The Interactive Whiteboard (IWB): Uses, Benefits, and Challenges.
A survey of 11,683 students and 1,131 teachers.

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Data collection and analysis

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iwb.crifpe.ca

Note

The masculine gender is used in this document for the sake of simplicity and readability, and not for purposes of discrimination.
# Table of Contents

**List of figures** ........................................................................................................ II

**Abstract** ..................................................................................................................... 1

1. Introduction .................................................................................................................... 2

2. The interactive whiteboard in education: what the research says............................... 5

3. Methodology.................................................................................................................. 9

   3.1 Participants .......................................................................................................... 9
   3.2 Data collection instruments ............................................................................... 10
   3.3 Data treatment and analysis ............................................................................. 10
   3.4 Methodological strengths and limitations......................................................... 11

4. Main results................................................................................................................... 12

   4.1 How was the IWB used? .................................................................................... 12
   4.2 What were the main benefits of the IWB? ......................................................... 16
   4.3 Specific benefits of IWB use............................................................................ 19
   4.4 Challenges of IWB use in class ..................................................................... 20

5. Conclusion .................................................................................................................. 25

6. Recommendations ..................................................................................................... 28

7. References .................................................................................................................. 29

8. Works consulted ......................................................................................................... 33
List of figures

**Figure 1**  
Presence of interactive white boards (IWB) in classrooms of various countries ................................. 3

**Figure 2**  
Change in the numbers of publications addressing the IWB in education ........................................ 5

**Figure 3**  
Distribution of participating students between elementary and high school ................................. 9

**Figure 4**  
Number of years of teaching experience for participating teachers .................................................. 10

**Figure 5**  
Use frequency of the IWB by teachers ................................................................................................. 12

**Figure 6**  
Use frequency of the IWB by students according to teachers .......................................................... 13

**Figure 7**  
Use frequency of the IWB by students according to students .......................................................... 14

**Figure 8**  
Main uses of the IWB in class ............................................................................................................. 15

**Figure 9**  
Students’ preference for the IWB over the blackboard ....................................................................... 16

**Figure 10**  
Teachers’ preference for the IWB over the blackboard ...................................................................... 16

**Figure 11**  
Main benefits of the IWB according to students ............................................................................... 17

**Figure 12**  
Main benefits of the IWB according to teachers ............................................................................... 18

**Figure 13**  
Main challenges of the IWB according to teachers .......................................................................... 21

**Figure 14**  
Frequency of technical problems according to teachers ..................................................................... 21

**Figure 15**  
Technical problems that teachers felt they could resolve on their own without a technician’s help ........................................................................................................... 22

**Figure 16**  
Main challenges of the IWB according to students .......................................................................... 24
Abstract

Over the past five years, the interactive whiteboard (IWB) has been massively introduced into schools across the province of Québec, Canada. This study, conducted by the team of the Canada Research Chair in Technologies in Education, aimed to identify how the IWB is used in Québec schools and the associated benefits and challenges. The study participants included 11,683 students (from 4th year elementary to 5th year high school) and 1,131 teachers. Five data collection instruments were used: 1) a survey questionnaire for all students (n=11,683), 2) a survey questionnaire for all teachers (n=1,131), 3) individual interviews with teachers (n=31), 4) group interviews with teachers (8 interviews with groups of 6 to 17 teachers), and 5) group interviews with students (16 interviews with groups of 8 to 24 students). This report begins with a presentation of the main educational uses of the IWB, followed by the many benefits as perceived by teachers and students. The main challenges that this technology poses for teachers and students are then addressed. Far from calling into question the need to integrate technology in education, the results reveal that certain tools, such as the IWB, may be more complicated and time-consuming to integrate than others. Thus, teachers appeared to have problems with technical aspects of the IWB. Nevertheless, the results also show that the IWB has real educational potential. The report concludes with a list of 12 recommendations.
1. INTRODUCTION

At the 2003 World Summit on the Information Society, Kofi Annan proclaimed that rapid technology advancements can “propel” us to “improve standards of living for millions of people on this planet.” He also foresaw that the power of these tools will be increasingly felt in all areas of life, with a growing influence on economic, societal, and educational aspects. For example, in just a few short years, classrooms all across Québec have been transformed: today, students routinely have their own laptops or are participating in one touchpad per child projects.

In Québec and around the world, more and more classrooms feature an interactive whiteboard (IWB) (Figure 1). Also called an IW or an interactive digital whiteboard (IDW), it refers to an electronic whiteboard that displays content projected by a computer, tablet, or other source. The IWB combines touch (pen-and-finger) control of the screen with computerized input from a variety of devices operated by teachers or students. However, while the IWB has become practically standard in the education systems of certain American states and countries such as Australia—and especially Great Britain, where they are present in 100% of elementary schools (Kitchen et al., 2007) and 72% of high school classrooms (Lee, 2010)—, IWBs began to be introduced into Québec’s education system only in the last five years.

The usual justification for this massive invasion—put forward by both governments and businesses—is that IWBs can improve school and academic outcomes for learners by improving teaching practices, by diversifying teaching resources (e.g., graphics, videos, audio), and by introducing more interactive teaching and learning activities. Nevertheless, the arrival of this technology in Québec and elsewhere raises questions about its actual usefulness for schools, particularly from a cost–benefit perspective.

In 2016, we still do not know much about how the IWB is actually used or the real impacts on educational outcomes. Moreover, studies on the educational impacts of the IWB have found contradictory results. Sometimes the impacts are modest, with no real significance for learning. Alternatively, many case studies, action research studies, and anecdotal accounts describe how exceptional teachers use the IWB.

These studies are instructive, and they help us understand how teachers might eventually manage to integrate the IWB in their classrooms. However, these same studies, as well as other reports of classroom experiments, tend to focus on a particular aspect: how the IWB is used by exemplary teachers and teachers who have succeeded in fully integrating the IWB into their teaching practice. Meanwhile, there are very few accounts of failed experiments.

Accordingly, and as Türel (2010, p. 3050) argued over five years ago, we still do not have enough rigorous empirical evidence on the impacts of educational technology on learning and academic performance. Our.

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2 http://futuresource-consulting.com/2014-06-EducationHardware-1176.html

The Interactive Whiteboard (IWB): team therefore felt it important for IWB implementation to be preceded by careful scientific reflection on how it will be used by both teachers and learners as well as a thorough analysis of the real educational impacts.

The objective of this study conducted by the team of the Canada Research Chair in Technologies in Education was to identify how the interactive whiteboard (IWB) is used in Québec schools and the associated benefits and challenges.

This study therefore aimed to shed scientific light on the educational uses and impacts of the IWB. This objective is also related to the *Avis sur l’éthique et les TIC à l’école* [Opinion statement on the ethics of ICT at school] released in 2015 by Québec’s *Commission de l’éthique en sciences et en technologie* [Commission for ethics in science and technology]. Two of their recommendations remind schools to determine first and foremost the impacts of technology on academic perseverance and achievement before introducing them across the board:

**RECOMMENDATION 1.** The Minister of education should promote the use of ICT only when it provides real added value in terms of specific characteristics, and taking into consideration the benefits for students and for course contexts (level, subject, etc.) [our translation] (p. 15).

**RECOMMENDATION 2.** The Minister of education should conduct or commission rigorous studies in order to demonstrate the educational value of various ICT applications before proceeding to implement them [our translation] (p. 16).

The present research report is organized into six sections. Following the introduction (Section 1), a synthesis of the literature on IWB issues in education is presented (Section 2). The research methodology (Section 3) and the main results (Section 4) are then presented. The report ends with a conclusion (Section 5) and a list of the main recommendations (Section 6).
2. THE INTERACTIVE WHITEBOARD IN EDUCATION: WHAT THE RESEARCH SAYS

We searched the main education databases (ERIC, CAIRN, and FRANCIS) and Google Scholar for studies on uses and impacts of the IWB from preschool to postsecondary school. Figure 2 shows a screenshot of Scopus, “[…] the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings.” We observed a small number of publications on the IWB from 2009 to 2011, followed by a growing interest that subsequently declined sharply. We then constructed a matrix to summarize the reviewed studies.

Figure 2. Change in the numbers of publications addressing the IWB in education

The analysis shows that although many publications have addressed the IWB, very few have attempted to assess the educational impacts empirically (see Khambari et al., 2014; Lopez, 2010). In fact, only a handful have done so (see Khambari et al., 2014; Türel, 2010). We found many pedagogical recommendations for teachers, but not much about the real impacts of the IWB, except for a few studies by authors such as Hennessy (2014) and Hennessy and colleagues (2006, 2007, 2011, 2014). There are also several case studies, for example, by Kennewell and colleagues (2007, 2008), who examined a small group of highly tech-savvy teachers and their use of the IWB. Studies tend to sing the praises of the IWB, but often without solid grounds, somewhat reminiscent of advertising flyers that tout product features. This is not surprising, given that many reports

http://www.scopus.com/
are funded by IWB producers. Indeed, Glover et al. (2005) and Smith et al. (2005) found that, since 2005, a large percentage of these studies have been funded by IWB producers. By the same token, the benefits that have been claimed in these studies are not necessarily consistent with the teaching approaches that are actually used.

Among the benefits that have been accentuated, we note that the IWB allows teachers to teach better by giving demonstrations “at the front of the class.” In the current era of student-centered learning, we would like to see less lecturing (where the teacher faces the entire class) and more engaged student activity. It is therefore rather odd that one of the benefits of a tool that is being promoted for educational purposes is that it facilitates teaching at the front of the classroom! For Khambari and colleagues (2014), this would be problematic for teachers who feel caught between the open-ended and student-centered learning approaches that schools advocate and use of the IWB, which encourages teachers to present ideas in front of the class using lecture-style teaching. However, Cutrim Schmid (2008) demonstrated certain benefits—as well as some major challenges—of IWB use for language teaching, and Slay and colleagues (2008), in South Africa, found plenty of challenges of using the IWB, particularly underuse of its interactive features.

We also retrieved 15 literature reviews or meta-analyses on this topic. The most exhaustive synthesis on the IWB was conducted by Miller and Glover (2010), with 100 sources. However, the authors pointed out that their objective was not to pass judgment on the methods used in the studies, but instead to draw an overall portrait of the situation (p. 1), which is tantamount to reporting results without assessing them. Furthermore, of the 15 reviewed syntheses, only four included a detailed examination of how the researchers conducted their review (DiGregorio & Sobel-Lojeski, 2010; Golonka et al., 2012; Saltan et al., 2009; Twiner et al., 2010), pointing to a lack of rigor on the part of the authors. Overall, these studies and meta-analyses mentioned two potential benefits of the IWB: 1) better presentation of certain theoretical content using multisensory techniques (Saltan et al., 2009), but at the same time, and more to the point, using a lecture-style approach (see Littleton, 2010); and 2) higher student interest, at least in the short term (see Balta & Duran, 2015; DiGregorio & Sobel-Lojeski, 2010; Wall et al., 2005). Student motivation (see also Higgins et al., 2007, 2010; Hall & Higgins, 2005) was also the most frequent finding across the studies. Nevertheless, this appetite for the IWB appears to wane over time (see Balta & Duran, 2015; Dostal, 2011; Türel, 2010).

For example, Balta and Duran (2015) noted that, “As students get older, their positive attitudes toward interactive whiteboard technology decrease […]” (p. 16). DiGregorio and Sobel-Lojeski (2010) qualify the impact on student motivation, proposing that the strength and duration of this impact depends primarily on the teaching practices used (p. 268). Harlow et al. (2010) also showed that certain uses of the IWB add shared interactional spaces where students can save and retrieve their work (p. 239). In other
The IWB has the potential to allow students to collaborate (see also Littleton, 2010; Saltan et al., 2009; Warwick et al., 2010), but only in certain circumstances. For Littleton (2010), the IWB, by enabling teaching at the front of the class, actually “saves time.” Finally, Dostal (2011) notes that the IWB can also make it easier to archive and share written work. What does all this have to do with students’ educational outcomes? To date, few serious studies have shown any real impacts of the IWB on academic achievement. Instead, they have generally found either no impacts (see, e.g., Lopez, 2010) or else minimally positive impacts for certain subjects—such as mathematics (see Swan et al., 2008), which could be attributed more to the attention paid to the participating students than to the impacts of the IWB itself—or else negative impacts (see Moss et al., 2010).

Türel (2010) and Khambari and colleagues (2014) contend that not a single study to date has concluded that the IWB has positive impacts on academic achievement. In fact, it is just the opposite: these authors argue that the many technical issues combined with lack of support (see also Fekonja-Peklaj et al., 2015) are more likely to undermine motivation in both students and teachers. In the reviewed meta-analyses, several authors also underscored certain negative impacts of the IWB, such as the time that teachers waste when they teach with it and the scarcity of support technical help (see Dostal, 2011). According to other researchers, when teachers use the IWB, they spend more time dealing with technology issues than attending to what their students are learning (see Sundberg et al., 2012).

The overall findings of these studies lead to only two real conclusions: that students are more motivated—although this motivation diminishes with time—(see Higgins et al., 2007), and that teachers can provide better presentations of theoretical content—albeit using a lecture-style approach (see Littleton, 2010).

Similarly, a recent OECD report (September 2015) called Students, Computers and Learning: Making the Connection addresses issues of the educational use of the IWB. This extensive international investigation (over 30 countries) of the impacts of information and communication technology (ICT) on education shows that countries that were early adaptors of computer technology for teaching and learning (like those that first acquired the IWB) tend to show poorer learning outcomes. And it gets worse. In some schools, the more that students use new technology, the worse the learning outcomes: “[…] but students who use computers very frequently at school do a lot worse in most learning outcomes, even after accounting for social background and student demographics” (p. 3). Of course, there are some exceptions, which suggests that even though technology holds enormous potential, the teacher continues to play a central role.
As mentioned above, in Québec and elsewhere around the world, many instructive studies (accounts of practices, action research) have illustrated how teachers can appropriate the IWB and other technology tools (see, e.g., Ersoy & Bozkurt, 2015; Raby et al., 2015). Although these studies may be highly inspiring for future teachers and for teachers who would like to improve their teaching practices, they do not provide a comprehensive picture of the uses, benefits, and challenges of IWB use in the classroom. And although these studies certainly have scientific legitimacy, there is a clear need for more extensive studies to document actual IWB use and to assess the educational impacts so that the findings can guide policies and actions by government and education decision makers.
3. METHODOLOGY

The objective of this study was to identify how the interactive whiteboard (IWB) is used in Québec schools and the associated benefits and challenges. This section presents the research method in accordance with the guidelines of the *Publication Manual of the American Psychological Association, Sixth Edition* (2013). First, the participants are presented (3.1), followed by the data collection instruments (3.2) and the data analysis strategies (3.3). A discussion of the methodological strengths and limitations (3.4) concludes this section of the report.

3.1 Participants

The study participants included 11,683 students enrolled in Québec schools (from 4th year elementary to 5th year high school) and 1,131 teachers. The students (6,211 girls, 5,472 boys) were from 10 to 18 years old, with an average age of 14.1 years. Figure 3 shows that 88.4% were attending high school (n = 10,324) and 11.6% (1,359) were attending elementary school (mainly 6th year). Of the teachers, 67.4% (634 women, 497 men) had from 11 to 25 years of teaching experience (see Figure 4). The subjects they taught covered the range of the curriculum taught in the Québec education system. Participants were selected on a voluntary basis from schools in which the IWB was used in class. Study data were collected from August 2014 to May 2015.

![Figure 3. Distribution of participating students between elementary and high school](image-url)
3.2 Data collection instruments

To better understand how the IWB is used in Québec schools and the associated benefits and challenges, data were collected from 12,814 participants who were currently in the education system (11,683 students; 1,131 teachers). Five data collection instruments were used:

1. A survey questionnaire for all students (n = 11,683)
2. A survey questionnaire for all teachers (n = 1,131)
3. Individual interviews with teachers (n = 31)
4. Group interviews with teachers (8 groups of 6 to 17 teachers)
5. Group interviews with students (16 groups of 8 to 24 students).

3.3 Data treatment and analysis

Data were collected from questionnaires containing both Likert scale responses and open-ended questions. The data were consequently subjected to a mixed analysis. A quantitative analysis, including descriptive statistics, was conducted using SPSS 235

5 http://www-01.ibm.com/software/analytics/spss/
and the online survey tool SurveyMonkey. The initial results were complemented by a qualitative analysis of the open-ended questionnaire responses using QDA Miner, including content analysis (see L’Ecuyer, 1990; Miles & Huberman, 2003) with semi-open coding constructed from the participants’ responses related to the main research issues (uses, benefits, and challenges).

Data from the individual and group interviews were analyzed based on the methods developed by L’Ecuyer (1990) and Miles and Huberman (2003), using a content analysis approach. Qualitative analyses were again conducted using QDA Miner, a widely used qualitative data analysis tool (Karsenti et al., 2011).

3.4 Methodological strengths and limitations

One of the main strengths of this study is the research methodology. The combination of online questionnaires and individual and group interviews provides a major advantage by allowing triangulation of multiple data sources. However, there are also certain limitations. First, the use of participants’ perceptions may be considered a limitation, which we attempted to offset by examining a very large sample (n = 12,814 participants: 11,683 students, 1,131 teachers) and using a variety of data collection tools. To reduce this methodological bias, responses by different respondent types were systematically compared in order to highlight differences.

Another limitation concerns the participant sample, which was not randomly selected. However, our purpose was not to select a representative population subset. In fact, the students and teachers were drawn specifically from Québec classrooms that contained an IWB. Why? Because for this particular study, it would be difficult or impossible to randomly select the participants. For instance, how could we have required students and teachers to participate in the survey? Therefore, we used a convenience sample, or a non-probability sample. Rather than to provide representation, the aim was instead to reach a body of respondents that was available, voluntary, and searchable. The sole condition for participation was that an IWB had to be present in at least one of the participant’s classrooms.

6 https://www.surveymonkey.com/  
7 http://provalisresearch.com/fr/produits/logiciel-d-analyse-qualitative/
4. MAIN RESULTS

This report presents the main results with respect to the research objectives, as follows:

a) Educational uses of the IWB
b) Educational benefits of IWB use
c) Challenges of IWB use.

4.1 How was the IWB used?

We began by asking the teachers how often they used the IWB (Figure 5). The survey data revealed that 48.2% of teachers used the IWB “always” or “often,” versus 39.3% who used it “sometimes” or “rarely,” and only 12.6% who “never” used it.

![Figure 5. Use frequency of the IWB by teachers](image)

The individual and group interviews provided a general overview of the use frequency. Teachers who responded that they “always” or “often” used the IWB explained that it “made it easier to present material to the class” (high school teacher). Others also found it easier to show information that they found online: “I can show my students all kinds of things that I find on the Internet” (high school teacher). In addition, some teachers who used the IWB regularly found that it simply replaced the old blackboard: “[…] in some classes […] I no longer have a blackboard […] so I have no choice […]” (high school teacher).
Teachers who used it “sometimes” or “rarely,” felt that it was overly complicated to use, and that the technological problems were daunting:

“[…] sometimes, it’s not programmed […] it takes a long time to do and I don’t have the time before class […]” (high school teacher).

“[…] because it doesn’t always work […] I only use it when I have extra time […]” (high school teacher).

“[…] I sometimes use it […] but I have my plan B […] it hardly ever works […]” (high school teacher).

Of the teachers who never used the IWB, some were unable to use it due to technical problems: “[…] I’ve been waiting now for over two months […] the lamp doesn’t work anymore […]” (elementary school teacher). There were also those who didn’t think that they needed it to teach: “[…] I never asked for it […] it’s complicated […] and I don’t think it’s very useful […] so, no […] I don’t use it” (high school teacher).

We also asked the teachers about student participation: did they have their students use the IWB (Figure 6)? The data revealed that only 4.0% of the surveyed teachers “always” or “often” had their students use the IWB, versus 23.4% who had them use it “sometimes” and 72.6% “rarely” or “never.”

![Use frequency of the IWB by students according to teachers](image)

**Figure 6.** Use frequency of the IWB by students according to teachers

In the individual interviews, the teachers put forward many reasons for not having their students use the IWB:
“[...] In high school [...] the classes are big [...] it’s hard to manage the class when you get everybody to the front of the room [...]” (high school teacher).

“[...] it doesn’t work very well [...] and if on top of that I let the students use it [...] I think that it would never work [...]” (high school teacher).

We also asked the students about how they used the IWB in order to compare their responses to those of the teachers (Figure 7). The responses showed little variation overall, confirming that they did not use the IWB very often. Thus, 4.4% of students felt that their teacher “always” or “often” let them use the IWB, with 12.9% “sometimes,” 29.5% “rarely,” and 53.2% “never” responses.

![Figure 7. Use frequency of the IWB by students according to students](image)

The group interviews with students provided further insight into some of the reasons that the teachers gave for having them use the IWB:

“[...] our teacher lets us go on the Internet sometimes [...]” (elementary school student).

“[...] as soon as it stops working [...] she [the teacher] asks one of the students for help [...]” (high school student).

“[...] when we do math [...] I sometimes come up to the front of the class and write the answers [...]” (high school student).
The group interviews also gave us a deeper understanding of why, according to the students, they were rarely asked to use the IWB:

“[…], when we do math […] I sometimes come up to the front of the class and write the answers […]” (high school student).

“[…], it’s not very interactive […] the teachers just write on it […]” (high school student).

“[…], it’s usually not working […] I don’t think that my teachers want us to touch it […]” (high school student).

“[…], if we touch it […], the teachers are going to think that it’s our fault that it doesn’t work anymore […] so we don’t touch it […]” (high school student).

Furthermore, we asked the teachers to describe the main ways that they used the IWB in class. From their responses, we identified ten main uses by teachers (Figure 8). The most common, mentioned by 51.6% of the teachers, was creating multimedia presentations with programs like Notebook or PowerPoint. Internet searches followed at 19.3%, video presentations at 10.8%, presentation of class notes as PDG or Word documents at 6.9%, and math and science demonstrations (particularly math) at 4.8%. Group corrections of written work, especially French texts (1.7%), presentation of digital books and textbooks (1.5%), interactive activities and exercises (1.4%), students’ oral presentations (1.2%), and geographic maps (0.8%) complete the list. These results indicate that the IWB was used mainly to project content onto the screen, and not as an interactive digital tool to support teaching and learning. In fact, only 2.6% of the main uses reported by teachers could be described as interactive.

Figure 8. Main uses of the IWB in class
4.2 What were the main benefits of the IWB?

When the students and teachers were asked about the potential benefits of the IWB, they came up with a substantial number.

First, we asked all the students (11,683) and teachers (1,131) if they preferred the IWB or the traditional blackboard. As shown in Figure 9, the students were almost unanimously in favor of the IWB (99.2 %) versus the blackboard (0.8 %).

\[\text{Figure 9: Students’ preference for the IWB over the blackboard}\]

The group interviews with the students confirmed this result:

“[…] it’s definitely better […] the teacher can go online […]” (high school student).

We asked the teachers the same question. Although a large majority preferred the IWB (73.6%), it is noteworthy that the teachers were considerably less enthusiastic about using it in class (Figure 10).

\[\text{Figure 10. Teachers’ preference for the IWB over the blackboard}\]
The individual and group interviews with the teachers revealed why some of them continued to prefer the traditional blackboard:

“[…] it never works […] it’s complicated […] I’d prefer a blackboard and chalk […]” (high school teacher).

“[…] I have several groups […] in some classes, it doesn’t work […] so I have to prepare different lesson plans […] I prefer not to use it […]” (high school teacher).

“[…] I never wanted it [the IWB], I didn’t ask for anything […] I don’t use it […] I find it a waste of time […]” (high school teacher).

We also asked the students and teachers more specifically about the benefits of having the IWB in the classroom. According to the students (Figure 11), the main benefit was permanent Internet access in class, mentioned by 23.5%. They found it amazing that they could “have Internet access through the whiteboard” (high school student). They also appreciated the visual support for teaching (19.1%), being able to watch videos (12.2%), their greater motivation to learn (11.8%), more varied teaching strategies (9.3%), learning better and more (9.1%), saving time, when there were no technical problems (7.2%), having a more organized teacher (5.8%), communicating with classmates (1.3%), and doing interactive activities (0.7%).

![Figure 11. Main benefits of the IWB according to students](image-url)
The main benefit of the IWB [...] “finally, having Internet access in the classroom.”

The main benefit of having the IWB in the classroom, as reported by 29.2% of the teachers, was “finally, having Internet access in the classroom” (high school teacher). Other benefits (Figure 12) were visual support for teaching (18.8%), and particularly multimedia presentations such as PowerPoint. Many teachers also mentioned higher student motivation (11.6%). They also found that the IWB helped them diversify their teaching approach (9.5%), usually enabled more effective teaching, as long as there were no technical problems (6.3%), and was generally beneficial for learning (6.1%), regardless of the subject being taught.

Some teachers pointed out that, despite the extra time they had to put in, the IWB helped them organize their teaching (5.9%), including planning lessons, managing documents, and so on. A few others (4.0%) said that the IWB helped students concentrate.

Only 3.9% of the teachers thought that the IWB could have positive impacts on students’ academic outcomes. A small number of teachers—particularly math and science teachers—emphasized the impacts on learning certain concepts (2.8%). A few others (1.3%) brought up the ability to “communicate with others, in front of the students, from the front of the class [...]” (high school teacher). Only 0.6% of the teachers mentioned interactivity as a benefit of the IWB.

![Figure 12. Main benefits of the IWB according to teachers](image)
The large number of participants in this study (11,683 students) enabled performing more advanced statistical inferences. Briefly, this type of analysis allows inducing characteristics of a given population (in this case, students and teachers across Québec) based on a population sample (i.e., the Québec students and teachers who participated in this study). As in previous studies, we then ran diverse statistical correlations. The results revealed some significant relationships (see Table 1), for instance, between the use frequency of the IWB by students and student-perceived impacts on variables that are known to be closely associated with academic achievement (academic grades, concentration in class, school motivation, overall satisfaction at school).

![Image](https://i.imgur.com/3Q5Q5Q5.png)

**Table 1:** Correlations between impacts perceived by students and their IWB use frequency

<table>
<thead>
<tr>
<th>Impact</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic grades</td>
<td>0.308**</td>
</tr>
<tr>
<td>Concentration in class</td>
<td>0.265*</td>
</tr>
<tr>
<td>School motivation</td>
<td>0.367**</td>
</tr>
<tr>
<td>Overall satisfaction at school</td>
<td>0.312**</td>
</tr>
</tbody>
</table>

*p < 0.001; **p < 0.0001.

The results show that the more that the students used the IWB in class, the more positive the perceived impacts on their grades, school motivation, concentration in class, and overall satisfaction at school (Table 1). In line with previous studies, this indicates that the impacts increase with more frequent use. Previous studies have found that teachers who had their students use the IWB frequently perceived similar impacts, but this was not the case for the present study. In previous studies, teachers who had their students work more regularly and frequently with the IWB perceived greater benefits for students.

As mentioned above, the results of the present study do not allow concluding overall positive or negative impacts of IWB use on students’ academic achievement. In fact, only 3.9% of the teachers reported such impacts. Nevertheless, the statistical inferences revealed that the more that students used the IWB in class, the more positive their perceptions of the impacts on their academic grades, school motivation, concentration in class, and overall satisfaction at school (Table 1).

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8 Correlation type: Kendall’s tau correlation (to learn more about this test statistic, see: [https://en.wikipedia.org/wiki/Kendall_rank_correlation_coefficient](https://en.wikipedia.org/wiki/Kendall_rank_correlation_coefficient))
Only 4.0% of the teachers said that they “always” or “often” had their students use the IWB.

We should keep in mind, however, that only 4.0% of the teachers said that they “always” or “often” had their students use the IWB. How, then, can this particular result be explained? We may propose two explanations. First, IWB use could have provided some interactive situations, where students participated actively in learning. Second, the IWB would have provided students with some opportunities to use specialized software that could help them learn certain academic content.

4.4 Challenges of IWB use in class

In addition to asking the respondents about the uses and benefits of the IWB in class, we asked both students and teachers about the challenges they encountered.

The teachers mentioned some major challenges of IWB use in class (Figure 13). The most formidable challenge was technical problems, cited by 70.6%: “[…] I’ve never seen anything that broke down so much […] and you have to wait for the technician […] he spends all his time fixing them […]” (high school teacher). At 17.3%, the time spent working with the IWB was another major issue. It’s a time-consuming tool, and the teachers gave many reasons for this:

“[…] it takes up a lot of teaching time […] you see, to learn how to use the IWB, I have to give up even more of my evenings and weekends […]” (elementary school teacher).

“[…] preparing lessons for the IWB […] it really takes a lot of time […] which I don’t have […]” (high school teacher).

“[…] I find that I have to fool with the Interactive whiteboard before every class […] it takes too much time […]” (high school teacher).

“[…] learning how to use all the IWB features […] it takes time […]” (high school teacher).

“[…] for me, it’s finding materials that takes up my time […]” (high school teacher).

The results indicate that this kind of tool is time-consuming for teachers, who already have a heavy workload. In addition, several teachers (9.6%) brought up the size of the screen: “[…] I have 32 students in my class […] the screen is too small if you’re sitting at the back [of the class]” (high school teacher). Class management was mentioned by a few teachers (1.4%). Last on the list was inadequate training (1.1%). For many teachers, the problem was not a lack of training as such, but rather lack of time to learn how to use the IWB before trying it out with the students:

“[…] this kind of tool is time-consuming for teachers, who already have a heavy workload”
“[…] I took some useful training sessions […] but I didn’t have the time to really sit down in class and try it out […] I need that […] without my students around me […]” (high school teacher).

“[…] the training, it’s only part of the problem […] what I would need is training in my classroom […] that way I could be ready for my students […]” (high school teacher).

The teachers were asked how frequently they had to deal with technical problems when they used the IWB in class (Figure 14). The results show that 93.5% felt that they “always” (23.6%) or “often” (69.9%) had such problems. Only 6.5% felt that they “sometimes” (2.9%), “rarely” (2.3%) or “never” (1.3%) had to deal with them. These findings indicate that technical problems constitute the greatest challenge of IWB use in class.
92.6% of the teachers had technical problems that required outside help to resolve.

These frequencies were confirmed by the results of the individual and group interviews:

“[…] I have technical problems very often […] and then I have to wait for the technician […]” (elementary school teacher).

“[…] there’s always something that needs fixing […] it gets in the way of my teaching […]” (high school teacher).

We also asked the teachers how many of the technical problems they managed to resolve on their own (Figure 15). Overall, the results show that the IWB incurred major and frequent technical problems that the teachers were usually unable to resolve by themselves (Figure 14). Thus, only 7.4% of the teachers said that they could resolve technical problems on their own.

In other words, 92.6% of the teachers had technical problems that required outside help, usually a technician. Thus, the great majority of them felt that they were more or less at the mercy of the technician—employed by the school board or the IWB provider—who had to come to their rescue: “[…] whenever there’s a problem […] we have to wait for the technician […] sometimes it takes weeks […]” (high school teacher).

These results indicate that, due to the many technical problems, teachers (especially high school teachers) who used the IWB were forced to prepare two sets of lesson plans. Planning a lesson with the IWB already took up too much time, and on top of that, they had to plan a back-up lesson in case the IWB didn’t work: “[…] if the interactive whiteboard wasn’t working with a group […] I have to make another lesson plan […] this doubles the work […]” (high school teacher).

Figure 15. Technical problems that teachers felt they could resolve on their own without a technician’s help
The students were also asked about problems and challenges of using the IWB (Figure 16). Although the problems they mentioned differed somewhat from those mentioned by the teachers, there were certain similarities. For example, technical problems headed the list, at 33.5%: “[…] it usually doesn’t work […] the teachers waste a lot of time installing it […]” (high school student).

The second most often cited problem was the small screen size (25.4%): “[…] the screen’s too small […] my TV at home is bigger […]” (high school student). The small screen size was a particular source of complaint for high school students. Some of them had a bigger TV screen at home for watching films and playing computer games compared to the IWB screen at school for learning math, science, French, and other subjects.

Many students also complained that their teacher was inept at using the IWB (19.0%): “[…] even though it’s not always their fault […] but it breaks anyway” (high school student). For the students, the problem appeared to be that the teachers were too often unable to resolve technical problems that arose:

“[…] my teacher can never fix it when there’s a problem […] she always says she has to wait for the technician […]” (high school student).

“[…] the digital whiteboard is super complicated […] my teachers can never get it to work […] we have to wait for a technician […]” (high school student).

Many students cited loss of motivation as a challenge (18.3%):

“[…] at first, I liked it […] but after a while […] it got boring […] a lot of students are practically asleep […]” (high school student).

“[…] it wasn’t’ interesting to look at hundreds of pages scrolling down […]” (high school student).

At the bottom of the list (3.8%) came the lack of interactivity in the lessons when their teacher used the IWB: “[…] it’s monotonous […] there’s only the teacher talking all alone […] we students […] don’t do anything […]” (high school student). The results show that the students didn’t appreciate the lack of interactivity when teachers used the IWB. In other words, the vast majority of the teachers used the IWB as a digital projector and failed to take advantage of the many interactive features.
Figure 16. Main challenges of the IWB according to students

- Technical problems: 33.5%
- Small screen size: 25.4%
- Teacher’s inability to use the IWB: 19.0%
- Motivation loss: 18.3%
- No interactivity: 3.8%
Far from calling into question the critical need to integrate technology into education, this study instead highlights that the classroom integration of certain technology tools, such as the IWB, may be more complicated and time-consuming than others.

The students appreciated having technology in the classroom: 99.2% preferred the IWB to a traditional blackboard.

For the OECD (2015), technology represents the “very future” of education. Moreover, because technology has invaded every corner of our lives, it becomes increasingly vital for upcoming generations to acquire technology skills if they want to succeed professionally and socially. There is every reason to believe that being able to self-train, self-learn, and communicate via technology will be the sine qua non condition for adapting to and fully participating in societies that are in permanent flux. Equally, there is every reason to believe that learning with technology is a key competency that will enable youth to succeed in school, and more broadly, in the knowledge society in which we now live.

The aim of this study, conducted by the team of the Canada Research Chair in Technologies in Education, was to identify how the interactive whiteboard (IWB) is used in Québec schools and the associated benefits and challenges. Study data were collected from 11,863 students and 1,131 teachers.

Far from calling into question the critical need to integrate technology into education, the results of this study instead highlight the fact that the classroom integration of certain technology tools, such as the IWB, may be more complicated and time-consuming than others. The results show that the participating teachers had substantial technical problems with the IWB. However, the results also indicate that the IWB has real pedagogical potential.

We have presented the uses and benefits of the IWB, which has been introduced en masse into schools all across Québec for the last five years. We began with the students’ appreciation of having this technology in the classroom: 99.2% preferred the IWB over the traditional blackboard. Among the teachers, however, although a large majority (73.6%) appeared to prefer the IWB over the blackboard, a non-negligible percentage (26.4%) actually preferred the traditional blackboard. The problem may have been related to the imposition of the IWB, which created a situation where teachers had no choice but to integrate the IWB into their teaching. A mandatory new method or technology is palatable only when some degree of choice is involved. On this topic, self-determination theory (SDT), developed by Deci and Ryan (1985), provides some insight into the possible motivations of teachers who preferred using the blackboard over the IWB.

That said, our results also show that slightly over half the teachers in this study did not use the IWB regularly (48.2%), and that 51.8% used it “sometimes,” “rarely,” or even “never.” There is a lot of work to do in order to persuade more teachers to use the IWB more often in class.
The problem does not lie solely in the teachers’ uses of the IWB: the students also had few opportunities to work with the IWB in class. In fact, our results show that, overall, only 4.0% of the students were allowed to use it regularly in class.

Our results indicate that the teachers used the IWB primarily as a digital projector, with only rare recourse to the interactive features (1.4% of reported uses). We may therefore propose that for the great majority of teachers, an electronic projector—at far less cost and with a much larger screen—would be more suitable for their teaching purposes. In addition, this type of system would entail far fewer technical problems compared to the IWB. Furthermore, the IWB may represent a conflict for teachers who are reluctant to revert back to lecture-style teaching. On the one hand, the easiest way to use the IWB is as a projection screen. On the other hand, it comes with a number of technical challenges if teachers want to use the interactive features. Our results are fairly consistent with those of Khambari and colleagues, who observed a certain amount of conflict between open teaching approaches (also called student-centered learning, among others) and use of the IWB, where the teacher usually stands in front of the class and delivers a lecture-style lesson. It is also possible that teachers don’t use the IWB interactively with their students because they don’t want to deal with all the technical issues.

That said, it is noteworthy that the results of this large-scale study show that the IWB offers significant benefits for classroom use, such as Internet access, visual teaching support, video presentation, motivation to learn, more effective learning, and efficient organization. We may therefore conclude that a judicious use of educational technology, when accompanied by adequate training, would be liable to have positive impacts on students’ academic outcomes. Furthermore, we must not forget that the results of this study highlight the fact that the impacts on the students depended mainly on how the teacher used the IWB in class. Hence, although the IWB has enormous educational potential, it is up to teachers and students to take advantage of all that the IWB has to offer in order to realize that potential.

The overall results of this study show that the more that students worked with the IWB, the more positive their perceptions of its impacts on their academic achievement, school motivation, concentration in class, and overall satisfaction at school. These are promising results, and the hope is that more than just 4.0% of teachers will venture into new territory and encourage their students to work with the IWB. There is an exciting new world of educational treasures to explore, and teachers who take the plunge will reap the rewards.

This study clearly shows that technical problems posed a daunting challenge for teachers who attempted to use the IWB. Over 92.6% of the teachers we queried reported technical problems that they were unable to resolve on their own. Other significant problems were raised as well:
the extra effort required—often on their own time—to learn how to use all the IWB features, the small screen size (especially for large high school classes), classroom management problems, and training issues. We may conclude that classroom use of the IWB can be time- and energy-consuming for teachers.

In light of the above, in addition to installing IWBs in classrooms, it would be important to provide teachers with adequate technological and pedagogical support as needed. We might also argue that the IWB should not be installed in classrooms until teachers are fully prepared to embrace it. Teachers need pedagogical days so they can take individual or group training sessions to learn how to use all the IWB features and functions, and especially the interactive aspects that allow students to engage more actively in learning. Many studies have demonstrated the effectiveness of hands-on technology training sessions as well as adequate technical and pedagogical support.

Based on the overall results, we cannot definitively conclude that the IWB has either negative or positive impacts on student outcomes. Only 3.9% of the participating teachers suggested that using the IWB could positively impact students’ academic grades. This does not mean that the other 96.1% felt that the IWB had negative impacts. What it means is that the vast majority of the teachers felt that the ways that they used the IWB did not have positive impacts on their students’ grades. In addition, the majority of the teachers felt that their uses of the IWB had similar impacts, in many respects, to their uses of more traditional educational tools, such as the blackboard.

Based on the observation that the vast majority of the teachers used the IWB as an electronic projector—which costs less, has a much larger screen, and entails fewer technical headaches—, we might suggest that the 2011 imposition of the IWB on all of Québec’s teachers, across the board, was a hasty decision. It might have been wiser to provide the IWB only to teachers who were inclined to use it more often and take advantage of its full potential.

Today, whether or not technology impacts educational outcomes may not be the right question to ask. Perhaps we should instead try to find out which conditions can foster positive impacts of technology on student engagement and academic outcomes. Furthermore, in order to better appreciate the true value and potential of technology for learning, the central issue is how that potential can be realized. We believe that technology tools such as the IWB can be used effectively—even if they do not all hold the same potential—depending on how the teacher uses them and what students are allowed to do with them. In this perspective, the essential issue in IWB use at school is how to tap that potential through reflective use, where students are also invited to work with it, as reported by only 4% of the teachers in this study.
6. **RECOMMENDATIONS**

Based on the results of this study, the following recommendations are proposed:

1. Encourage more teachers to use the IWB regularly.
2. Provide specific training programs to prepare more teachers to use the IWB’s interactive features.
3. Provide specific training programs to prepare more teachers to have their students use the IWB.
4. Recognize the time that teachers spend learning how to use the IWB.
5. Rethink technical support strategies for teachers who regularly use the IWB so that they feel genuinely supported.
6. Do not impose new technology tools on teachers involuntarily and across the board.
7. When it comes time to do major upkeeps and upgrades on the IWBs that were installed five years ago, it would be important to consider whether teachers who are not prone to realizing the full interactive potential of the IWB might prefer a new electronic projector instead.
8. When purchasing IWBs in future, consider a larger screen size, especially for high school classrooms, which typically contain 30 or more students.
9. Raise teachers’ awareness of students’ motivation loss and the need to apply various strategies to stimulate their taste for learning.
10. Because practically all Québec classrooms currently have an IWB, all future teachers should be trained in pedagogical and interactive uses of the IWB.
11. Continue to assess the uses, benefits, and challenges of the IWB in class.
12. Conduct further action research and case studies on educational integration of the IWB.\(^9\)

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\(^9\) Similar to the studies by Raby.
7. REFERENCES


8. WORKS CONSULTED


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The Interactive Whiteboard (IWB):
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