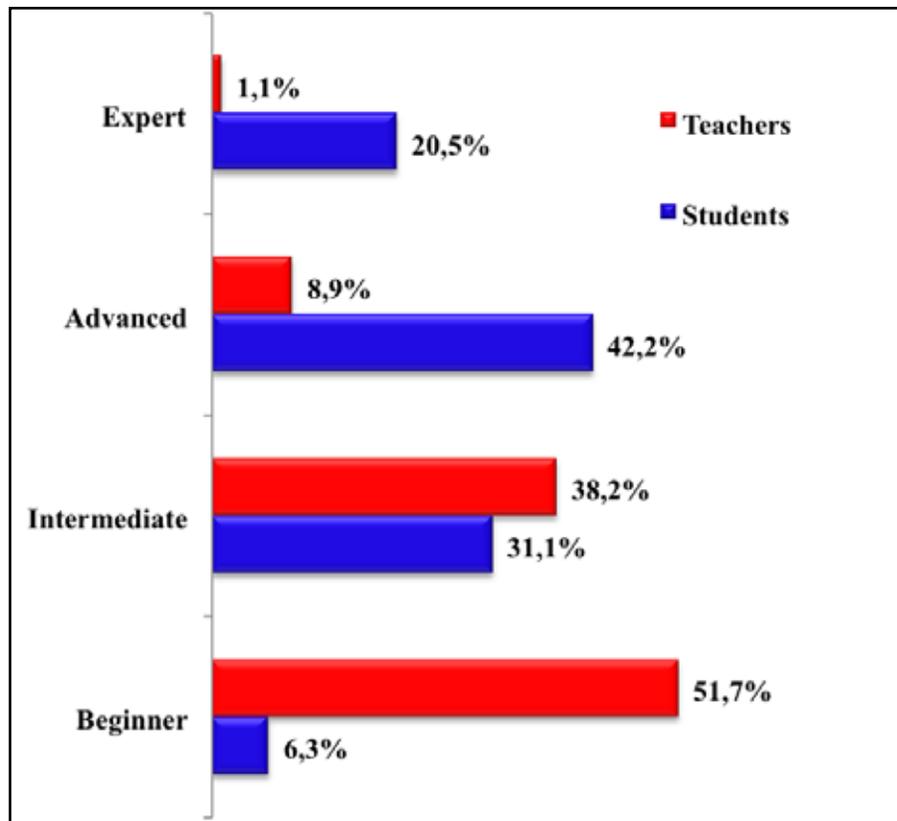
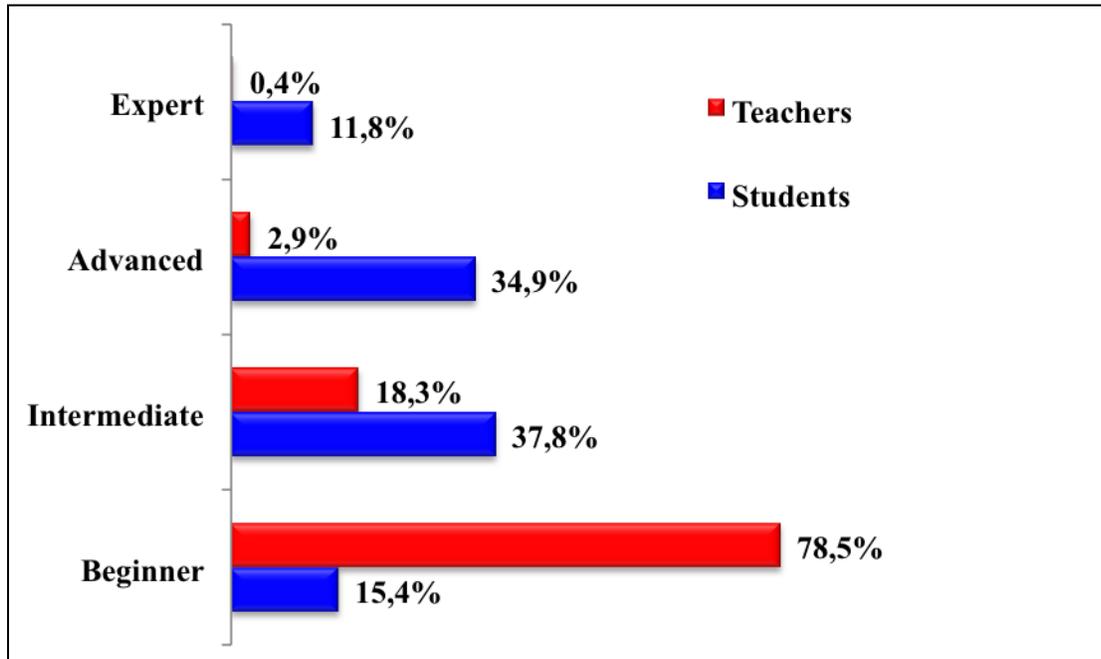


Figure 9. Teachers' and students' perceptions about the students' level of expertise in finding information.



**Figure 10.** Teachers' and students' perceptions about the students' level of expertise in judging the validity of found information.

Given this pronounced difference in perceptions between students and teachers, we may conclude that the students overestimated their competency in using ICT, confirming the findings of a number of studies (Kuiper, Volman & Terwel, 2005; Ladbrook & Probert, 2011; Walraven, Brand-Gruwel & Bos-huizen, 2008). We should nevertheless underscore the fact that many students were becoming more and more aware of the challenges inherent to finding the most valid information on the Internet.

*I will always find information on more than one site when doing my research so I can see if it is really true or someone is trying to trick you. (S13)*

## 5.7 Main benefits of using technologies in the classroom

One of the objectives of this study was to gain a better overall understanding of the benefits of technologies from the standpoints of both teachers and students. Due to their transversal scope, the results reported here on the students' and teachers' responses, based on the qualitative data, end up supporting many of the above-reported results on the impact of technologies on skills development.

The 389 teachers participated in this study reported a considerable number of benefits. Figure 11 presents the ten main educational benefits of the use of technologies in the classroom. The first is student motivation, reported by 19.5% of the teachers, which concurs with the literature:

*The two greatest benefits are student motivation and engagement. The students are much more interested in learning new concepts and practicing skills when the lessons are supported by interactive technology. (T3)*

Access to information, mentioned by 18.4% of the teachers, ranks second among the benefits. This was considered a major benefit, because information was accessible quickly and continuously:

*The greatest benefit is the wealth of information available at our fingertips. It truly is amazing. Students can explore and discover all kinds of knowledge and it is accessible to all. (T4)*

The variety of available resources was also a main benefit, cited by 17.3% of the teachers:

*As a teacher, I am always seeking to improve my courses, and many of the BBC, PBS and CBC websites provide information, images and videos that I use in my classroom [...] As a teaching resource, the Internet is like having thousands of invisible helpers who provide many options for teaching different subject to different kids in different ways! (T5)*

Next, we note the potential to develop individualized teaching (8.9%), recognized as a distinct advantage for both gifted students and students with learning difficulties.

*Students are able to have the curriculum tailored to their ability. I am able to use websites for skill development that will adjust to the ability of the student. (T6)*

Some of the teachers (7.9%) felt that using technologies in class also allowed them to prepare their students to fully partake in society in future:

*It benefits the students to be able to work with technology so as they continue their education they will be comfortable working with technology as well as in their future fields of working. (T7)*

Technologies also appeared to facilitate effective work methods (7.6%). This benefit, which some teachers stressed, is consistent with the above-presented results on effective work methods. As the following extract shows, the teachers viewed technologies as tools that enabled their students to work faster and more effectively.

*It is faster to get assignments done on time. There is usually less talking going on, making it easier to concentrate. (T8)*

In addition, 7.3% of the teachers reported that their students felt more competent, that is, when performing their assigned tasks:

*Also, since the students are so used to technologies in their everyday life it helps them to relate to the material better sometimes. (T9)*

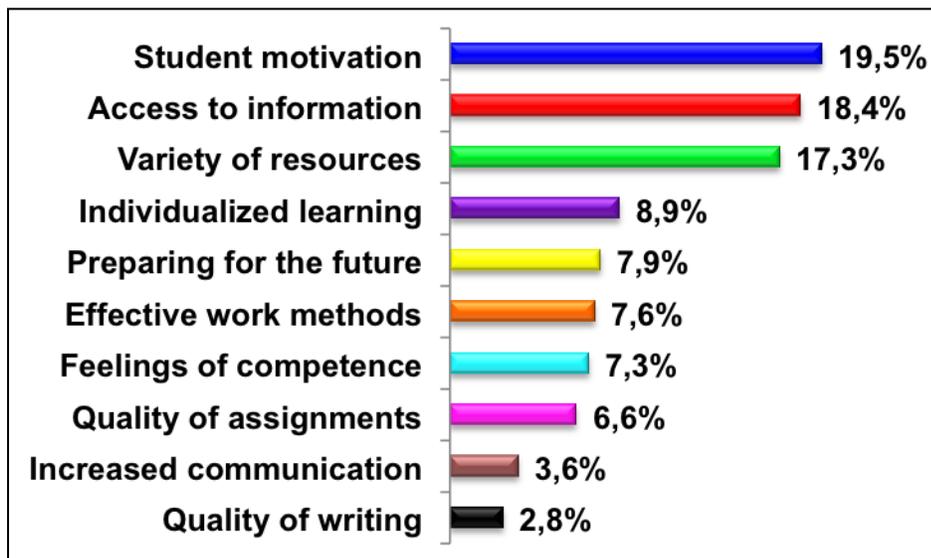
On this point, we note that the literature (see Deci & Ryan, 2000; Bandura, 2003) clearly demonstrates that greater feelings of competence are strongly associated with academic success.

Another benefit was the improved quality of the students' assignments (6.6%), as the following teacher explains:

*There are many applications which can aid a student in their respective assignments as well, such as [...] visual presentation for a project. It allows students [...] to refine their work and to make sure it is the best they can offer. In many ways, the computer is truly a useful educational tool. (T10)*

Greater communication potential (3.6%) and better written work by the students (2.8%) were further benefits that the teachers perceived when technologies were used in the classroom. As the following extract shows, the quality of written work was noticeably improved, in terms of not only presentation, but also ideas:

*There is auto correction, which allows you to see your mistakes as you go and being able to learn from them. The Internet provides useful information that students can use for ideas in their assignments or quotes to support their argument. (T11)*



**Figure 11. Teachers' perceptions of the 10 main benefits of using technologies in the classroom.**

When we asked the 2,712 students about the main benefits of using technologies in class, their qualitative responses differed slightly from those of the teachers. The first benefit in the students' view was access to information, with 28.8% reporting that ICT enabled them to access a vast store of information (Figure 12). Like the teachers, the students perceived this as a major benefit:

*I could give you 1,000 advantages, but one of the most is you can find your information needed really fast... instead of going in books looking for hours. (S14)*

Moreover, 25.5% said that the technologies enabled them to organize their work better. The two following extracts illustrate this perception:

*I think that using a computer to do assignments is much more effective than doing it by hand in certain respects for a number of reasons. (S15)*

*Firstly, using a computer, doing the work is much less time consuming due to the readily available information provided by the internet, and not to mention, typing is also much faster. It enables students that are writing assignments that have a word limit and minimum to view their progress as well. [...] There are many applications which can aid a student in their respective assignments as well, such as making a movie or a visual presentation for a project. It allows students the ability to refine their work and to make sure it is the best they can offer. (S16)*

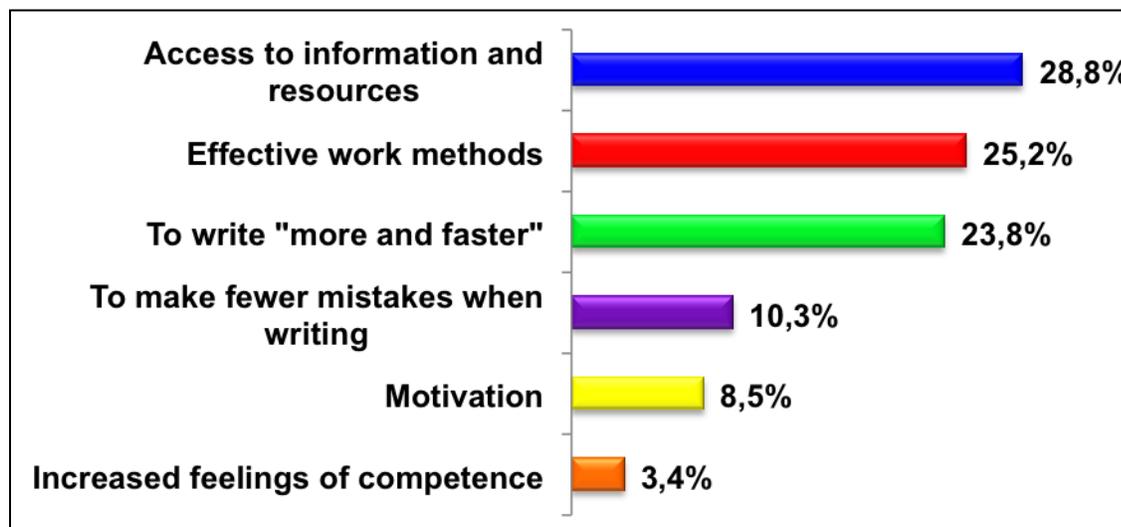
For the students, the ability to write “more and faster” was ranked third among the benefits of using technologies (23.8%):

*I like using laptops for work at school, because it saves a lot of time, because I can type a lot faster than if I am writing it by hand. (S17)*

The students apparently perceived that improved writing was a central benefit of using technologies in class, because “to make fewer mistakes when writing” was ranked fourth (10.3%):

*It makes you make fewer errors in writing because the computer is correcting you, so you don't really care about your mistakes anymore. (S18)*

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**Figure 12.** Students' perceptions of the main benefits of using technologies in class.

This was followed by motivation, which, although only 8.5% of students mentioned it, is nevertheless an important dimension of academic success:

*I also believe that using technology makes us students more excited and involve into doing the homework or assignment. (S19)*

Although most students did not spontaneously mention motivation (Figure 12), it was obvious that they were motivated when they were observed using technologies in class. The lower ranking given

to motivation by students than by teachers could be explained in part by the fact that they experienced this aspect differently. That is, they thought more in terms of “enjoyment.” In fact, when the students were asked about how well they agreed with some of the statements about technologies (Figure 13), 94.3% responded that they *liked* using the computer at school, and 94.2% *liked looking for information* on the Internet. Furthermore, 89.3% of the 2,712 students surveyed felt that using technologies in

class *helped them learn*. These results suggest that young people enjoy using technologies, and not just for fun, but also to learn and to find information.

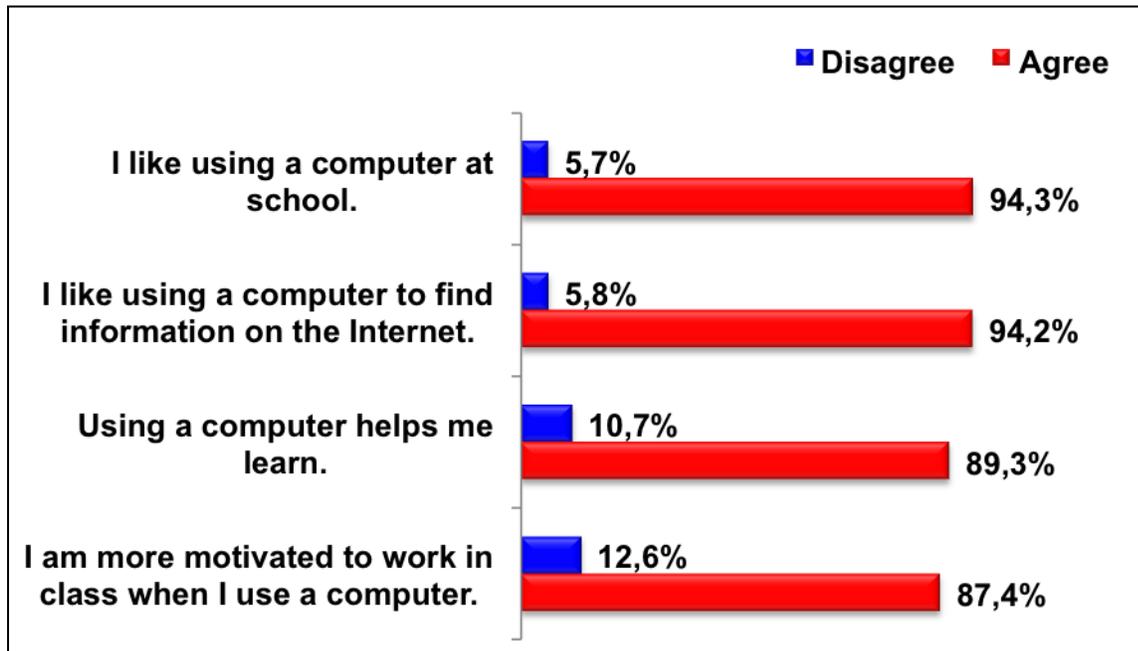


Figure 13. Students' perceptions of the main benefits of using technologies in class.

Finally, note that teachers as well as students claimed that the use of technologies in class increased feelings of competence (3.4%):

*Firefox, Word, PowerPoint, Excel, Garage Band, iMovie, iPhoto, Smartboard. [...] All of these programs help me to learn and to understand what I am expected to do. [...] They really help me in my assignments and for me to have good grades! (S20)*

## 5.8 Main challenges in the use of technologies in class

In addition to the benefits of ICT integration into education, it was important to identify the main challenges that teachers met when using technologies in class in order to consider potential solution avenues. The qualitative data gathered from the 389 surveyed teachers revealed six main challenges that they faced, sometimes daily, in using technologies in class (Figure 14). Consistent with the literature, the most frequent challenge was the equipment, with 52.9% of teachers wishing that they had better equipment in their classrooms.

Some teachers felt that time was an obstacle to the successful integration of technologies in the classroom (14.6%). The two following extracts aptly illustrate this challenge:

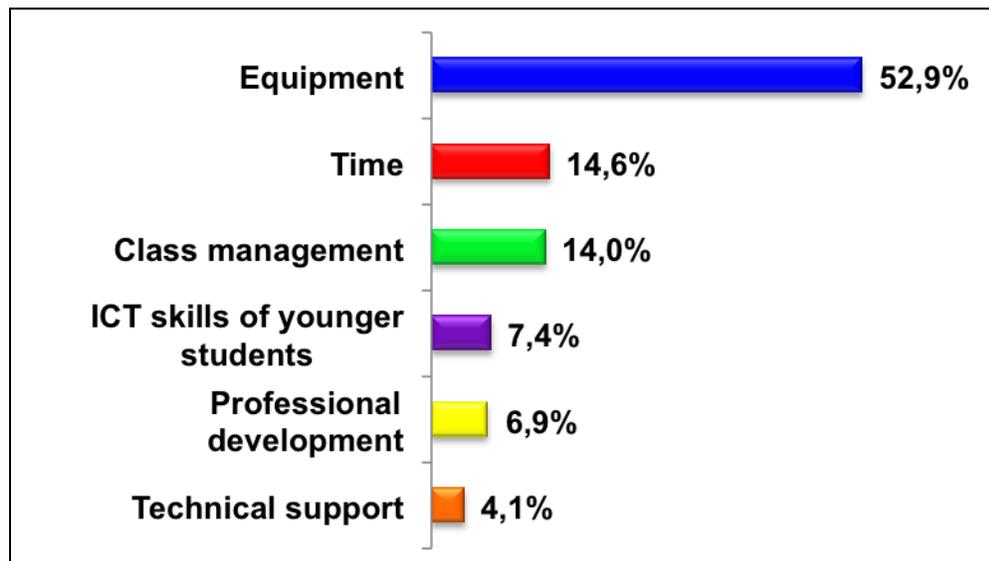
*The enormous amount of time required to properly and effectively integrate ICT to any program remains a huge obstacle to meeting curriculum objectives. (T13)*

*Finding the time to experiment with the technologies to make the most of the ICT available. It is one thing to use ICT in the classroom, but using it in a “natural” and “educational” manner is another. (T14)*

*Time to prepare lessons (such as Smartboard lessons). (T15)*

*Effective use of ICT requires that the equipment be up-to-date, reliable, [...] within the classroom. (T12)*

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**Figure 14.** Teachers' perceptions of the main challenges of using technologies in class.

One noteworthy finding is that a greater proportion of elementary than secondary teachers (with statistical significance) felt that the equipment itself constituted an inconvenience when using technologies in class.

Classroom management, particularly when technologies were being used, was a daily challenge for many teachers (14.0%). A good number of them pointed out the challenges posed by social media, such as Facebook and YouTube, which were highly distracting for the students and prevented them from completing their assignments:

*[...] 12-year-old students who are very easily distracted by Facebook, Twitter, YouTube and game sites. (T16)*

The students' technological skills also posed a challenge for some teachers (7.4%). It appeared that it was sometimes difficult to set up complex projects involving technologies when the students' skills varied. This was particularly problematic in the second year of elementary school and the beginning of third year, when the students had different backgrounds in handling technologies at school. The following extract describes one teacher's experience with this problem:

*What I have found most difficult is the fluctuation and changes in who gets what over the years: i.e. one year grade 3 then 4 didn't get laptops so when I got those students in 5, I had to start from scratch; one year I had a very strong group who had had one to one laptops in 3, 4, 5 and 6 and were very skilled with multimedia projects. [...] The following year they received crappy G4 with none of the applications they had become so proficient with. (T17)*

Professional development was another challenge for certain teachers (6.9%). However, this finding should be related to that of the first investigation (Karsenti & Collin, 2011), where the teachers reported this as a greater challenge. We may therefore conjecture that the many efforts undertaken by the school board had gone some way to overcome this problem. Besides the fact that only 6.9% of teachers still considered this a problem, the teachers generally felt the opposite, and they greatly appreciated the variety of training programs that were available to them, particularly the use of interactive whiteboards in class and the use of tablets, such as the iPad. We should also mention that almost 80%

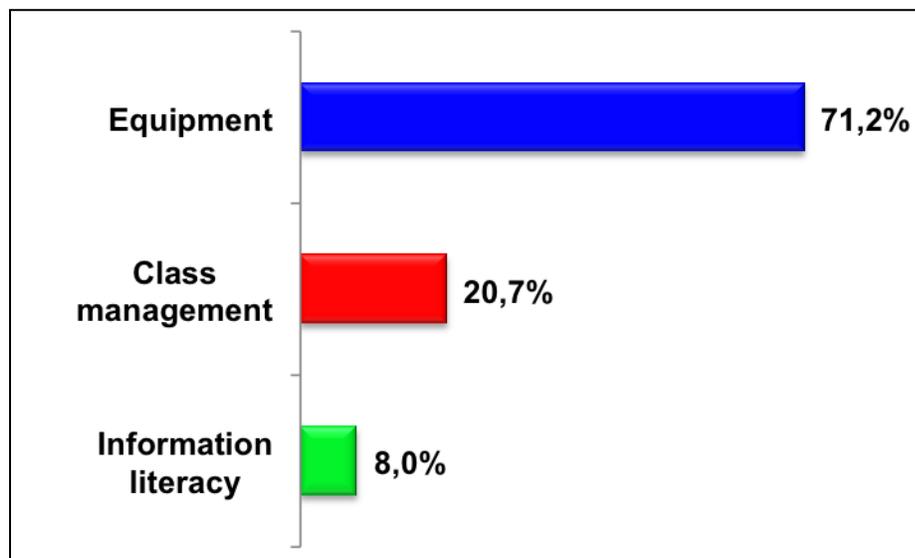
of the teachers surveyed felt that the professional development programs that they attended had an impact (from somewhat to major) on their teaching practice. This finding also contrasts substantially with that of the first investigation, where most of the teachers perceived that the training they had received had very little impact.

Technical support concludes the list of challenges reported by the teachers (4.1%). This challenge appeared to be greater in the smaller schools, where the technicians were less available:

*There should be more technician time in small schools. There also should be time allowed to meet with him to ask questions and deal with our concerns. (T18)*

The proportion of teachers who found the technical support inadequate was minimal, however, particularly when compared with other surveys that show this complaint at the top of this list for school staff (Karsenti & Collin, 2011). We could therefore interpret this finding as an acknowledgement of the effectiveness of the technical support measures put in place by the school commission since the last investigation.

We also asked the 2,712 students about the problems they had using technologies in class. The qualitative results show three main challenges (Figure 15).



**Figure 15. Students' perceptions of the main challenges in the use of technologies in class.**

A large proportion of the students (71.2%) stressed that the equipment they had to use constituted a challenge. This was by far the most significant problem for them, as illustrated by the following extracts:

*The computer are 2005 so there quite old so they have often problem like mine didn't want to opened so I had to send it to help desk. (S21)*

*When your computer crashes you can't use it but the rest of the class can so that's not very fair. (S22)*

*Some main problems are that if it needs to be charged sometimes you can't use the computer. (S23)*

*Sometimes the computers crash, and we lose our work. (S24)*

The next challenge, which some might find surprising, was the teacher's classroom management (20.7%). That is, sometimes the presence of technologies made more problems for the teacher. On this point, we should mention that using computers for fun at school was not particularly appreciated, by either students or teachers, because as many pointed out (as they did in the first investigation), social networking sites like Facebook could be very distracting:

*[...] many people are too busy on Facebook instead of working. (S25)*

*It makes you want to go on another site that your not supposed to be on (ex: Facebook, Skype, Ttwitter, etc.). (S26)*

*Sometimes you go on Facebook or other sites like that and it gets you distracted. (S27)*

*The main problems includes people using the laptops to go on social networking sites such as Facebook and Ttwitter instead of completing their work. (S28)*

It is therefore interesting to note that, contrary to certain concerns about the use of ICT in education, the surveyed students, like their teachers, appeared to have developed a profoundly educational vision of technology use in class, to the point where using the laptop for amusement was frowned upon. The students' "technoeducational maturity" is no doubt connected to the frequency with which they used technologies. In other words, the implication is that the more that students use ICT for learning, the more they will appreciate their educational value.

The last main challenge, reported by a few students (8.0%), was the difficulty in finding and identifying good information versus unreliable information. This relates to the competency "use of information and communications technologies," which sometimes appeared to be severely tested, given the amount of resources available on the Internet:

*Well, most of the time it's from not finding the information that I need. (S29)*

*I rarely have problems on the computer at school, but I would say my main problem is going through all the websites to see if my information is true or not. (S30)*

*You don't always know if the answers on the internet are right. (S31)*

*The main problem is that the information you may retrieve could be wrong. (S32)*

These results, which were reported by a minority of the students, are in contrast with the results reported above (see the section *Impact of technologies on students' capacity to exercise critical judgment*), where a large majority of the students felt that they had advanced or even expert skills in finding information on the Internet. We may tentatively conclude that the students were not fully aware of the issues or limitations of information literacy.

# 6. Conclusion

Let us recall that this project was initiated under a partnership between the Canada Research Chair on Information and Communication Technologies (ICT) in Education and the Eastern Townships School Board. Ten years ago, the education actors at this school board decided to provide each of its students and teachers with laptops for learning and teaching.

In this study, which is still ongoing, we aimed to determine the perceptions of the students and teachers of the impacts of ICT on 1) writing skills, 2) creativity, 3) communication and cooperation, 4) effective work methods, and 5) critical judgment. We also aimed to identify 6) the main benefits and 7) challenges involved in regular use of technologies in the classroom, and 8) the equipment and access available to teachers and students at the school board. In all, 2,712 students (from grades 3 to 11) and 389 teachers participated in the study. We administered a widespread questionnaire survey to students, teachers, and other education stakeholders, the results of which are presented in this report. We also held individual and group interviews and observed classrooms in order to gain a deeper understanding of the benefits and challenges of using laptops for teaching and learning.

First, the analysis of results shows that ICT played an instrumental role in the development of the students' writing skills. They wrote faster, more, and better—in terms of planning and structure—and they enjoyed writing more. Considering that writing is a core competency in the school curriculum—it is deemed essential for academic success in secondary school—it may be concluded that the education actors at the Eastern Townships School Board played a key role by enabling their students to mobilize the cognitive potential of ICT to develop their writing skills.

Second, the results clearly demonstrate the central role of ICT in the development of a diversity of competencies required for academic success: creativity, communication and cooperation, effective work methods, and critical judgment. Taken together, the testimonies of the surveyed teachers and students made a strong case for the capacity of ICT to facilitate the development of these competencies.

Third, and more generally speaking, we grouped the main challenges that the education actors at the Eastern Townships School Board faced, and which they could overcome in the coming months:

1. universal access to good quality equipment;
2. the time required to properly prepare lessons and activities that take full advantage of ICT in class;
3. class management;
4. students' information literacy.

The greatest challenge concerned the equipment itself, underscored by 52.9% of the teachers and 71.2% of the students. Moreover, as the results show, the other challenges paled by comparison. It is also understandable that the teachers and students, with their extensive experience in using ICT in education, would appreciate having better equipment to work with.

Among the other challenges were lack of time, which will probably always remain a problem in teaching, a notoriously time-consuming profession. Classroom management was also an unavoidable downside of teaching. Nevertheless, through greater use of ICT, these challenges can be handled better. Moreover, teachers can take some reassurance from the fact that the students at the Eastern Townships School Board were also aware of these challenges. This would appear to be a first step in the search for a solution. Students' information literacy was the fourth challenge that teachers faced. Some students were unable to judge the validity of the information they found, particularly in today's society, with

its deluge of Internet information. However, this fourth challenge also had a flip side. Students at the Eastern Townships School Board were probably far better at using technologies than any other students in Quebec, thanks to their many years of using technologies in class.

Fourth, the data gathered in this study revealed 10 main benefits to using technologies in class for teaching and learning :

1. Students' motivation
2. Access to information and educational resources, for both students and teachers
3. Students' writing skills
4. Students' effective work methods
5. Students' feelings of competence
6. Individualized learning
7. Students' quality of work
8. Easier communication, cooperation and teamwork, for both teachers and students
9. Better preparation of youth for the future, and for their own future
10. Students' creativity.

We find motivation at the head of the list of benefits of using technologies in class. Of the 2,712 surveyed students, 94.3% said that they liked using computers in class. We may note that 89.3% stated that using technologies in class helped them learn. The perceptions of these benefits by the almost 3,000 students who participated in the study suggest that the use of technologies in the classroom for teaching and learning can play a major role in academic success.

Another particularly interesting result of this study was the attitude of the Eastern Townships School Board teachers towards technologies. It is frequently argued in the literature on ICT integration in education that ICT are motivating for students, but that teachers are less enthusiastic (e.g. Livingston, 2012), because they have to change their teaching practices in order to incorporate them. As indicated by Livingston (2012), it is particularly unusual to

find so few teachers expressing a negative attitude about technologies (less than 4% of the surveyed teachers).

In light of the results of this second study, we may hypothesize that the “one laptop per child” program implemented at the Eastern Townships School Board contributed to some extent to the students' achievement rate. Although it is almost impossible to relate the teachers' ICT use with school success—which was not our objective in this research project—there is no doubt that the results clearly highlight that the pedagogical use of technologies, by both teachers and students, improved the teaching context (enhanced writing skills, creativity, communication, cooperation, work methods, critical judgment, etc.), which could have played a significant role in the students' achievement.

In other words, the teaching context put in place at the Eastern Townships School Board may have contributed to the outstanding decrease in the student dropout rate (by almost 50%) over the succeeding decade. Above all, this remarkable progress, which we may attribute in part to a well-planned use of technologies for teaching and learning in the classroom, would not have been possible without the complete commitment and outstanding skills of the teachers, school principals, and other education stakeholders at the Eastern Townships School Board. This also means, implicitly, that the official statistics on student dropout rates at this school board are in line with the results of this second inquiry, which highlighted, among other things, the central role that technologies play in developing students' writing skills and other key competencies central to students' achievement rates.

Many educators and sociologists contend that the fight against school dropout must be taken beyond the school walls, and that it is a matter of concern not only for those who work in the education field, but also for the students, their parents, the entire community, and the governments. Even though the Eastern Townships School Board has succeeded over ten years in almost halving their dropout rate,

elsewhere in Quebec, over 18,200 adolescents quit school each year, steadily increasing the pool of undereducated citizens (Statistics Canada, 2011). Not only do they not have a high school diploma, their future will be more challenging. If the Government of Quebec wants to intensify the battle against dropout and improve the odds of succeeding for its youth, thereby ensuring Quebec's future growth, it would do well to take notice of this commendable initiative by the Eastern Townships School Board to implement pedagogical and technological change. It should find ways to introduce technologies into the classroom under a widespread, carefully considered educational program. However, not just any technology will do. Our investigation revealed a key element for academic success: each student and teacher, in line with their school context and pedagogical needs, seem to benefit more from using their own laptop than any other technology.

# 7. Directions for future research

The results obtained in this second investigation point to several promising directions for research:

1. More systematic studies on the impacts of enriched technology environments, such as at the Eastern Townships School Board, on students' academic success
2. More specifically targeted studies on adaptation processes in teachers and students when making the shift from a traditional class to a laptop class, and vice versa
3. Studies on the relationships and interactions between students' use of laptops in class and at home
4. Longitudinal studies to trace the academic and professional paths of students who attended "one laptop per child" classrooms to gain a better understanding of the impact extent of this innovative project.
5. More specifically targeted studies in students who do not have Internet access at home, to better understand how they experience "technological exclusion" from society.

# 8. Twelve main recommendations

1. Enable the Eastern Townships School Board to continue implementing education innovations through well-planned and pedagogically sound programs that incorporate a “one laptop per child” approach.
2. Continue to assess the impacts of the “one laptop per child” program through rigorous studies in order to gain a deeper understanding of the benefits and challenges inherent in this particular educational context.
3. Conduct longitudinal assessments of the impacts of this pedagogical formula (“one laptop per child”), for example, in graduates from the Eastern Townships School Board.
4. Extend the use of laptops in class to all students at the school board, including elementary grades 1 and 2.
5. Promote a return to the “one laptop per child” model for classes that have adopted other approaches.
6. Foster the development of information literacy and other computer skills in students and teachers.
7. Follow up on all efforts related to students’ capacity to “write better.”
8. Continue the outstanding efforts to promote teachers’ professional development, and continue to ensure that the programs offered meet their needs.
9. Raise awareness in students, teachers, and other education stakeholders, including parents, of the many benefits of using laptops in the classroom.
10. Find ways to provide Internet access at home for the 9.6% students who do not have it.
11. Extend the experience of the Eastern Townships School Board to other school boards so that Quebec can become a leader in innovation through well-planned and pedagogically sound uses of technologies in class.
12. Raise students’ awareness of appropriate and educationally beneficial uses of technologies, both at school and outside school, so that social media, instead of posing an obstacle to academic success, become allies.

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