

Interactive Uses of the IWB A Look at Quebec Teachers' Practices

Utilisations interactives du TNI : regard sur les pratiques d'enseignants du Québec

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Résumé de l'article

Les écoles du Québec vivent depuis quelques années un renouveau technologique lié à l'intégration des outils numériques, dont les tableaux numériques interactifs (TNI) (MEES, 2018). Malgré cette recrudescence, des recherches montrent depuis quelques années que les TNI font l'objet de critiques, notamment par rapport à l'interactivité qu'ils induisent (Aflalo et al., 2018; Chen et al., 2020). Cette recherche qualitative décrit différents types d'interactivité sollicitée lors de l'utilisation du TNI et dégage les conditions qui y sont associées. Issus de groupes de discussion impliquant 51 enseignants, les résultats révèlent que l'utilisation du TNI se fait principalement de façon traditionnelle et que peu d'enseignants se risquent dans des utilisations sollicitant une interactivité de haut niveau.





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Abstract

In recent years, Quebec schools have experienced a technological renewal with the integration of digital tools, including interactive whiteboards (IWB) (MEES, 2018). Despite this digital upsurge, research shows that IWBs have received some criticism in the research, notably concerning the interactive aspect (Aflalo et al., 2018; Chen et al., 2020). This qualitative study describes various types of interactivity used with the IWB and the associated conditions. Results from discussions with 51 teachers reveal that the IWB is used primarily in traditional ways, and that few teachers attempt high-interactivity situations.

Keywords

Interactive whiteboard, interactivity, elementary school, high school, pedagogy.

Résumé

Les écoles du Québec vivent depuis quelques années un renouveau technologique lié à l'intégration des outils numériques, dont les tableaux numériques interactifs (TNI) (MEES, 2018). Malgré cette recrudescence, des recherches montrent depuis quelques années que les TNI font l'objet de critiques, notamment par rapport à l'interactivité qu'ils induisent (Aflalo et al., 2018; Chen et al., 2020). Cette recherche qualitative décrit différents types d'interactivité sollicitée lors de l'utilisation du TNI et dégage les conditions qui y sont associées. Issus de groupes de discussion impliquant 51 enseignants, les résultats révèlent que l'utilisation du TNI se fait principalement de façon traditionnelle et que peu d'enseignants se risquent dans des utilisations sollicitant une interactivité de haut niveau.

Mots-clés

Tableau numérique interactif, interactivité, primaire, secondaire, pédagogie.

Research context^{1,2,3}

To help students play a role in a digital world, the Organization for Economic Co-operation and Development (OECD, 2016) recognizes the importance for all member countries to modernize their educational system. Moreover, in the current situation of a raging COVID-19 pandemic, diverse pedagogical strategies are urgently needed to encourage interactivity among students, teachers, and digital tools, with distance learning as part of the solution. Quebec (Canada) has seen its share of government initiatives, the latest being the Digital Action Plan for Education and Higher Education (2018), which values better pedagogical uses of technologies through greater access to technology. More specifically, this reform follows the movement that began in 2012, which aimed at providing elementary and high school classrooms across Quebec with interactive whiteboards (IWB) to adapt the technological fleet to today's reality, in which students are increasingly exposed to technology. While recent investments are earmarked (MEES, 2018) for the purchase of other digital tools such as tablets, virtual reality headsets or robots, teachers are still struggling to incorporate the IWB into their classroom.

Teaching with an IWB

The rapid deployment of IWBs in classrooms in recent years has raised concerns among teachers regarding the added value of this digital tool to their teaching practices. The lack of time and training related to the integration of IWBs has prompted teaching professionals to focus more on technical constraints than on educational ones. Past research has noted a surge in transmissive education when the IWB is used (Al-Qirim, 2011; Aflalo and al., 2018; Bennett and Lockyer, 2008; Chen et al., 2020; Divaharan and Koh, 2010; Gillen et al.,

2007; Karsenti et al., 2012; Raby and Charron, 2019). This is surprising given that the IWB is meant to be a tool to increase the interactivity of teaching-learning sequences. However, studies reveal that the interactive potential of the IWB is seldom used by teachers (Akerlind, 2004; Miller et al., 2005; Samson et al., 2016). Teachers tend to use the IWB as a teaching aid, sharing information such as videos, images and texts in a unidirectional manner, without any real engagement by students.

Interactive teaching with an IWB

Interactive teaching with an IWB is inherent in situations where teachers and students are both engaged with the IWB and understand its full potential (Higgins et al., 2007; Richards et al., 2018). Teachers who place their students in interactive learning situations using an IWB allow them to engage in conversation and explore ideas, solve problems and actively participate in constructing their knowledge (Murcia and Sheffield, 2010). Mercer, Hennessy and Warwick (2010) add that the IWB could be used to contribute to student engagement, involve students in co-constructing knowledge, and develop student questioning through the development of a dialogic space where each individual (students and teacher alike) can interact directly on the tool. Raby et al. (2015) also stress the importance of maintaining this student engagement during activities carried out with the IWB in order to further increase collaboration and interaction in the classroom. Used as such, the IWB could also allow students to explore different alternatives to solve a problem and learn from their mistakes. The digital tool then becomes a teaching and learning aid, rather than just a support for projecting documents. Despite this, researchers and practitioners have very little data to illustrate in concrete terms what an interactive use of the IWB represents. This is in addition to what Mohon (2008) has said about students' interactions with the IWB being a challenge — in elementary and high schools alike — since the user of the IWB remains primarily the teacher.

While much has been written about the use of the IWB in the classroom, few authors have analyzed the “interactive” dimension associated with the IWB. What's more, there appears to be a lack of consensus on what interactivity in the classroom represents. In addition to the aforementioned studies that attempt to briefly describe the interactive use of the IWB, other works, such as that of Hargreaves et al. (2003), Moss et al. (2007) or Beauchamp and Kennewell (2010), have addressed this issue more specifically. However, analysis of previous research reveals that the various models proposed present conceptual differences. On the side of Hargreaves et al. (2003), the definition of interactivity is distinguished into two categories, i.e., surface and depth forms. These forms are themselves broken down into 9 sub-categories defining various levels of interactivity. As for the study by Moss et al. (2007), it proposes a model presenting three distinct classes (technical, physical, and conceptual interactivity) which relate to the integration of digital tools in general. Finally, Beauchamp and Kennewell (2010) propose a theoretical model that represents five categories of interactivity. This latter model will be discussed in more detail later in this article. Therefore, to this day, it is still difficult to define what is an interactive use of the IWB.

Research objectives

The context presented highlights, such as when the IWB is used in the classroom, a predisposition to traditional teaching, the projection of documents and a under-utilization of the tool's interactive potential. Uses of the IWB as well as the interactivity employed are two aspects on which researchers should focus. The study reported in this article aims to document interactive uses of the IWB by French-Canadian teachers in various pedagogical settings and to define, given the lack of consensus, the concept of interactivity as it relates to the use of the IWB.

Conceptual framework

Definition of IWB

Also called the interactive digital whiteboard (IDW), the interactive whiteboard is a touch-sensitive device that can be activated using a stylus or one's fingers (Beucher et al., 2020). Some IWBs require a projector while others are used with a television. It is often used to interact with multimedia content, such as images, animations, videos, and websites (Al-Qirim, 2011; Karthigesu & Mohamad, 2020). It can be used by both teachers and students, and appears to be an important vector in increasing interactivity in the classroom (De Vita et al., 2014). Over time, its use has become widespread in elementary and secondary schools, in Canada and abroad.

Interactive teaching with and without technology

The existing literature on interactivity in the classroom approaches this topic from different perspectives. First, Hargreaves *et al.* (2003) propose the "typology of interactive teaching constructs", a representation of interactive teaching that focuses on teachers' conceptualizations of interactivity without the use of technological tools. The typology consists of two broad categories that are mutually exclusive. The first, called surface learning, consists of a type of teaching where teachers use few strategies to engage their students in their learning. The second category, known as deep forms of learning, refers to strategies that allow students to co-construct their learning in a setting that fosters teacher-student and student-teacher interaction. As the study of interactivity in a context where the presence of digital tools, notably IWBs, can largely influence teaching, it is rather necessary to retain a typology which includes the use of technological tools. Additionally, with only two broad categories, the typology set forth by Hargreaves *et al.* scarcely accounts for the different nuances of the types of interactivity employed.

Moss *et al.* (2007) propose that interactive uses of technologies can be categorized as follows: technical interactivity, physical interactivity and conceptual interactivity. Technical interactivity refers to manipulations made only by the teacher in the presence of students. Physical interactivity is also associated with teacher manipulations, but provides students with the opportunity to interact with the IWB through simple manipulations (e.g., hide and reveal, drag-and-drop). These manipulations are not intended to bring about a reflexive dialogue about a topic, but to achieve limited conceptual thinking. Conceptual interactivity consists of a dialogic space where students are constructing, interacting with and exploring notions using the IWB. This goes beyond the simple manipulation of tools using the

IWB and is more in keeping with modelling, visualization and the dynamic manipulation of objects. While it takes into account the use of a digital tool, this categorization needs to be refined. The nuances between the different categories of interactivity make it difficult to establish a detailed description of the interactive uses of IWBs. This significant limitation leads us to consider the following typology.

Beauchamp and Kennewell (2010) mapped out a five-part typology with characteristics specific to each category for the use of various technologies. The typology provides a fairly detailed view of the interactivity that can be employed within a teaching-learning setting integrating the IWB. Beauchamp and Kennewell (2010) developed the following categories: no interactivity, authoritative interactivity, dialectic interactivity, dialogic interactivity, and synergistic interactivity. This model was selected for several reasons. First, it has been used in several recent studies that explore the interactive dimension related to the use of the IWB in the classroom. Second, the typology's foundation is based on several previous works, notably those of Hargreaves et al. (2007) and of Moss *et al.* (2007).

Beauchamp and Kennewell typology (2010)

By distinguishing five types of classroom interactivity, Beauchamp and Kennewell (2010) make it possible to better define teachers' practices with the IWB. The five types are outlined below.

No interactivity

No interactivity refers to the frequent use of teacher-directed projection activities on the IWB, in which students have little or no influence on the process. The students' passivity dominates in this setting where the teacher remains in total control of the pace of IWB-backed activities. The teacher controls the teaching and learning situations in the classroom. Students observe what is displayed on the IWB without being directly engaged. An example cited by Beauchamp and Kennewell is the presentation of a prepared sequence of slides on a defined subject matter where the teacher is speaking in front of the classroom, leaving little room for student intervention and interaction between students and the teacher.

Authoritative interactivity

With this type of interactivity, the teacher leads activities with fixed instructions (questions, for example) that allow students to react by formulating specific answers. The limited number of possible answers decreases the depth of the feedback, which does not initiate an elaborate process of discussion and collaboration between students and the teacher. The teacher provides simple instructions: for example, the teacher may ask the student to match words or to fill in the blanks of a sentence directly on the IWB. Students may move simple objects around an IWB to complete matching, sorting or labelling tasks.

Dialectic interactivity

This type of interactivity suggests that the teacher establishes a setting conducive to the construction of knowledge or the resolution of specific problems arising from discussions between students. The

teacher welcomes students to use the IWB. The IWB is no longer used to teach only; it is used to support learning. In this context, students can use the resources available for the TNI and its functions, including recording information or attempting to solve problems.

Dialogic interactivity

In dialogic interactivity, the lesson structure is flexible and promotes a common space where students are encouraged to participate. Through discussions, students are encouraged to explore avenues that allow them to build new knowledge. Teachers' uptake questioning is combined with the use of software or animations on the IWB. Teaching is a bidirectional activity in this setting. Whether from the student to the teacher or from the teacher to the student, the role of each party is to build a network of concepts with a view for organizing them, thus developing new knowledge in the discipline addressed.

Synergistic interactivity

Synergistic interactivity is the last type of interactivity. In this setting, students use the IWB to engage in open problem-solving and in the development of significant situations. Beauchamp and Kennewell (2010) posit that the IWB can enable the sharing and exploration of metacognitive tools to better represent and structure the way students learn. This interactivity suggests that students can use the IWB to achieve sophisticated solutions.

Using the Beauchamp and Kennewell (2010) model, this research aims to identify the types of interactivity employed by teachers participating in this study. By better defining these types of interactivity, it is possible to further operationalize the concept of interactivity.

Methodology

Type of research

Like the work of Raby et al. (2019) and Rozario et al. (2016), who studied the interactive use of the IWB using the Beauchamp and Kennewell typology (2010), this study focuses on the reported practices of elementary and high school teachers when using the IWB. The qualitative approach (Denzin & Lincoln, 1994; Savoie-Zajc, 2011) allows for a better understanding of teachers' interactive uses of the IWB. This approach falls within a qualitative/interpretive study design. These types of studies are used to examine specific situations through the eyes of those who actually experience them. Here, we focus on how elementary and high school teachers use the IWB in their teaching practices.

Participants

The target population for the project comprised teachers working in the Francophone public sector in the province of Quebec, Canada. A total of 51 teachers (27 teachers at the elementary school level and 24 teachers at the high school level) participated in the group discussions. The sole inclusion criterion required that the teacher have regular access to an IWB. The teachers who participated in the study worked in various regions in Quebec and their years of teaching experience ranged from 4 to 30.

Data collection

Online discussion groups were the method selected to collect data given the wide geographic distribution of the participants. Discussion groups were preferred to one-on-one discussions, since this format allows participants to remember certain elements of their practice by listening to others. It has also been shown to increase the number of ideas or topics discussed. The number of teachers per discussion group varied from 3 to 9. All participants were contacted using the VIA conferencing tool. The interview protocol contained 20 questions designed to elicit teachers' descriptions of their practices with the IWB in class. Here are some examples of questions asked to participants during the focus groups: "What are the aims you are pursuing by using an IWB in the classroom in terms of teaching and learning?", "What has the arrival of IWBs changed in your teaching in terms of planning, teaching and assessment?" and "Could you describe an activity that exploits IWBs that you have done in class for which you are particularly proud and satisfied with the result?". These questions have allowed the emergence of examples of teaching practices that integrate the IWB and which can be categorized according to the model of Beauchamp and Kennewell (2010). The discussions lasted approximately 60 minutes.

Data treatment and analysis

The data was subjected to content analysis, whereby the verbal reports were organized into meaning units according to defined categories. In this case, a meaning unit corresponds to an idea, generally expressed as either part of a sentence, a complete sentence, or several sentences (Paillé and Mucchielli, 2016). Five categories corresponding to types of interactivity (none, authoritative, dialectic, dialogic, and synergistic) in the Beauchamp and Kennewell (2010) model were considered. The categories were double-coded by the research team, and over 95% inter-rater agreement was obtained on 40% of the overall data. A total of 445 (elementary = 221 and high school = 224) meaning units were coded for all participants. The following results allow these units of meaning to be categorized according to the educational level taught as well as the teaching experience of the participants.

Results

In the context of this section, some research results are presented. These results reflect the categories of interactivity requested by teachers, depending on grade level and their teaching experience. With regard to the school level, the results are distinguished according to elementary school or high school. On the teaching experience side, the results are split into three parts, that is, 0-9 years, 10-19 years and 20+ years of experience. A few teachers' meaning units from the discussion groups help to support the results obtained.

Differences between elementary school and high school

Figure 1 shows a similar distribution of IWB uses at the elementary ($n_{\text{total}} = 221$) and high school level ($n_{\text{total}} = 224$). Regardless of grade level, teachers mainly employed authoritative interactivity when using the IWB.

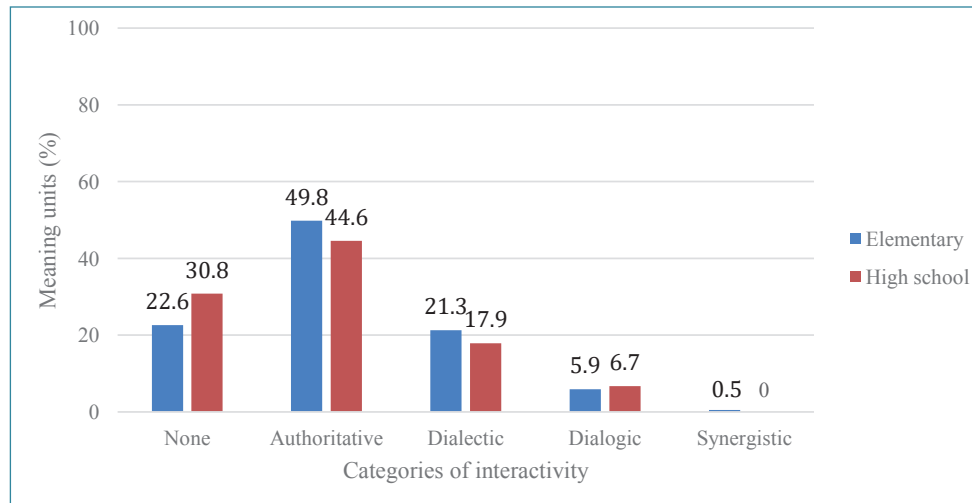


Figure 1

Distribution of meaning of units for type of interactivity employed in teachers' use of the IWB by grade level

At the elementary school level, 49.8 % (n = 110) of meaning units are associated with authoritative interactivity. To a lesser extent, elementary teachers reported uses associated with no interactivity (22.6 %, n = 50) and dialectic interactivity (21.3%, n = 47). Fewer uses were associated with dialogic interactivity (5.9 %, n = 13). Lastly, scarce uses associated with synergistic interactivity (0.5 %, n = 1) were reported. It is possible to observe that the use of IWBs at the elementary school level is mainly situated in authoritative interactivity, that is to say that it is the teachers who use the IWB most of the time. The following unit of meaning testifies to this usage: *“At the planning level, I plan to embed videos, to look for things on the Internet. This allows us to vary our teaching more.”* (Participant 2.13)

The results at the high school level showed a similar distribution to that of the elementary level. Authoritative interactivity is very frequently employed, accounting for 44.6% (n = 100) of all meaning units, while 30.8% (n = 69) of the teachers' statements referred to non-interactive uses. Uses that foster dialectic interactivity of the IWB at the high school level account for 17.9 % (n = 40) of meaning units. Uses related to dialogic interactivity of the IWB represent 6.7 % (n = 15) of the statements recorded among high school teachers. Lastly, analysis of the data showed that there was no use (0 %, n = 0) related to synergistic interactivity of the IWB by high school teachers. Despite the fact that we also observe several uses that are part of authoritative interactivity in high school, the fact remains that many of their words illustrate activities that are part of no interactivity as evidenced by this unity of meaning: *“I mainly use it as a projection, as a projector. So the students don't have an interaction.”* (Participant 2.6)

While elementary and high school teachers' uses of the IWB tend to employ similar types of interactivity, a few observations are worth noting. The results show that elementary school teachers tend to employ slightly more authoritative (49.8% vs. 44.6%), dialectic (21.3% vs. 17.9%) and synergistic (0.5% vs. 0%) types of interactivity than their high school counterparts. On the other hand, high school teachers are more inclined to resort to non-interactivity (30.8% vs. 22.6%) and dialogic interactivity (6.7% vs. 5.9%) than elementary school teachers. These findings will be discussed later on.

Differences by teaching experience

Figure 2 illustrates the types of interactivity included in the uses of the IWB by teachers based on their years of teaching experience. For teachers with 1 to 9 years of teaching experience, the data shows that most of their uses ($n_{\text{total}} = 65$) of IWB fall within authoritative interactivity (40 %, $n = 26$) and non-interactivity (36.9 %, $n = 24$). A small number reported dialectic (12.3 %, $n = 8$) and dialogic (10.8 %, $n = 7$) uses of the IWB. Lastly, these teachers made no mention of synergistic interactivity when using an IWB. Among the results obtained, it is interesting to note that teachers in this category refer more to dialogic interactivity in their proposals than teachers who have more experience. This excerpt from a high school teacher testifies to this:

Certainly in terms of interactivity, participation in action, this is the main impact that I have seen in the students. They were more awake because they were like “I’m the next one going to go forward”. It’s very positive. It’s really more active listening from students that I’ve seen. (Participant 1.6)

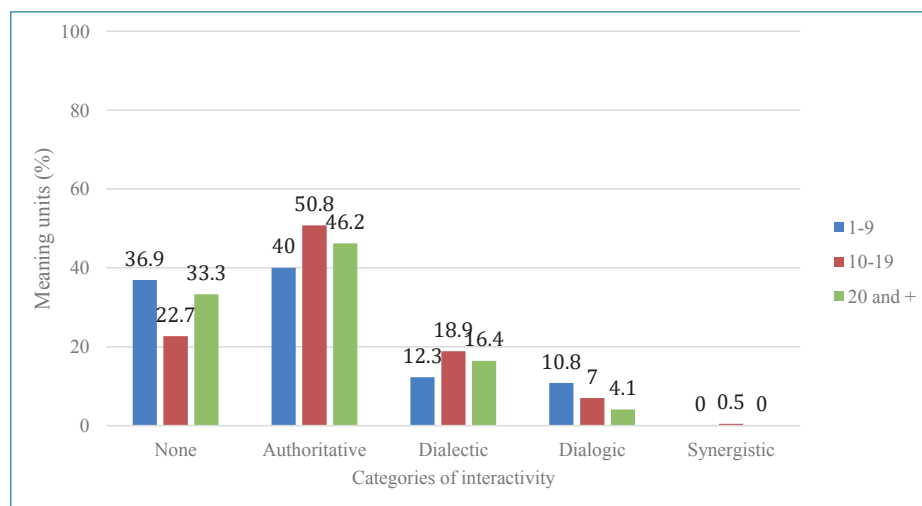


Figure 2

Distribution of meaning units for type of interactivity employed in teachers' uses of the IWB by years of teaching experience

Many teachers with 10 to 19 years of experience reported uses ($n_{\text{total}} = 185$) associated with authoritative interactivity (50.8 %, $n = 94$), no interactivity (22.7 %, $n = 42$) or dialectic interactivity (18.9 %, $n = 35$). Some teachers employ dialogic interactivity (7.0 %, $n = 13$), while a very small number resort to synergistic interactivity (0.5 %, $n = 1$). This group is distinguished by the existence of words that are part of synergistic interactivity. This rare extract bears witness to this:

Before, I didn't let students use the IWB independently. I experienced this last year and a lot this year. I allow the students now to go independently to use the IWB for the study of words, the study of verbs, etc. Then they discovered many, many functions on their own. They are made very well! I didn't expect them to develop such expertise, but I should have thought about it. (Participant 2.17)

Among teachers with 20 or more years of experience, they reported ($n_{\text{total}} = 195$) authoritative (46.2 %, $n = 90$) or non-interactive (33.3 %, $n = 65$) interactivity when using the IWB. Dialectic interactivity and dialogic interactivity accounted for 16.4% ($n = 32$) and 4.1% ($n = 8$) of meaning units, respectively. No synergistic interactivity in using the IWB was reported (0 %, $n = 0$). This group is mainly represented by an interactivity of the "authoritative" type. The following example illustrates this category:

As I am in mathematics, it is a lot of demonstrations. I take my ruler on the IWB then there, they see my ruler appear. I draw the line and then after that, I rotate. Looks like some students understand better when they see it on screen. (Participant 1.16)

The figure makes it difficult to identify trends in the interactive uses of the IWB by teachers based on teaching experience. However, teachers with 1 to 9 years of experience are those whose uses are the most non-interactive in nature and those who employ the most dialogic interactivity, but the least authoritative and dialectic types of interactivity. Teachers with 10 to 19 years of teaching experience mostly employ authoritative interactivity, no interactivity, and dialectic interactivity. As for teachers with more than 20 years of experience, the types of interactivity employed in their uses of the IWB vary greatly, but represent those who make the least use of dialogic interactivity.

Operationalization of the Beauchamp and Kennewell typology (2010)

The results gleaned from the participants' statements can shed a more specific light on the types of interactivity posited by the Beauchamp and Kennewell typology (2010). For each type of interactivity, the characteristics of the average teacher are identified in Table 1, making it possible to further operationalize the theoretical model. This represents a significant contribution to the advancement of knowledge with regard to the study of interactive uses of the IWB.

Table 1

Characteristics of the average teacher for each type of interactivity

No interactivity

- Less than 9 years and more than 20 years of experience at the high school level
- IWB similar to a conventional projector (can be replaced by a whiteboard or chalkboard)
- Lecture-based teaching most of the time
- Little to no manipulation on the IWB by students (recopying class notes)

Authoritative interactivity

- Experience varying from 10 to 19 years at the elementary school level
- IWB used to create hyperlinks, animations, videos or mathematical tools for presentations and to browse the Internet occasionally
- Teacher controls the mechanical aspects of the IWB
- Students seldom use the IWB, but may use it for simple tasks (drag-and-drop)

Dialectic interactivity

- Experience varying from 10 to 19 years at the elementary school level
- Teacher suggests students use the IWB to search for information related to an ongoing project
- IWB used to consolidate information and to generate collective reflection on the quality and relevance of the data collected
- Teacher tries to diversify teaching practices by further engaging students in the construction of their learning with the IWB

Dialogic interactivity

- Less than 9 years of experience at the high school level
- IWB serving as a common space where students and the teacher can reflect, discuss, solve problems, and brainstorm ideas about a given subject
- IWB supports teaching and learning by combining action, dialogue and reflection on a given subject
- Students often work on the IWB to create concept diagrams, run experience simulations and develop materials

Synergistic interactivity

- 10 to 19 years of experience at the elementary school level
- Use of the IWB by all class members on equal terms
- Teacher uses other digital tools (tablets) to resolve problems and foster collaboration between students
- Students encouraged to develop teaching sequences (mini-teachers)
- Among other things, the IWB is used to collect information and for collaboration, sharing, and creative purposes

Discussion and conclusion

No interactivity and authoritative interactivity frequently employed

The results of this research are in line with the findings of De Vita et al. (2014), Aflalo et al. (2018) and Chen et al. (2020), which reported few interactive uses of the IWB. Uses of the IWB at the high school level tend to lean toward no interactivity. Factors such as lack of time, lack of training, the number of students per classroom, and the workspace are factors likely to limit the use of the IWB. Frontal teaching, a pedagogical method frequently used and adopted by high school teachers (Benaïcha, 2015) could also explain the greater prevalence of no interactivity. By its very nature, frontal teaching usually features the teacher giving a presentation at the front of the classroom while students are in a listening position (Aflalo et al., 2018; Raby et al., 2015). This arrangement would therefore foster no interactivity.

Moreover, teachers with less than 9 years of experience or more than 20 years of experience reported various uses of the IWB associated with no interactivity or authoritative interactivity. As for teachers with 1-9 years of experience, a possible reason to explain this finding is job insecurity, which may prevent some teachers from using a IWB on a regular basis. Lack of time for planning teaching sequences may be another element to consider. New teachers, who must often contend with different classes from year to year, must constantly renew teaching materials and sequences to present to students. This extra workload may compel them to develop teaching sequences that are often more magistral than constructivist. However, it can be surprising to note that teachers with 20 or more years of experience also reported using the IWB in a non-interactive or authoritative manner. With a certain stability and no longer having to contend with different classes from year to year, one might have expected this group of teachers to be more innovative in their practices.

Occasional dialectic interactivity and dialogic interactivity

Uses by elementary teachers tend to foster dialectic and dialogic types of interactivity. We noted that the statements by high school teachers slightly exceed those made by elementary school teachers compared to the units of meaning referring to dialogic interactivity. The role that some teachers take on in their environment could explain this finding in favour of high school teachers. Some of them are called upon to play a trainer role to support their colleagues in incorporating the IWB in their classroom. Moreover, teachers with less than 10 years of experience stand out from the others with regard to dialogic interactivity. Their motivation (Karimzadeh et al., 2017; Lefebvre and Samson, 2013) to create didactic sequences for greater engagement of students in their learning may have had an influence on their use of IWBs. Finally, social desirability bias should not be underestimated, which may have influenced the statements of some participating elementary school and high school teachers during discussion groups. These are avenues to explore in future studies.

Synergistic interactivity, a rare occurrence

Although a very small amount of meaning units ($n = 1$) have been coded as synergistic interactivity, the statements are associated with elementary school teachers. Gareau (2014) explains that the IWB can help with different types of group activities as reported by some elementary school teachers in this research. What likely explains the presence of synergistic interactivity exclusively at the elementary school level is the fact that elementary school teachers are generalists who pay particular attention to pedagogy and the teaching context in addition to being in constant presence of students. Inversely, high school teachers generally specialize in specific subjects and are in contact with students during one period per day. This would limit the type of interactivity employed during the teaching process. It should also be noted that the results of this research are consistent with those obtained by Raby et al. (2015). They reported little to no practices related to this type of in-class interactivity.

In closing, it seems reasonable that the interactive uses of the IWB vary based on the grade level or years of experience. The context of use, the age of students, the subject matter being taught and the teacher's pedagogical or technological pedagogical skills are all factors likely to influence the interactivity employed with the IWB. The goal is not to determine whether uses of the IWB at the elementary school level are better than those reported at the high school level or vice versa, but rather to describe the characteristics associated with the different types of interactivity. Perhaps pedagogical settings at the elementary school level are more conducive to certain types of interactivity than at the high school level, and vice versa. Only future research will tell. We should also mention that since Quebec introduced its Digital Competency Framework (MEES, 2019), certain types of interactivity, notably discussion and exchange, should be included in teaching practices with the IWB. Thus, the Framework stipulates that learners should fully develop their skills and abilities so that they can work, collaborate, communicate, and produce content with digital technologies. As observed across the interactivity categories, the IWB can provide strong support for these practices, thereby enabling learners to develop digital skills. Additionally, as teachers' practices are expected to evolve over time, there is every reason to believe that teachers will progress in their appropriation of the IWB, as suggested by planned change models like the one proposed by Hall and Hord (2001). Longitudinal studies could shed some light on this matter.

From a pragmatic perspective, the characteristics associated with the types of interactivity should be considered when creating content for the initial and continuous training of teaching staff, and particularly during the current COVID-19 pandemic, which calls for renewed and transformed teaching practices. One of the objectives of this study was to define the interactivity related to the use of the IWB. By keeping in mind the various interactive uses of the IWB employed by elementary or high school teachers, trainers could better meet the needs of the professionals in their intended audience. Further research is needed with regard to interactivity, especially in terms of the added value it can bring to students and teachers.

Like all research, this one has limitations. During discussion groups, some teachers spoke more than others, to the detriment of the other participants. When sharing their practices with enthusiasm, some participants dominated the discussion, making it difficult for all participants to express their opinions during the discussion. This is where the role of the discussion host becomes essential. Social desirability may also have played a role for some teachers who wished to have their voices heard. The

host therefore had to ensure smooth running of the discussion groups and extract more statements from more discrete participants.

Notes

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² This study was approved by an ethics committee for human research.

³ The researchers have no conflict of interest to declare.

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