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Investigating the Impact of Interactive Whiteboards in Higher Education: A Case Study

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Interactive whiteboards (IWBs) are a billion-dollar industry. Their prominent position in classrooms, frequently the single display to share digital information, draws attention to their influence on teaching and learning processes. This research presents a case-study of a Canadian college with over five years of IWB experience. Findings show that despite implementing best-practices, most instructors underutilize IWB capabilities. This research concludes that the IWB contribution to student learning has been limited with potentially detrimental impacts on student perception and comprehension given the smaller size of IWBs and their lower mounting position when compared to traditional projection screens.

Background

Lethbridge College completed a three-year classroom technology standardization project in 2013. The work entailed installation of audio-visual communication technologies to support the amplification, transmission and capture of information (e.g., text, audio, video). The focal point of the installation was interactive whiteboards (IWBs), a technology purported to enable innovative teaching practices and learning experiences. Given their prominence in classrooms, the single display to share digital information, IWBs are not insignificant mediators of teaching and learning processes. Having surpassed the five-year implementation point, the extent of adoption and the relative impact of IWBs on teaching and learning at Lethbridge College has remained unclear.

Using a case-study approach, this research provides a rich description of a Canadian post-secondary institution. The investigation has two overarching research questions: (1) What is the IWB contribution to teaching practices? And (2) what is the IWB impact on student learning experiences? The research begins, first, by synthesizing IWB literature, second by sharing institutional findings from an instructor survey on the topic of IWB utilization, and lastly it identifies best practices concerning IWB installation with a focus on learning, achieved using a document review. This research culminates with assertions that may be of interest to post-secondary institutions currently deploying or considering deployment of IWBs.

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Literature review

A rapid review of interactive whiteboards (IWBs) identifies the relationship between IWBs, teaching and learning, academic achievement and factors influencing educator IWB adoption.

Current state of interactive whiteboard (IWBs) deployments

Interactive whiteboards (IWBs), also referred to as electronic whiteboards, are one type of classroom technology. A conventional IWB installation includes an electronic whiteboard connected to a networked computer and a data projector (Smith et al., 2005; Al-Qirim, 2011). IWBs receive considerable attention and are found in classrooms around the world. The UK has the highest penetration rates worldwide with adoption rates of 80% in primary and secondary schools, and to a lesser extent in further education colleges (Hennessy & London, 2013). Similarly, commencing 2004, Mexico saw EUR 1.43 billion invested into IWBs and associated implementation in fifth and sixth-grade classrooms, and in 2012, Turkey forecasted equipping 620,000 classrooms with IWBs over five years. Hennessy and London further estimated classroom penetration rates, as of 2011, at 41% in the USA and 31% in Canada with forecasted penetration rates of 52% and 46%, respectively by 2016. The five-year introduction of IWBs into 43,000 (Bolkan, 2012) K-12 classrooms across schools in Quebec, Canada, suggests the popularity and appeal of IWBs remains unabated (Karsenti, 2016).

Educational impact of IWBs

The predominant benefit of IWBs is to enable whole class teaching (Becta, 2004; Armstrong et al., 2005). In the context of digital learning, Betcher & Lee (2009) stated: "The opportunities for connecting students with highly relevant and engaging digital content are enormous, but without some way of sharing those resources on a whole class basis, the potential of the PC for teaching with these resources is fairly limited. As a tool for connecting teaching to learning in a digital world, the interactive whiteboard appears to be the missing link" (p.3).

In their critical review of IWB literature, reflecting a focus on changes in classroom interaction and learner attainment, Smith et al. (2005) noted the relative advantage of IWBs remains unclear when compared to other presentation technologies, especially a data projector and screen. DiGregorio and Sobel-Lojeski (2010) extended this perspective, noting studies carried out too soon after implementation, sparse longitudinal research, and a need for more insight on the contextual factors influencing IWB implementation (e.g., school culture, technical support).

In their systematic review of the literature from the vantage point of preschool and primary education, Kyriakou and Higgins, (2016), indicated, "there is a general consensus across the studies of this review that IWBs have not raised pupils' achievement levels, at least as measured by tests of attainment" (p. 17). Karsenti (2016), likewise, notes, "As of 2016, not much is known about how the IWB is actually used or the real impacts on educational outcomes, and the results on the educational impacts are contradictory" (p.3). Despite recognition for the potential of IWBs, Karsenti's (2016) survey results from 11,683 students and 1,131 Teachers in the Canadian K-12 system led him to propose, "for the great majority of teachers, a simple electronic projector would be more suitable for teaching purposes, at far less cost and with a much larger screen" (p. 16).

Contextual factors influence IWB adoption amongst educators

DiGregorio and Sobel-Lojeski (2010) identified five common themes or effects associated with IWB use: pedagogy, motivation, interaction, perception, and achievement. The extent to which such effects are realized, they note, is dependent on contextual factors, including, available opportunities for teacher training, teacher confidence (e.g., time to develop confidence), institutional culture (e.g., supportive leadership), skilled technical support (e.g., knowledgeable, reliable), and time for lesson preparation and practice. Betcher and Lee (2009) further noted the importance of optimal IWB placement and installation and use of quality software.

Gregorcic, Etkina, and Planinsic (2017) draw attention to the importance of disciplinary context, noting the influence of epistemological conventions on instructors' selection of learning activities and methods of technology utilization. Hennessy and London (2013) identified student age, suggesting that adolescents may feel self-conscious completing activities in front of their classmates. A range of contextual factors, in addition to those under the purview of the institution (e.g., professional development), can thus been seen to mediate IWB adoption and use. DiGregorio and Sobel-Lojeski (2010) acknowledge that institutions vary in how and the extent to which such factors are addressed, making it difficult to generalize results of IWB studies.

Summary

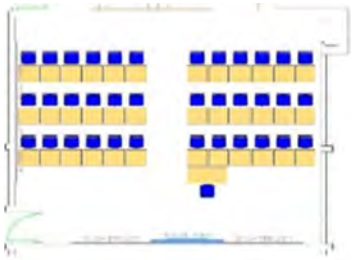
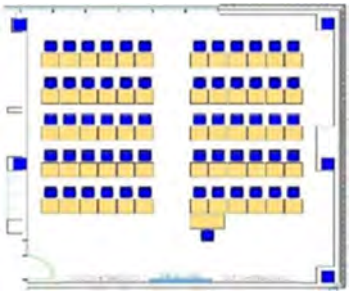
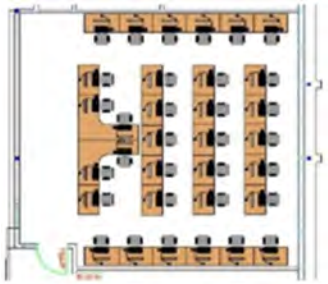
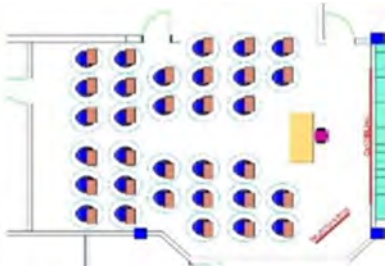
This brief literature review offers insight into the relationship between IWBs and teaching and learning, academic achievement, and factors that influence educator adoption of IWB technology. Three findings emerge. First, IWB technology is portrayed as an enabler of whole class teaching and learning with the potential to positively affect pedagogy, motivation, interaction, perception, and achievement. Second, numerous contextual factors such as institutional culture and skilled technical support staff, which are noted to vary across institutions, mediate the IWB influence in relation to teaching and learning. Third, the relationship between IWBs and student achievement remains unclear–resulting from situational factors that influence instructor utilization of IWBs. Less clear, as noted in the literature, is the extent to which educators use IWB features to support student learning; with further research needed to determine the relative impact of IWBs in comparison to other presentation solutions, e.g., data projectors and screens.

Case description

Contextual factors

Lethbridge College, a comprehensive community institution, has approximately 4000 full-time students. A classroom technology standardization project, completed in 2013, entailed installation of an instructor podium, a projector, a Blue-ray/DVD player, speakers, cabling and requisite adaptors (e.g., VGA, HDMI) and an interactive whiteboard in 128 classrooms, encompassing five classroom types (Table 1). The instructor podium is typically positioned off to one side and orientated so that the instructor faces the class (Figure 1).

Table 1: Classroom Inventory

Type 1. Small Classroom	Type 2. Medium Classroom	Type 3. Large Classroom	Type 4. Labs. e.g., Computer, Science, Health	Type 5. Active Learning Classrooms
				
12-20 seats. 30-50sqm	20-40 seats. 45-85sqm	40-60 seats. 85-100sqm	Seating capacity and room size are variable.	20-40 seats. 45-85sqm

Room depth: A proportional stratified random sample, completed December 2017 (n=29), indicates an average classroom depth of 30.22 feet (362.72 inches) with a sample standard deviation of 8.41 feet (100.97 inches); 95% CI [27.03, 33.43 feet]. Calculated based on a measurement of student seating in the furthest row from the interactive whiteboard.

Not included here are lecture theatres which are equipped with large format projection screens, and specialized spaces (e.g., shop spaces).

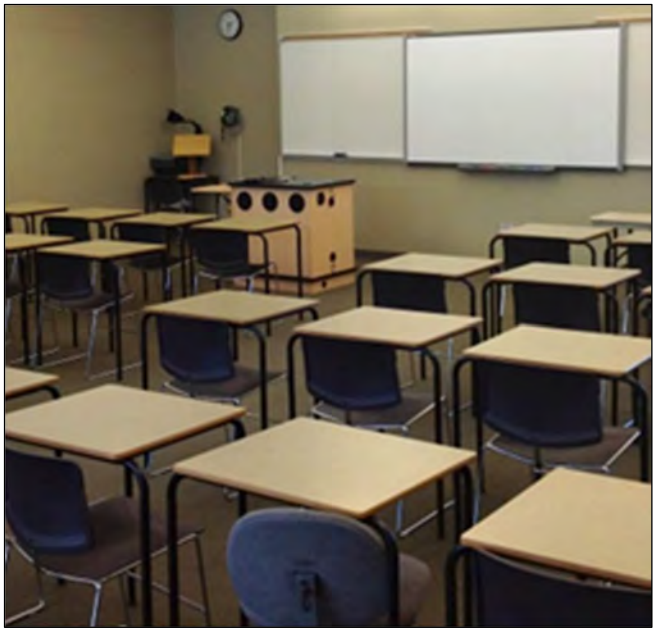


Figure 1. **Podium placement**

The IWB is almost exclusively 84" (46 inches X 82 inches) and wall-mounted at approximately one meter from the floor–the maximum height at which an instructor of average height will be able to touch the upper area of the IWB–and positioned at the front of the room with whiteboards placed on each side. The IWB is the primary instructional interface used by the instructor and students for whole class learning. The laptop-to-IWB connection process includes three to six steps: (1) plug-in laptop for power, (2) insert HDMI into a laptop, and (3) locate projector remote, identify input and power on. Instructors utilizing IWB touch-enabled features also need (4) insert a USB for IWB interactivity, (5) access and open the IWB companion software application on their laptop, and (6) complete the IWB board calibration process. In contrast to IWB deployments in the K-12 sector, where teachers typically occupy a single classroom or homeroom throughout the day, instructors in post-secondary institutions might complete this process in whole or in part numerous times each day as they transition from classroom to classroom across campus.

As noted in the IWB literature, contextual factors (e.g., training opportunities, teacher confidence, institutional culture, and skilled technical support) mediate adoption and utilization of IWBs. For these reasons, select institutional survey findings (response rate 13%) (Lethbridge College unpublished, raw data 2014), from a 2014 research partnership with the Educause Centre for Applied Research (ECAR) on the topic of faculty and technology are provided. The results show generally favorable perceptions amongst faculty in four areas: (A) professional development (Figure 2), (B) institutional support for technology integration (Figure 3), (C) classroom technology reliability (Figure 4), (D) ease of use (Figure 5), and (E) overall satisfaction with classroom technology (Figure 6). Results from other ECAR participating institutions, categorized as "Canadian" and "International" (Educause Centre for Applied Research, 2014) are also included [1]. Collectively, this information enhances the relevance of research findings for other institutions with a similar profile.

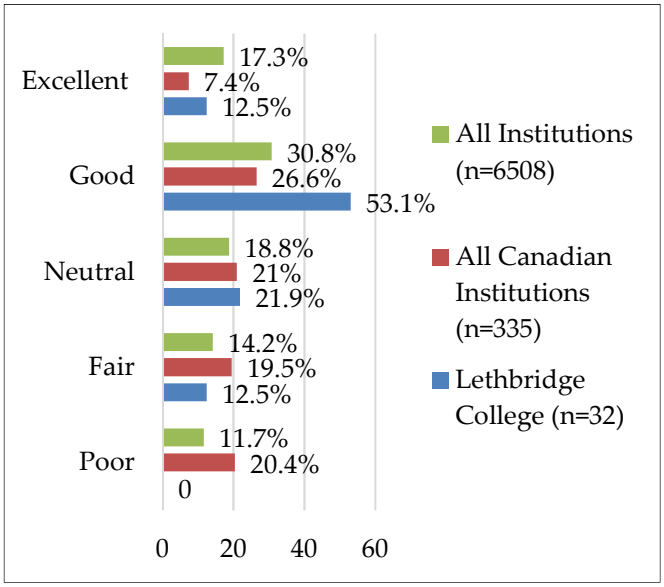


Figure 2. **Experience with professional development around integrated use of technology**

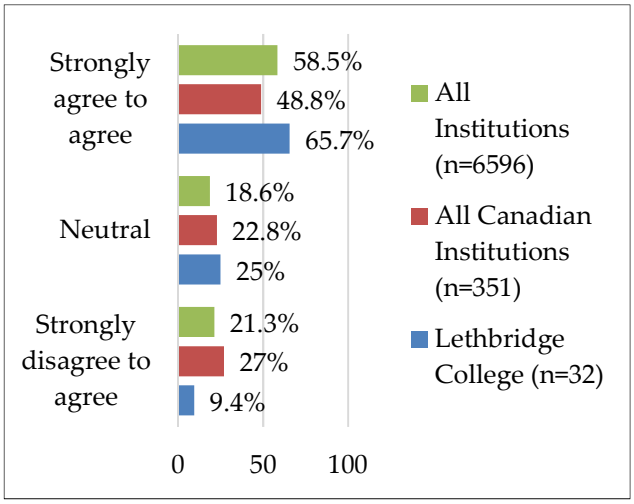


Figure 3. **My institution assists faculty with the integration**

[1] The total number of survey respondents is adjusted to account for the removal of responses labeled "don't' know or "not applicable."

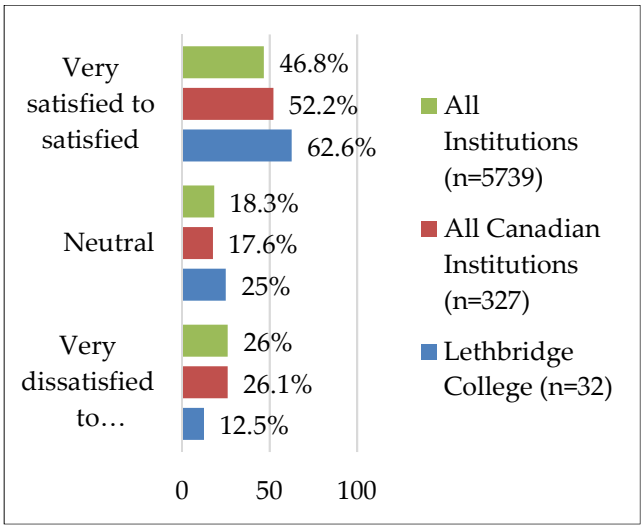


Figure 4. **Reliability of classroom technology equipment**

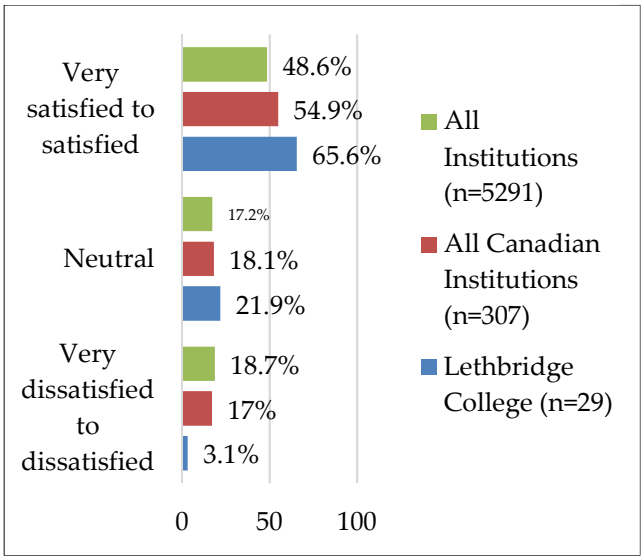


Figure 5. **General ease-of-use of podium systems in classrooms**

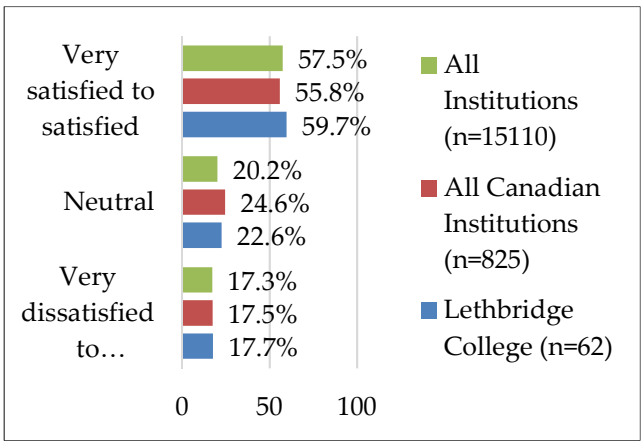


Figure 6. **Overall satisfaction with classroom technology**

Methodology and approach

This research project is a mixed-methods instrumental, educational case-study. Noting the diverse meanings and variations of "case study," Willis (2007) characterizes it as a research method emphasizing the use of varied data sources to generate rich descriptions, focusing on real people and situations in specific contexts. Creswell (2013) extends this conception viewing the case study as a methodology, a type of qualitative research design in addition to being an object of study. Creswell distinguishes between intrinsic and instrumental forms of the case study noting that an instrumental case study endeavors to understand a specific issue, problem or concern by selecting one or more cases to enrich understanding. Shared attributes of the case-study approach pertinent to this research project include a rich description of the case under study, the development of in-depth understanding achieved through the collection of various data, and the generation of "assertions," (Creswell, 2013) or "lessons learned" (Liamputtong, 2013).

Literature review

I undertook a rapid review of the topic, interactive whiteboards in education, to explore IWB benefits, the relationship between IWBs and academic achievement, and factors influencing educator adoption of IWBs. A rapid review, as defined by Grant and Booth (2009) is "a means of providing an 'assessment of what is already known about a policy or practice issue, by using systematic review methods to search and critically appraise existing research" (p.100).

The search utilized Google Scholar with the following terms: "interactive whiteboards higher education," "interactive whiteboards education," "interactive whiteboards and academic achievement," and "interactive whiteboards and adoption." I selected articles between 2005-2017 for inclusion.

Instructor survey

I developed a twenty-two question, online survey in consultation with audio-visual staff to identify IWB adoption rates and utilization practices (see Appendix 1). We released the survey to all faculty (n=400). It included a mix of Likert, multiple choice, multiple response as well as open-ended questions. The survey remained open for seven days yielding a response rate of 31.25% (n=125).

Document review

I reviewed the document, *Designing Screen Sizes and Sightlines* (section 4.4), as found in InfoComm's *AV/IT*

Infrastructure Guidelines for Higher Education (2014), to identify audiovisual best-practices pertaining to IWB installation. InfoComm International is an American National Standards Institute (ANSI) accredited standards developer organization[2]. I identified two considerations, screen size and sightlines, given their potential influence on viewer perception and comprehension. A web search using the keywords "learning space design guidelines" confirmed these guidelines are integrated into post-secondary institution learning space documentation, for instance the Learning Space Design Guidelines at the University of British Columbia (See: http://www.infrastructuredevelopment.ubc.ca/facilities/learningspaces/learningspace.htm)

Results

Survey results: institutional and academic centres

Five academic centres, encompassing all faculty (see Table 2), were represented in the survey with a combined response rate of 31.25% (n=125). Figures seven through eleven report on combined results for all academic centres, denoted as "Institutional Results," complemented by individual results for each academic centre, denoted as "Academic Centers." These results are presented as one-hundred percent stacked bar charts to convey the relative percentage of responses within each academic centre while providing an at-a-glance view of similarities across all academic centres. Given five years of IWB institutional deployment as detailed in the case description, the findings illustrate (1) IWB utilization, (2) adoption rates and relative importance of the companion software which enables development of learning interactivities (3) essential features, and (4) extent of IWB student utilization.

Table 2: Response Rate by Academic Centre

Academic Centre	Response rate
Centre for Applied Arts and Science	20%
Centre for Applied Management	34.40%
Centre for Health and Wellness	12%
Centre for Justice and Human Services	11.20%
Centre for Technology, Environment, and Design	20.8%
Other	*1.6% (*Excluded from further analysis*)

[2] InfoComm International. About us: https://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/aboutus.htm

A. IWB utilization

Approximately sixty-five percent of all respondents (Figure 7) agree to strongly agree that their main use of the IWB is to present/share digital information–the most frequent response across all academic centres (Figure 7A).

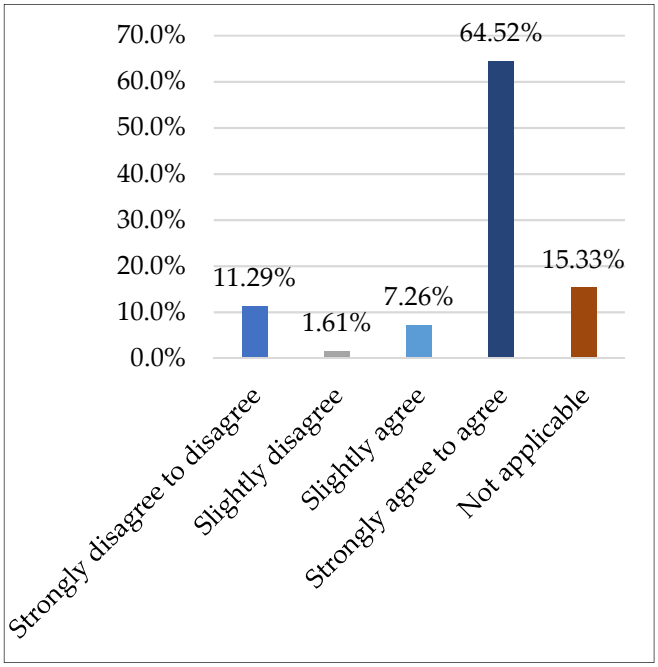


Figure 7. **(Institutional results.) My main use of the IWB is to present/share information**

B. Adoption and relative importance of companion software

Seventy-three percent of respondents indicated they use the IWB companion software in less than one-quarter of their lessons (Figure 8), with the remainder utilizing it in one quarter to all lessons. Centre-specific results (Figure 8A) reveals the highest relative frequency is in the Centre for Applied Management with thirteen respondents using the companion software in fifty to one-hundred percent of lesson plans. Sixty-six percent of respondents across all academic centers (Figure 9) ranked the companion software as being not at all important to slightly important. Relative to other academic centres, faculty in the Centre for Applied Management (Figure 9A) most frequently indicated the companion software was important to very important.

C. Essential features

Fifty-one percent of respondents across all academic centers (Figure 10) did not identify any essential or "must have" features of the companion software for their lesson delivery, with the remainder identifying embedded video, interactive response and 3D tools as three of the top features. The extent to which tools are considered "must have" or essential, is noted to vary across academic centres (Figure 10A).

D. Student utilization

Almost seventy-four percent of respondents (Figure 11) indicated that students *never to rarely* interact with the classroom IWB, with the remainder indicating occasional to very frequent usage. The Centre for Applied Management reveals the highest proportion of faculty indicating student usage on an "occasional" basis (Figure 11A).

Document review results: IWB installation and mounting

Institutional findings reveal the most frequent use of IWBs is to present and share information (Figure 7) thus underscoring the importance of IWB placement and installation, as noted by Betcher and Lee (2009). Review of InfoComm's *AV/IT Infrastructure Guidelines for Higher Education (2014),* indicates, firstly, in a non-tiered or flat classroom, the bottom edge of the screen's viewable area be no less than 48" (1.2m) above the floor with an ideal mounting height of 53" (1.35m), and secondly, that maximum (*not optimal*) viewing distance is contingent on type of displayed material (e.g., text, video) and the type of viewing behavior required of the participants (Table 3).

Projector manufacturer, Epson offers a third type of viewing, "passive", with a suggested viewing distance of no more than 8 X Height. Figure 12 presents a visual explanation of the 4/6/8 rule as interpreted by Epson.

Applying the four, six and eight rule at our institution, with IWB dimensions of 46" X 82", reveals maximum viewing distances of 15.3 feet (184 inches), 23 feet (276 inches) and 30.67 feet (368 inches), respectively. Given a sample mean of 30.22 feet (362.72 inches) for classroom depth with a standard deviation of 8.41 feet (100.97 inches), it is estimated that the classroom depth in all Type 1 to Type 5 classrooms will fall within the interval of 27.03 to 33.43 feet (324.32-401.13 inches) at a 95% level of confidence (see Table 4). Current IWB dimensions, therefore, are best suited for passive viewing, e.g., watching a video.

Table 3: Viewing type on maximum viewing distance (InfoComm International, 2014).

Basic or detailed or viewing	The farthest viewer must not be farther than a distance equal to *6 X Display Height* from the center of the screen.
Inspection or analytic viewing	The farthest viewer must not be farther than a distance equal to *4 X Display Height* from the center of the screen.

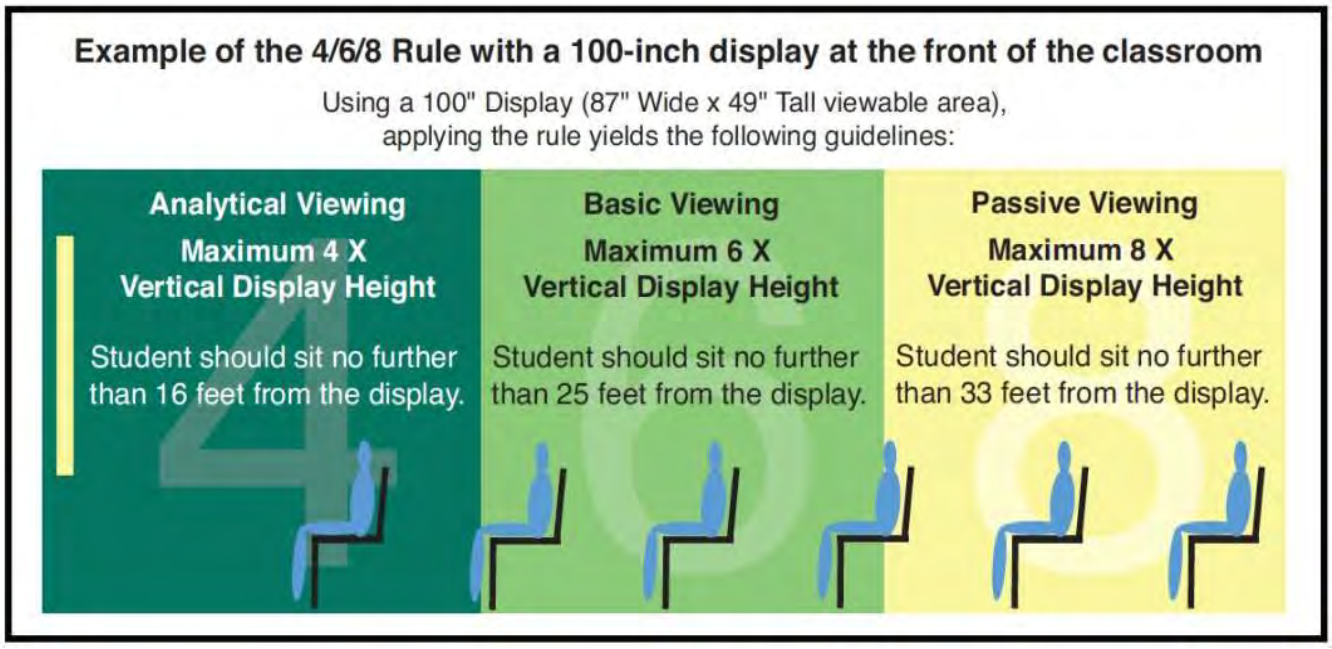


Figure 12. **Epson 4/6/8 Rule for Viewing Distance (2016).**

Figures 7A, 8, 8A

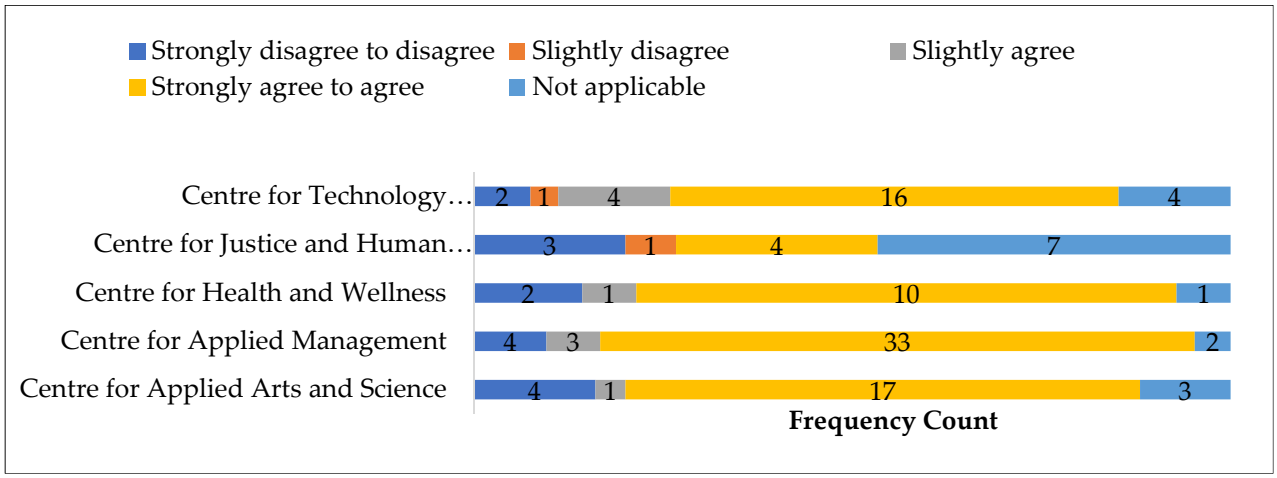


Figure 7A. **(Academic centres.) My main use of the IWB is to present/share information**

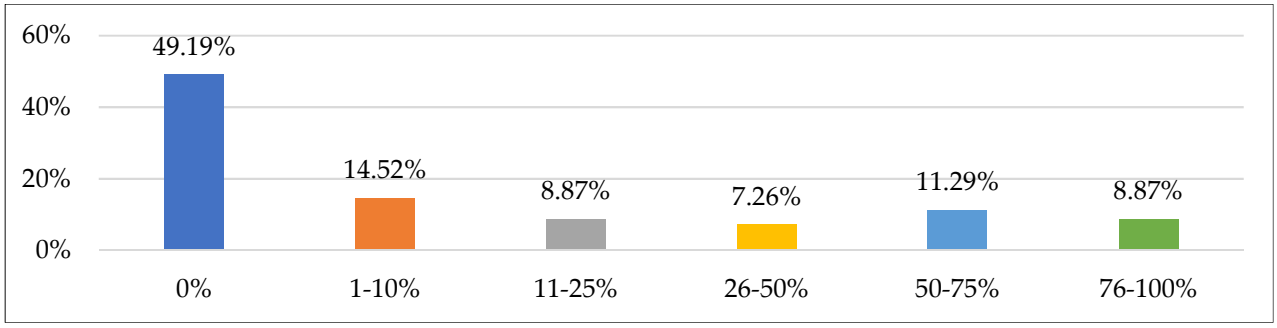


Figure 8. **(Institutional results.) What percentage of your lesson plans utilize the companion software, not including the inking tool? (n=123).**

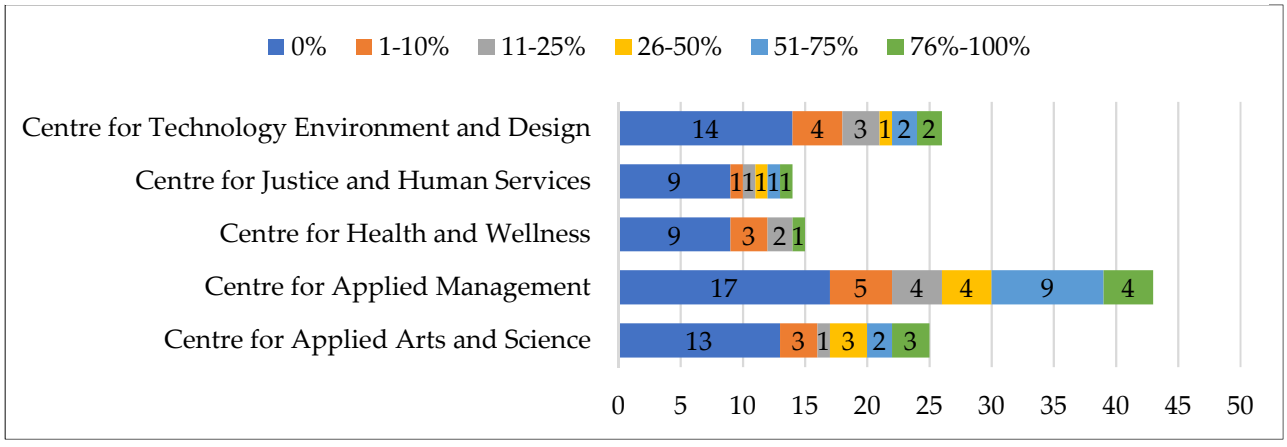


Figure 8A. **(Academic centres.) What percentage of your lesson plans utilize the Smart Notebook software, not including Smart Ink?**

Figures 9, 9A, 10

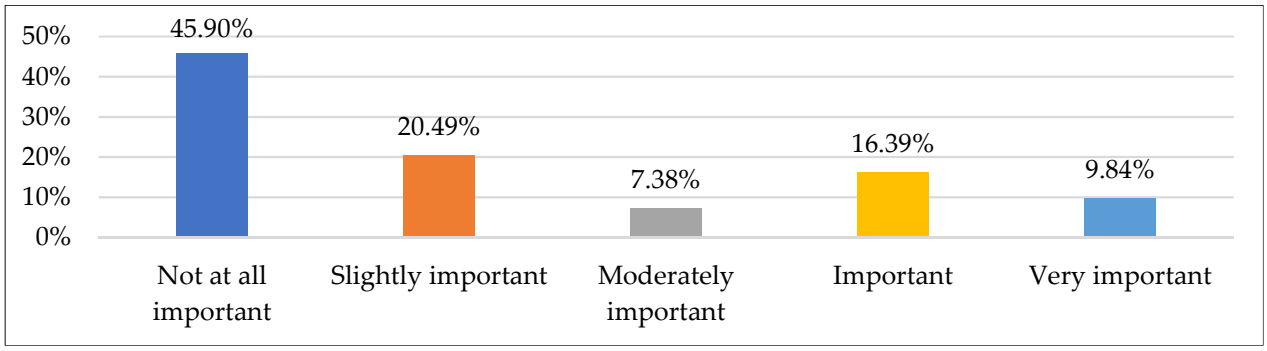


Figure 9. **(Institutional results.) Please rank the importance of the companion software for your lesson delivery (n=120)**

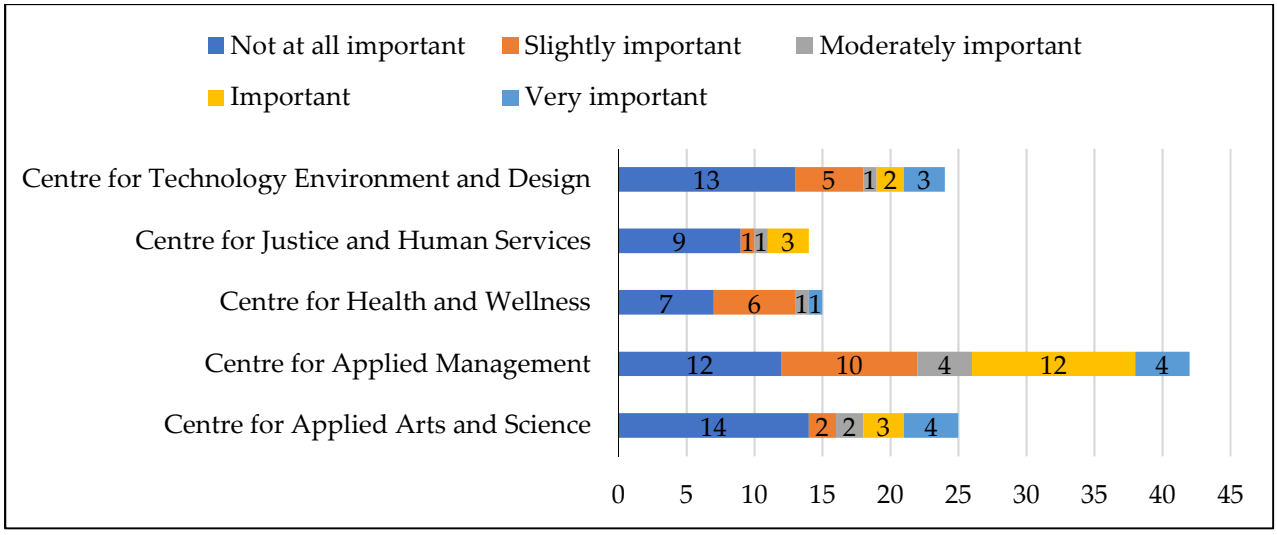


Figure 9A. **(Academic centres.) Please rank the importance of the companion software**

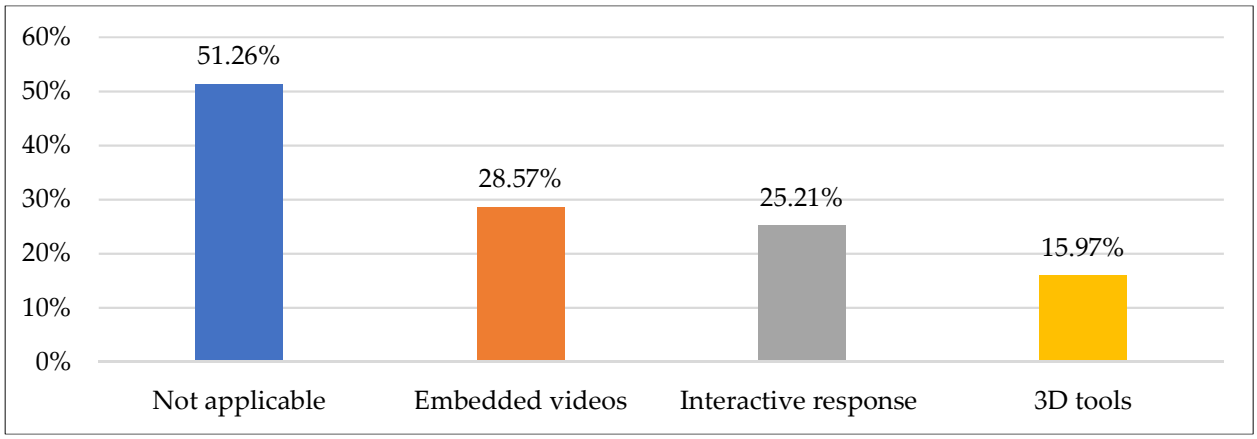


Figure 10. **(Institutional results.) Please select any "must have" or essential features of the companion software for your lesson delivery (not including the inking tool) (n=119).**

Figures 10A, 11, 11A

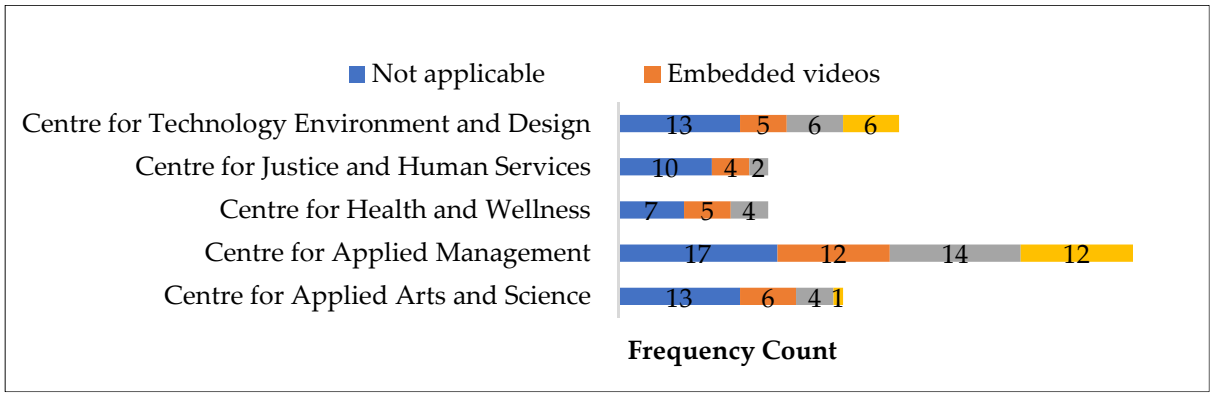


Figure 10A. **(Academic centres.) Please select any "must have" or essential features of the companion software for your lesson delivery (not including the inking tool).**

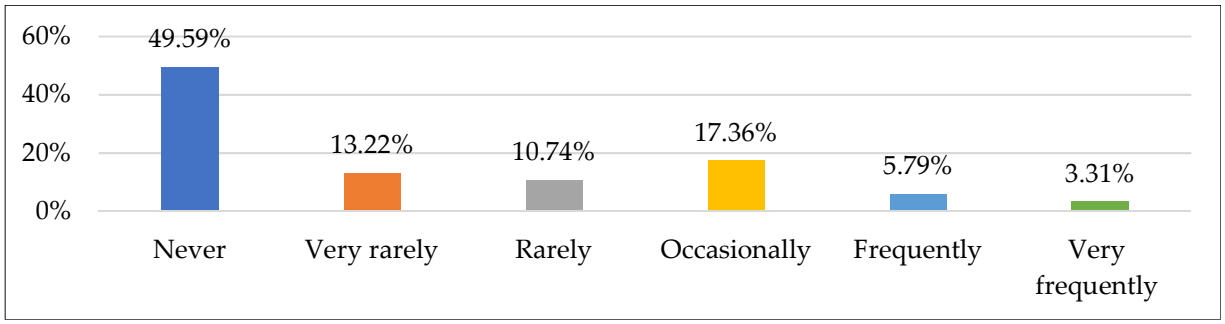


Figure 11. **(Institutional results.) How frequently do students physically interact with the IWB in your class? (n=121)**

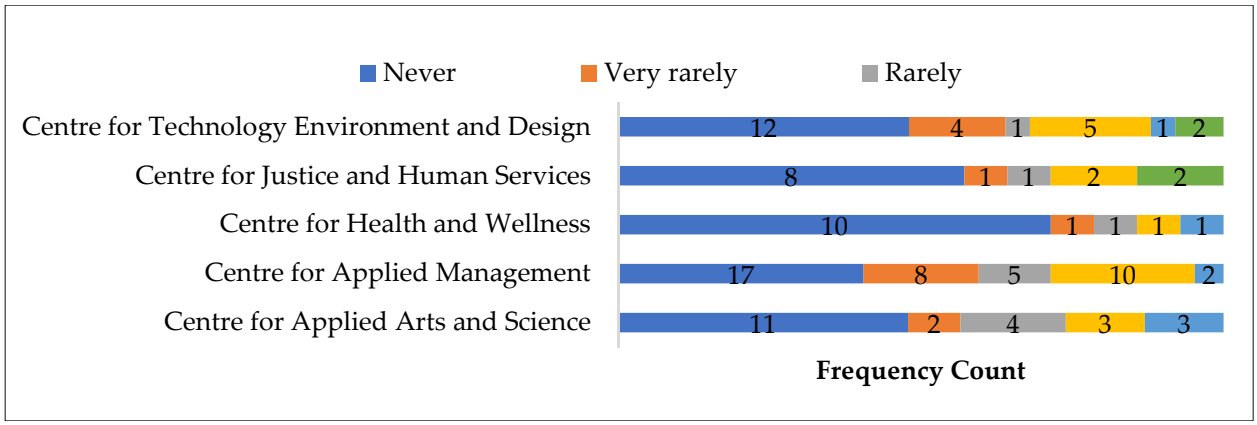


Figure 11A. **(Academic centres.) How frequently do students physically interact with the IWB in your class?**

Table 4: Institution maximum viewing distance

Viewing type	Maximum viewing distance given display height of 46″	Institutional sample mean of Type 1-Type 5 classrooms	Population mean of Type 1-Type 5 classrooms
Passive viewing (8X)	23 feet up to 30.67 feet	$\bar{X}$=30.22 feet sd=8.41 feet	95% CI [27.03, 33.43 feet]
Basic or detailed or viewing (6X)	15.3 feet up to 23.30 feet		
Inspection or analytic viewing (4X)	Up to 15.3 feet		

Further study

Although this research achieved the stated research goals, there were some unavoidable limitations resulting from time constraints. First, missing from this study is qualitative feedback from faculty explaining the generally low utilization rates of IWB features and, in contrast, the higher utilization rates within a few select programs. Second, the students' experience of IWBs is notably absent from this study. Future research efforts would benefit from more in-depth methods of participant engagement, including interviews and/or focus groups.

Discussion

Classroom projection solutions, specifically, interactive whiteboards (IWBs), are not insignificant mediators of teaching and learning processes. In classrooms, such technology is implemented to support the comprehensible transmission, amplification, and capture of information (e.g., text, audio, video), whether generated by instructors or students. Review of the literature indicates an internationally sustained and extensive uptake of IWB technology, primarily to enable whole class teaching and learning. Despite purported benefits, the extent to which defining IWB features, most significantly, interactivity, are utilized to support teaching and learning processes has remained unclear. Moreover, the literature shows that the relationship between IWBs and student achievement remains elusive, in part attributable to the individual (e.g., teacher confidence), institutional (e.g., available staff supports), and technical factors (e.g., hardware, software) that vary across classrooms and institutions. The literature further reveals that IWB research studies are frequently carried out too soon after implementation, providing only limited details on the institutional context.

Using a case-study approach, encompassing two methods of data collection (instructor survey and document review) this research effort addresses gaps in the literature. A rich description of a Canadian college with over five years of IWB utilization experience provided the context to explore the IWB contribution to teaching practices and the IWB impact on student learning experiences. Findings indicate that despite having implemented numerous best-practices to support IWB utilization over the past five years, with comparatively higher rates of instructor satisfaction on measures, including professional development opportunities, classroom technology reliability and ease of use when compared to other post-secondary institutions, IWB affordances are significantly underutilized by most instructors. Seventy-three percent indicated they use the IWB software in less than one-quarter of their lessons with the majority (49.2%) indicating they never use it, and fifty percent indicated students never physically interact with the IWB. A small subset of programs, however, do demonstrate greater utilization rates of IWB interactive features than others, illustrating the potential importance of disciplinary context on IWB adoption and utilization, as noted by Gregorcic, Etkina, and Planinsic (2017).

With sixty-five percent indicating the primary use of the IWB is to present/share information, the extent to which students benefit from IWB technology when contrasted against more cost-effective solutions such as a digital projector and screen, an issue raised by Karsenti (2016) remains an open question, as do the key conditions institutions need address to ensure higher rates of IWB interactive features. Document review of audio-visual installation guidelines further reveals important considerations to ensure the display or projection solutions are right-sized based on room dimensions. A proportional stratified random sample (Type 1 to Type 5 classrooms, n=29), calculated based on a measurement from students seating in the furthest row from the interactive whiteboard, indicates an average classroom depth of 30.22 feet (362.72 inches) with a sample standard deviation of 8.41 feet (100.97 inches); 95% CI [27.03, 33.43 feet]. Using this industry standard formula suggests that a subset of students, those seated beyond the threshold of 15.3 feet and 23.3 feet, may experience a diminished ability to perceive and engage in basic and analytic type viewing activities. In the context of learner and learning centered classrooms, our institution, therefore, needs to consider the level of acceptable level deviation (e.g., 5-10%).

Conclusion and reflection

A billion-dollar industry, IWBs and their companion software are purported to create opportunities for innovative teaching and learning practices, most notably in the form of at-the-board digital interactivity. As a case study, this research provides a rich description of a Canadian college with over five years of IWB implementation experience. Despite an institutional context that demonstrates enactment of numerous best practices and comparatively higher rates of instructor satisfaction on key measures relating to implementation when compared to other institutions, institutional survey findings reveal limited uptake and utilization of IWB interactive features amongst faculty.

This research concludes by noting that the overall IWB contribution to student learning has been limited with potentially detrimental impacts on student perception and comprehension given IWBs smaller size and lower mounting position when compared to traditional projection screens. Additional investigation is required to ascertain the ideal circumstances and context in which to deploy interactive whiteboards to ensure interactive features are utilized while at the same time ensuring students can adequately perceive displayed information.

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Appendix 1. Instructor IWB Survey

1. In which school do you teach? *(select from drop down list).*
2. The Smartboard I use most is: *(A) mounted on the wall, (B) mounted on a moveable cart, (C) I don't use the Smartboard.*
3. Which operating system do you use? *(A) Mac OS, (B) Windows, (C) other (please specify).*
4. What percentage of your lesson plans utilize the Smart Notebook software, not including Smart Ink? *(A) 0%, (B) 0-10%, (C) 11-25%, (D) 26-50%, (E) 51-75%, (F) 76-100%.*
5. Please select any "must have" or essential features of the Smart Notebook software for your lesson delivery (not including Smart Ink): *(A) not applicable, (B) embedded videos, (C) Smart Response, (D) Smart 3D Tools.*
6. Please rank the importance of Smart Notebook software for your lesson delivery: *(A) not at all important, (B) slightly important, (C) moderately important, (D) very important.*
7. Any other information you would like to share about the Smart Notebook software? *(open response).*
8. What percentage of your lesson plans utilize Smart Ink capability to make annotations? *(A) 0%, (B) 0-10%, (C) 11-25%, (D) 26-50%, (E) 51-75%, (F) 76-100%, (G) What is Smart Ink?*
9. What tool/equipment do you use to make annotations with Smart Ink? *(A) I use a mouse, (B) I use the Smart Pen, (C) not applicable, (D) other (please specify).*
10. How frequently do you use the Smart Ink feature in your class? *(A) never, (B) very rarely, (C) rarely, (D) occasionally, (E) frequently, (F) very frequently.*
11. What percentage of your lesson plans utilize Microsoft Ink capability to make annotations? *(A) 0%, (B) 0-10%, (C) 11-25%, (D) 26-50%, (E) 51-75%, (F) 76-100%, (G) What is Microsoft Ink?*
12. Please identify your level of satisfaction with Smart Ink: *(A) very dissatisfied, (B) moderately dissatisfied, (C) slightly dissatisfied, (D) neutral, (E) slightly satisfied, (F) moderately satisfied, (G) very satisfied.*
13. What tool/equipment do you use to make Microsoft Ink annotations? *(A) I use a mouse, (B) I use the Smart Pen, (C) not applicable.*
14. How frequently do you use the Microsoft Ink feature in your class? *(A) never, (B) very rarely, (C) rarely, (D) occasionally, (E) frequently, (F) very frequently.*
15. Please rank your level of satisfaction with Microsoft Ink: *(A) very dissatisfied, (B) moderately dissatisfied, (C) slightly dissatisfied, (D) neutral, (E) slightly satisfied, (F) moderately satisfied, (G) very satisfied.*
16. Please identify the relative importance of each for your lesson delivery: *(A) I use the Smartboard to display instructional content/information (e.g., PowerPoint, software demonstrations, video), (B) I use the Smart Notebook software, (C) I use the Smartboard Ink features for annotation, (C) I use the Microsoft Ink features for annotating on Microsoft applications.*
17. My main use of the smartboard is to present/share information (e.g., PowerPoint, software demonstrations, video): *(A)strongly disagree, (B) disagree, (C) slightly disagree, (D) undecided, (E) slightly agree, (F) agree, (G) strongly agree, (H) not applicable.*
18. How frequently do students physically touch/interact with the Smartboard in your class? *(A) never, (B) very rarely, (C) rarely, (D) occasionally, (E) frequently, (F) very frequently.*
19. Do you require use of the BluRay/DVD player in the classroom? *(A) yes, (B) no.*

20. Please rank your level of satisfaction with the size of the Smartboard display: *(A) very dissatisfied, (B) moderately dissatisfied, (C) slightly dissatisfied, (D) neutral, (E) slightly satisfied, (F) moderately satisfied, (G) very satisfied.*
21. Please provide your name if you would like to be contacted to share additional information. Is there any other feedback you would like to share about the following classroom technologies: instructor podium, DVD/BluRay players, and whiteboards.