

Literature Review

Exploring the Integration of Interactive Whiteboards in K-12 Education

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Introduction:

As the Calgary Board of Education (CBE) continues to expand the use of SMART boards in CBE schools the effective use of such technology is being explored in academic and popular literature. The literature on Interactive White Boards (IWBs) is a growing body.

Interactive White Boards (IWBs) consist of a large free standing or wall mounted screen that requires a computer linked to a projector that is connected to, and controlled by the touch sensitive whiteboard. According to Miller and Glover (2002) one of the advantages of such a system is that teachers are able to control the projected lessons from the front of the class, rather than from a mouse at the computer. The ability to use various applications including PowerPoint, Word, internet browsing, and multi-media applications in one seamless lesson is a major advantage of using IWBs. Smith, Hardman and Higgins (2006) argue that IWBs can motivate greater discussion in classes, and that “whiteboards add a social dimension to learning because pupils can share knowledge publicly and learn by making mistakes together” (p. 445). Glover and Miller (2001) argue that IWBs are tools that are greater than the sum of their parts and have the potential to, when combined with pedagogical change, greatly enhance teaching practice. The goal of changing teaching from a didactic, teacher centered practice to a more interactive process is at the heart of integrating IWBs into education.

Major Themes Identified in the Literature

Positive Impacts:

The literature thus far on IWBs supports the idea that they can positively impact student motivation and engagement (Hall and Higgins, 2005; Knight, Pennant, Piggott, 2005; Wall, Higgins & Smith, 2005; Weimer 2001), they can aid teachers in meeting students' diverse learning needs, (Glover and Miller, 2001; Glover and Miller 2002; Glover, Miller, Averis, & Door, 2007: Hall and Higgins, 2005; Smith, Higgins, Wall, & Miller, 2005; Wall et al. 2005), and they can dramatically improve classroom presentations (Glover and Miller, 2001; Hall and Higgins, 2005; Smith et al. 2005).

Challenges:

Some of the major challenges identified in the literature with IWBs are issues arising from technical difficulties (Glover and Miller, 2001; Hall and Higgins, 2005; Wall et al. 2005), teacher's level of comfort and knowledge with the technology, and the availability of the IWBs and time for professional development (Miller and Glover, 2001; Smith et al. 2005).

Overriding Themes/Discussions

There are several major discussions in the literature concerning IWBs. A major discussion is around what is referred to as the "wow" factor of IWBs, and what impact will the IWBs have if this factor wears off (Armstrong, Barnes, Sutehrland, Curran, & Mills, & Thompson, 2005; Beauchamp and Prakinson, 2005; Miller and Glover 2001; Smith et al. 2005). Finally, the most predominant topic in the literature focuses on what factors or changes are needed in order to successfully integrate IWBs into education. The need for change in teaching pedagogy is at the forefront of this debate (Armstrong et al.

2005; Hall and Higgins, 2005; Miller and Glover 2001; Miller and Glover, 2002; Smith et al. 2005).

Scope of the Literature:

The literature reviewed for the purpose of this review consisted of both academic literature and popular literature. It consisted of qualitative and quantitative studies and mixed method designed studies. Literature published by private companies, particularly manufactures of IWBs, were not included in order for the review to remain unbiased towards any one product and to focus on the impacts of the overall technology.

Literature Review

Smith, Higgins, Wall and Miller (2005) provide a critical review of the literature on interactive whiteboards. Their literature review aimed to identify “any impact on classroom interaction, on teachers’ perceptions and on pupils’ attainment, progress and attitudes” (p. 91). Smith et al. (2005) caution readers to carefully examine the literature available on IWBs as the majority of it thus far has been primarily focused on perceptions, and the impact on actual attainment has been largely undocumented. Furthermore, they argue that the rigor of many of the studies is unclear. This literature review drew on many similar articles that Smith et al. (2005) utilized, and therefore this critique can be extended to many of the articles to be reviewed here.

Another note on the literature to be reviewed is that it is primarily based in the UK. The British government has invested substantially in this technology, while North American support for the project is just now growing; therefore literature based in Canada and the US is still relatively sparse. This is a definite gap in current academic literature that purposeful research within the CBE has the potential to fill.

Benefits of IWB Use:

Student Motivation & Engagement

The most widely documented benefit of employing IWBs in schools is that they are fun, and they motivate students to become more engaged in their learning. Knight, Pennant and Piggott's (2005) study of 6 classrooms in the UK quoted a participating teacher saying that "the interactive whiteboard is a valuable tool in the classroom: it seems to draw children's focus and leave them motivated and empowered to undertake independent work" (p. 13). Also supporting this argument is Weimer's (2001) two classroom experimental designed study that took two classes, same grade level, same teacher and same assignment, but the experiment group was taught using an IWB and the control group using other methods. This experiment was conducted twice, changing the experimental group to ensure that students' natural motivation levels did not skew the data. The students were surveyed after completing their projects. In both cases the experimental group, (group using the IWB) reported higher levels of motivation and enjoyment. In addition, the qualitative responses to the survey were much more detailed and expressive from the experiment group than the control group. This demonstrates that even in this level of engagement of written responses; students having used IWBs in their learning were more motivated.

A study by Hall and Higgins (2005) based on focus groups with 72 grade six students found students to be "enthusiastic about particular aspects of IWBs, such as their versatility in the classroom, multimedia capabilities and the fun and enjoyment they brought to learning" (p. 102). Students reported being able to do "more" with the IWBs in comparison to the traditional whiteboards and projectors. When speaking about the

traditional whiteboard and projector, one student stated “it’s really boring, you feel like you’re going to go to sleep. On that one, (IWB) you’re like still awake and interested” (p. 106). According to Hall and Higgins (2005) the use of multi-media applications with students has been advantageous in engaging and holding their attention.

Wall, Higgins, and Smith (2005) used bubble diagrams to explore children’s metacognitive processes when using IWBs. By engaging students in this creative research technique, Wall et al. (2005) were able to explore not just students’ attitudes about IWBs, but gather information on how they can affect the learning process. Wall et al. (2005) found that the use of IWBs helped to facilitate learning. Students frequently mentioned how the use of IWBs assisted their learning, and the use of games had a large impact on this, as students reported learning being more fun on IWBs. Students were also very motivated when they could use the IWBs themselves. Wall et al. (2005) found students were very motivated to use the boards and to display their own projects on the board. Students also became more motivated to share thoughts and contribute ideas during classes when IWBs were used.

Meeting Diverse Needs

The benefits, both actual and potential, are a major theme in the literature on IWBs. Smith et al. (2005) identify flexibility and versatility as major benefits of IWBs. These themes resounded in the literature with many scholars reporting that IWBs allowed teachers to meet the diverse needs of various students in their classroom through the use of this technology. This argument is supported by Glover and Miller (2002) and Miller and Glover, (2002), as well as Glover, Miller, Averages and Door (2007). Students who learn through visual, audio and tactile learning styles can all easily be accommodated

using IWBs. Hall and Higgs (2005) argue that children learn best through their dominant senses, seeing hearing and touching. They argue that IWBs “can appeal to all three of these senses simultaneously through a variety of visual representations, sounds and the capacity to touch and interact with the IWB” (p. 107). Students in their study reported that they “enjoyed sounds, the visual aspects such as video clips, colour movement, and the tactile elements, that is, being able to touch the board and manipulate objects” (p. 107). In addition to meeting various learning styles, IWBs have also been found to be an effective tool for various age ranges being used in every setting from nursery schools, to elementary, high schools, and post secondary institutions (Smith et al. 2005). Likewise, Wall et al.’s (2005) study on the impact of IWBs on metacognitive processes also found that the use of IWBs facilitated the various learning styles of students. One teacher in Glover and Miller’s (2001) study stated that they:

realized that I could respond to the differing visual and auditory learning strengths of the group.... it has made me think more about the impact of what I am offering in the classes and as a result I am more careful in the structure of what I do (p. 263).

The potential to meet diverse student needs is a strong advantage documented in the literature on IWBs.

Improved Classroom Presentations

Much of the motivation and fun that is achieved through the use of IWBs comes from the improved presentations that teachers can produce with the aid of this technology. Hall and Higgins (2005) argue that “children of the 21st Century have been part of a multi-media world from birth and as a result they are comfortable with such technologies and this experience can be exploited in the learning environment” (p. 106).

The use of IWBs gives teachers a tool to tap into students’ interest and keep them

engaged through improved presentations. Glover and Miller's (2001) study involving 45 educators and 750 students on the implementation of IWBs into secondary schools in the UK demonstrate this point. Staff identified improved presentation as the most frequent result of the implementation of IWBs. One teacher in this study added that IWBs "adds a whole new dimension to the way in which we can do things and with PowerPoint as the driving program we are sure that we offer the students a good standard of presentation of lessons" (p. 263). Smith et al. (2006) also support the argument of improved presentation by reporting that pupils report that with IWBs "lessons were quicker and more fun", and Miller and Glover (2002) report that students were engaged in the lesson because of the element of surprise that lessons on the IWBs can bring.

Smith et al. (2005) argue that IWBs have the ability to draw on a greater number of resources than is possible with other approaches. Citing Morrison's 2003 study, Smith et al. (2005) give one teacher's description of how they have used IWBs to make their secondary school history class more dynamic: "I can take pupils into a First World War trench and give them a 360 degree panoramic view. I can then instantly enable pupils to hear a veteran evoke the sights sounds and smells of warfare" (p. 93). Other examples of this include the ability of math teachers to use real time movement software to teach measurement of angles. One language teacher described the possibilities on how they could employ an IWB during their linguist unit: "you can create sequences linking sound files, web pages, images-anything from your desktop and build it up, layer upon layer" (p. 93). Other teachers have used IWBs to create interactive games for students, and building student use of the IWB into classroom activities has also proved to be a popular and effective use of this technology.

Challenges of Using IWBs

Technical Difficulties

Throughout the literature on IWBs the challenges of the boards are clear. The most common challenges cited by teachers and students are technical issues that arise while using the technology and teachers' ability to troubleshoot issues that arise. Glover and Miller (2001) argue that some teachers are hesitant to fully integrate the use of IWBs into their daily teaching practice because of their fear of technology failure and then subsequently being stuck for their lessons. Hall and Higgins (2005) solicited student feedback on what they did not like about IWBs, and students, like teachers, identified technical issues as their number one complaint. From the student perspectives the technical issues, such as the IWB freezing or crashing, and the continual need to reorient the board with any movement were frustrating. Students found that these issues caused disruption and delays in the class. Wall et al. (2005) echo the concerns about the need to reorient and wait for the board to be ready for use in their study of students in the UK. The concern of technical difficulties is directly connected to another common concern by teachers, which is their ability to troubleshoot issues as they arise. Smith et al. (2005) argue that overcoming this trepidation is dependent on providing teachers training on not only how to use the IWBs, but also to ensure that training on troubleshooting is provided or immediate technical assistance is available.

Availability of Resource

Another common challenge involved with the adoption of IWB use in education is the availability of the technology to teachers. Smith et al. (2005) argue that easy and frequent access is critical to teachers using IWBs. Teachers reported that if they have to move their students from their primary classroom or have to pre-book the equipment they

are less likely to use it than if it is readily available for use in their classroom environment (Miller and Glover, 2001). One of the challenges identified by Glover and Miller (2001) is the challenge of teachers investing time in developing IWB lessons when they do not have access to the technology in their classroom. They argue that the full potential of IWBs cannot be realized until each classroom has a whiteboard for daily use. Miller and Glover (2001) argue that the difference between schools who share IWBs and those that have them in each classroom was considerable. They argued that in schools with IWBs in every class “there was no distinction in the minds of staff between the interactive whiteboards and any other teacher resource” (p. 8). One grade one teacher commented that:

After one full year of developing the materials to use for teaching we had got to the point where neither the students nor myself think of the board as anything special. It is used in the course of every day and they have learnt a discipline whereby I say “whiteboard” they pick up their “slates” and move to the carpet area and we are ready to move ahead (Miller and Glover, 2001, p. 8).

The full and seamless integration of IWBs into daily activities, as described by this grade one teacher, is the direction that schools adopting IWBs are moving towards. However, in order to get there, there are still several major considerations on how to move towards this goal.

Major Discussions

Impact on the Classroom: Moving Beyond the ‘wow’ factor

Overall the impact of the implementation of IWBs in the classroom has been documented as a positive experience for teachers and students. As mentioned earlier, numerous studies have examined the new opportunities available to teachers when using IWBs, and that students respond very positively to IWBs because they are interactive and fun. This notion of fun however brings up a major discussion in the literature about

interactive whiteboards. Some teachers are fearful of what will happen once the ‘wow’ factor wears off (Beauchamp and Parkinson, 2005). Some scholars worry that the “fun and games” aspect of using IWBs, although they produce great motivation, may be detracting from actual learning (Armstrong, Barnes, Sutherland, Curran, Mills and Thompson, 2005). In their study, a classroom teacher had designed a lesson plan to explore biology in which students designed a virtual fish and then would monitor it in various conditions. The majority of the fish only survived for about 30 minutes and the second part of the lesson plan was lost. The activity changed into a game of designing the fish rather than a science lesson monitoring the changes in the fish. Armstrong et al. (2005) argue that teachers will often frame the activities on IWBs as games to engage the students, however this approach reinforces to students this idea and negates much of the educational potential of IWBs.

As previously stated the goal is that IWBs will be integrated seamlessly into the classroom. However, some teachers fear that this too could be problematic if students become so accustomed to this style of teaching and move on to classes that are not using IWBs and lose the motivation and engagement created by the use of the IWB (Miller and Glover, 2002).

Another concern that is connected to the ‘wow’ factor is the level of interaction that is created through the use of IWBs. As previously discussed in this paper, the increased student motivation, engagement, and interaction is a major theme in the literature on IWBs. However, Armstrong et al. (2005), Tanner and Jones (2007) and Smith et al. (2006) all question the depth of the increased interaction. The above example of the biology lesson turned into a game outlined in Armstrong et al.’s (2005)

study highlights the point that simply because students are engaged in an activity does not mean that they are learning the desired skills or lessons. Smith et al. (2006) documented that lessons that used IWBs often had greater student involvement and volunteering of ideas and a faster paced classroom. However, they argue that the increased percentage of responses is at the expense of more in-depth student answers. They argue that as responses increased in IWB lessons they also became shorter, and uptake questions and presentations from students decreased. Likewise, Tanner and Jones (2007) argue that deeper levels of learning happen when students are engaged in “collective reflection.” In this process the focus is on students evaluating what they have learned and reflecting on that learning. They argue that with IWBs, although students may engage more in the lessons, there is typically not enough time given to allow for collective reflection. They argue that in order to use IWBs to move beyond this more superficial level of interaction teachers need to use IWBs as a tool that is accompanied with a change in teaching pedagogy that employs a highly interactive approach to teaching. All of the scholars who question the ‘wow’ factor of IWBs do so not on the basis of the technology, but rather on how to the technology is used by educators.

Successful Integration

The final and possibly the most important theme that has emerged in the literature on IWBs is how to successfully integrate them into education effectively. Resoundingly the concern with the integration of IWBs has not centered on the technology itself, but rather on how educators use it in their practice. Miller and Glover (2002) have outlined three conditions that must be met in order for the potential of IWBs to be realized. They argue that these include, first, a will to develop and use the technology. Second, teachers

have to be willing to become mutually interdependent in the development of materials. Finally, there has to be some change of thinking about the way in which classroom activities are organized. The role of school leadership was paramount in the success of these things occurring. Schools that fully adopted the use of IWBs into all classes were found to be more successful because they fostered whole staff involvement and there was no tension between teachers who did and did not have the tool. One school leader described their investment in IWBs as a commitment “to a new way of teacher and an awareness of the way in which children learn that should underpin all our attempts to get better grades and that is surely what this is all about” (Miller and Glover, 2002, p. 18). Creating an environment where the use of IWBs is supported by staff and school leadership is paramount to effective integration.

Impact on Teaching Pedagogy

The need for teachers to support the integration of IWBs through a change in pedagogy is a dominant theme in the literature. One of the greatest challenges of the integration of IWBs according to Glover and Miller (2001) is that many teachers “are still at a stage of using technology as an interest enhancer rather than as a new approach to learning” (p. 269). Armstrong et al. (2005) argue that the one of the main reasons for supporting the infusion of this technology is “its ability to directly support interactive whole class teaching” (p. 458). Glover and Miller (2001) argue that “IWBs are least effective and have limited impact on teaching and learning when teachers fail to appreciate that interactivity requires a new approach to pedagogy” (p. 257). The goal, according to Hall and Higgins (2005), of using IWBs is to transform teaching from teacher centered to a more “de-centered role of teacher as facilitator and knowledgeable

guide” (p. 112). The goal of this is that in this process of teachers changing their role, it will “result in more independent and self-directed learning among students” (p. 112). The most common reasons that teachers have identified for this not happening is due to lack of training on how to use the IWBs and lack of time to plan the lessons integrating the technology beyond a presentation tool (Glover and Miller, 2001). Through the literature it is clear that a more effective integration of IWBs will require extensive teacher training as well as allowing teachers the time to develop the resources to effectively use the technology. According to Smith et al. (2005) the initial investment of time “should eventually be reduced given the facility of IWB technology to save, share and re-use lesson materials” (p.94). However, teachers must be open to this change and an environment has to be created in which teachers are supported in this process to make the adoption successful. One area that scholars are in complete agreement is that the infusion of IWBs alone does not improve teacher and learning, and only with a change in pedagogy can the full potential of IWBs be realized (Smith et al. 2005).

Gaps in the Literature

The body of literature on IWBs is growing but some major gaps still exist. One major gap that exists is empirical studies on student attainment. It is clear that students enjoy using IWBs and are more motivated and engaged in learning, however the impact that this has on students’ grades has yet to be closely examined. A second gap is the lack of research based in the North American context. Great Britain has heavily invested in the integration of IWBs, and thus the vast majority of the research on IWBs is based there. Finally, the literature clearly identifies that effective professional development opportunities for teachers and a need for a change in teaching pedagogy is imperative to

the successful integration of IWBs; however there is no literature at the present time examining what types of professional development opportunities are needed, or literature on the effectiveness of training opportunities offered. As the body of literature grows these are areas of study that would add great insight into the application of IWBs. There is great potential for work within the Calgary Board of Education to fill some of these gaps with future research.

Conclusion

The adoption of the use of IWBs within the Calgary Board of Education makes it imperative that we examine how to most effectively support a change in teaching pedagogy in order to enable IWBs to be used to their full potential and to allow teachers to meet diverse needs of students through increase motivation and engagement with the goal of enhancing student learning and outcomes.

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