

## Elementary Teachers' Uses and Perceptions of Interactive Whiteboards for Instruction

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**Abstract.** This research examines several public school teachers' perceptions and usage of interactive whiteboards (IWBs). The study was conducted using the conceptual framework of Roger's (2003) theory of diffusion and innovation, Davis' (1989) technology acceptance model and Ajzen's (1991) theory of planned behavior. Nine public school elementary teachers who used IWB technology in their classrooms for a full academic year were selected as the participants for this research study. The data were collected using two interviews over Skype or phone in conjunction with an analysis of lesson plans snapshots. The teachers' experiences were classified according to *lesson development with IWBs, teaching using IWBs, and assessing students with IWBs*. The teacher's perceptions were categorized as *the successful integration of IWBs, pedagogical practices with IWBs, general issues with IWBs, and school support*. The study concluded that overall teachers have positive attitudes towards IWBs and see integrating technology as a beneficial aid in their pedagogical practices. In addition, the participants identified the need for professional development, extra planning time for new lessons development, consistent technical support, and upgrades to the technology as essential elements for the successful implementation of IWBs in the classrooms.

**Keywords:** interactive whiteboard, public school, elementary teacher, technology, innovation.

### Introduction

In the Vockley's (2007) research study, the author concluded that in a digital world without incorporating technology into everyday practice no organization could achieve considered necessary results. According to existing research, the extensive use of technology is necessary for educational systems to guide students in the global economy blending this technology into lessons to increase student achievement and so that students may be successful in their future (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). The 21st century involves the integration of technology to support the innovative

education that is necessary for the development of the advanced potential students' needs (Voogt, Erstad, Dede & Mishra, 2013).

A good example of educational technology is the interactive whiteboard (IWB) extensively introduced in Turkey in the early 1990s (Şad & Özhan, 2012). According to Gursul and Tozmaz (2010), this technology might be a revolutionary teaching tool for the twenty first century. According to current research, the use of IWB technology in classrooms may enable instruction to be "more productive, creative, and efficient for all learners" (Samsonova, 2017). By using IWBs, teachers might support reflective practices in schools and keep students' attention by enhancing the visual quality of instruction materials especially on the elementary level (Gursul & Tozmaz, 2010; Samsonova, 2017). Murcia (2014) noticed that compare to secondary students young scholars have a high level of learning engagement interacting with IWBs. Besides, the IWB gives elementary students opportunity to understand information in several formats, which "helps enhance the synthesis and retention of information" (Murcia, 2014, p.76). Lastly, IWBs also enable professionals to plan and deliver lessons resourcefully and systematically (Gursul & Tozmaz, 2010).

The research in this study is based on work presented in Samsonova (2017). Founded in the literature review, there is narrow research on using IWB technology learning resources to develop lessons in elementary schools (Samsonova, 2017). There is also limited research on IWB teaching methods and procedures, such as interactive activities, creating PowerPoint presentations, and whole-class discussions in primary schools (Lopez & Krockover, 2014; Samsonova, 2017). Finally, there is deficient research on assessing and evaluating students' knowledge using IWBs in elementary schools (Samsonova, 2017; Teck, 2013).

### **Literature Review**

The research on the integration of IWBs into the classroom included studies that emphasize the benefits of and issues with the IWB technology. Besides, it identified several aspects that influenced whether this technology was incorporated effectively to encourage advanced students' learning (Samsonova, 2017). These factors incorporated: the pedagogical practices and beliefs of the teachers, the types and quality of professional development, and the nature of the school's support for the teacher.

The IWB users, such as students, teachers, and school administrators, offered a broad spectrum of opinions about the IWBs, highlighting both negative and positive sides (Corbo, 2014; Tertemiz, Sahin, Can, & Duzgun, 2015; Turel & Johnson, 2012). The existing studies about the IWBs highlighted that digital education in the classroom endorsed learner-centered pedagogy and positive social norms, and underscored that IWBs were advantageous in that they: (a) enhanced interactions in combination with a remote device; (b) supported collaborative learnings; (c) facilitated learnings; (d) saved the instructor's time; and (e) enhanced class management and preparation (Berson, Cross, Ward, & Berson, 2014; Tertemiz et al., 2015; Yang & Teng, 2014). The current research also pointed out several advantages IWBs had over conventional whiteboards such as interactivity, efficiency, lesson participation, idea sharing, collaboration, and

the capability to save and post writings and drawings (Alvarez, Salavati, Nussbaum, & Milrad, 2013; Lopez & Krockover, 2014).

The increasing body of research studies signified that IWBs enhanced learners' motivation and had an encouraging effect on their achievement (Emeagwali & Naghdipour, 2013; Fraser & Garofalo, 2015). IWBs know how to improve students' motivation to learn, supporting theoretical learning with a visual representation (Begolli & Richland, 2015). The Tertemiz et al.'s (2015) study established that IWBs enlarged learners attention and motivation and that students recognized IWBs as exciting. IWBs can make a big difference in students' achievement (Amiri & Sharifi, 2014; Katwibun, 2014). Also, IWBs might provide an instructional enrichment facilitating active engagement, learning, and creativity in learner-centered environments (Fessakis, Gouli, & Mavroudi, 2013; McCrea, 2014). The research also found that students and educators were pleased and had positive attitudes toward powerful and practical IWB technology (Emeagwali & Naghdipour, 2013) and that this technology made a tremendous impact on learning and teaching (Bakadam & Asiri, 2012; Tosuntaş, Karadağ, & Orhan, 2015).

Regarding benefits for student learning, the present research recognized that IWBs could potentially increase the quality of subject and social interactions among teachers and students, and boost conceptual and problem-solving understanding (De Vita, Verschaffel, & Elen, 2014; Lopez & Krockover, 2014). The literature also recommended that use of IWBs supported professionals by helping to advance the students' participation, motivation, and concentration (Erbaş, Ince, and Kaya, 2015; Ozerbaş, 2013). Mellingsaeter and Bungum (2015) found that IWBs facilitated the collective meaning-making process in group work, in which educators, and sometimes learners, modeled the dialogue and guided the students' engagement.

On the other hand, in Erbaş, Ince, and Kaya's (2015) research study that evaluated the IWB classrooms to the conventional classroom environments, learners in the IWB classrooms did not improve reasoning and interpretation and skills as much as those learners in the traditional classroom. Besides, technical problems with IWB affected learners negatively and interrupted the order in the classes. The next problem identified in the research was deficient in collaborations and interactivity with the IWBs (Samsonova, 2017). Decreasing the number of students in the classrooms was suggested for a more interactive learning environment (Bakadam & Asiri, 2012). Researchers also found that educators experienced struggle related to a lack of academic knowledge, concerns with technical skills, and a need for access to materials required for well-organized IWB use (Korkmaz & Cakil, 2013).

Regarding pedagogical practices with IWBs, researchers found that educators preferred to use IWBs rather than other boards and alleged that the IWBs "improved teaching performance, stimulating attractive pedagogical approaches with the highest level of interactivity in the classroom" (Bidaki & Mobasheri, 2013, p.142). IWBs were found to support professionals in lesson development, contribution learning resources, and making the lessons fun, entertaining, and comprehensible to learners (De Koster, Volman, & Kuiper, 2013). Additionally, Teck's (2013) qualitative research study found that IWBs were practical tools for enhancing learning processes and that educators demonstrated consideration in

incorporating assessments with the IWBs because they offered an excellent means to assess young children's learning efficiently and quickly. According to Türel and Johnson (2012), teachers mostly avoided using IWBs during their lessons, but, if they did integrate IWBs into their experiences, most teachers used IWBs as overhead projectors and for Internet research.

Research also identified the need for professional development for educators to integrate IWBs into their classrooms (Akkoyunlu & Baskan, 2015; Korkmaz & Cakil, 2013). Bourbour, Vigmo, and Samuelsson's (2015) study; Erbas, Ince, and Kaya's (2015) research; and Lopez and Krockover' (2014) study all concluded that IWBs were most useful if the educators knew how to utilize technology. Teachers require special IWB training, as well as guidance to prepare resources needed for IWB usage (Korkmaz & Cakil, 2013). Professional development in how to use the software: (a) basic techniques such as learning to organize files into folders; (b) recognizing different types of files; and (c) using digital resources efficiently in classroom sustained the new technology integration (Peled, Medvin, & Domanski, 2015; Whyte, Schmid, van Hazebrouck Thompson, & Oberhofer, 2014). Türel and Johnson (2012) established that through a partnership with colleagues, the teachers' IWB skills enhanced as they used the IWBs more often and educated each other. Hennessy, Haßler, & Hofmann (2015) suggested whole school training to integrate IWBs into classroom practice.

Most of the teachers identified school support issues with successful IWB integration, including insufficient numbers of professional development classes and a deficit of experts in schools for urgent technical assistance with IWB struggles (Akkoyunlu & Baskan, 2015). Teachers stated that they could not find appropriate resources on the Internet and incorporate them into their lessons within a limited amount of time (Bidaki & Mobasheri, 2013; Corbo, 2014). Teachers also needed time to become familiar with the IWBs, and to consider how to incorporate them into their teaching strategies and methods (Peled, Medvin, & Domanski, 2015; Whyte et al., 2014).

In conclusion, with several studies with mixed results, the main difference between efficient and non-effective IWBs integration into classrooms is to support the advanced learning processes of students including teachers' pedagogical beliefs, professional development, and school support for teachers, such as time to develop materials and technical assistance (Samsonova, 2017).

### **Conceptual Framework**

This study utilizes three conceptual theories to understand the issues inherent in the participants' experiences: (a) Rogers' (2003) theory of diffusion and innovation; (b) Davis's (1989) TAM model, and (c) Ajzen's (1991) TPB. Rogers' theory contributes to understanding the acceptance level of innovation as a new technology, the IWBs, is integrated into the teachers' classroom (Samsonova, 2017). The teachers' experiences with IWBs were interpreted through Davis's theory, and Ajzen's model was used to understand the participants' beliefs about IWB usage.

Barriers to innovative technology integration exist at every level of the educational system (Çelik, 2015). Individuals vary in how they perceive, accept, and use innovative technology (Rogers, 2003). How teachers admitted and utilized new technology in their everyday teaching practices was central to this

study. The conceptualizing and conducting of the research was informed by Rogers' (2003) theory of the diffusion of innovations, primarily the concepts of *observability, compatibility, complexity, and relative advantage*. Besides, Davis's (1989) definition of *perceived ease of use* (in this study, the level to which teachers expected the use of IWBs to be free of effort) directly informed the development of Research Question 1. Ajzen's definitions of *normative, behavioral, and control beliefs* were used to understand the expectations of individuals about a behavior (IWB integration) and informed the development of Research Question 2.

### Research Methodology

The purpose of this qualitative study was to understand the experiences and views of elementary teachers integrating IWBs for pedagogical practices. This study was conducted using a case study approach because of its value in exploring, describing, interpreting, and explaining individuals' experiences (Stake, 1995). This type of approach allowed for the identification of key themes and clarification of educators' perspectives on the use of IWBs when analyzing data. The research questions were the following:

RQ1: *What are the experiences and views of elementary teachers integrating interactive whiteboards in their classrooms?*

RQ2: *How do elementary teachers integrating interactive whiteboards in their classrooms view the use of the IWB?*

A purposeful sampling was used for the participants' recruitment using the following criteria: (a) teachers identify themselves as full-time public school elementary educators teaching Pre K-5th grades, (b) teachers indicate that they have implemented the IWBs into their professional practice, and (c) teachers suggest that they have used the IWBs for at least a full academic year. An attempt was made, through sampling, to include diversity such as gender, racial-ethnic groups, educational backgrounds, and various years of experience working as elementary public school teachers. There were nine study participants selected for this study. Table 1 includes an outline of the demographics of the participants.

**Table 1: Participants Demographics**

Name	Specialization	Grade	Gender	Years of experience	Education
1. Ms. B	Special Education	2nd	F	10-15	Master's
2. Mrs. E	Special Education	1st	F	5-10	Master's
3. Mrs. F	General Education	K	F	15-20	Master's
4. Mrs.H	General Education	2nd	F	5-10	Master's
5. Mrs. I	General Education	Pre-K	F	0-3	Bachelor's
6. Mrs.M	General Education	3rd	F	5-10	Master's
7. Ms. T	General Education	K	F	15-20	Master's
8. Ms. A	General Education	4th	F	10-15	Master's
9. Mr. H	General Education	5th	M	3-5	Bachelor's

### **First Interview**

Two semi-structured interviews were scheduled with each participant via Skype or phone for approximately one hour each. The interviews were expected within a few days of each other. Besides, the participants e-mailed snapshots of their IWB lesson plans for use in conjunction with the interviews. For the first interview, the following interview questions were used:

- *How do IWBs affect your planning/preparation of lessons?*
- *How do you use IWBs in your classroom?*
- *What are the difficulties you experience in developing and teaching lessons with IWBs and their features?*
- *What are the benefits of using IWBs and their features for developing and teaching lessons?*
- *How do you use IWBs for whole class teaching?*
- *How do you use IWBs to ensure all children are motivated and engaged in learning?*
- *How do you use IWBs for assessing your students' learning?*
- *What types of additional resources do you use with your IWB?*

### **Second Interview**

The first interview was coded to recognize areas for more in-depth discussions and clarifications before scheduling the second interview. The second set of interview questions for each participant was revised based on this coding, resulting in the following interview questions:

- *How do IWBs help you support your students' learning?*
- *How do IWBs affect your expectations of what your students will learn?*
- *Do you believe that using an IWB motivates and engages your students in learning?*
- *How has the school supported your integration of IWBs?*
- *What are ways the school could provide better support?*
- *Are there other ideas or experiences you would like to discuss?*

Below in Figure 1 are the coding structures that resulted from the analysis as they relate to the first research question, which was, "What are the experiences of elementary teachers integrating interactive whiteboards in their classrooms?" Figure 2 represents the coding structures as they relate to the second research question, which was, "How do elementary teachers integrating interactive whiteboards in their classrooms view the use of the IWB?"

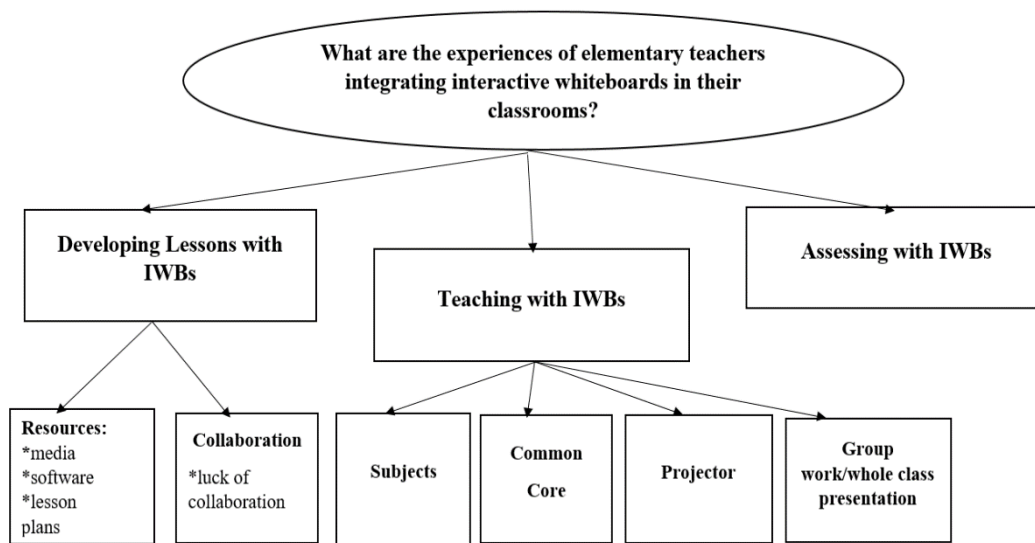


Figure 1: Coding concept map for Research Question 1

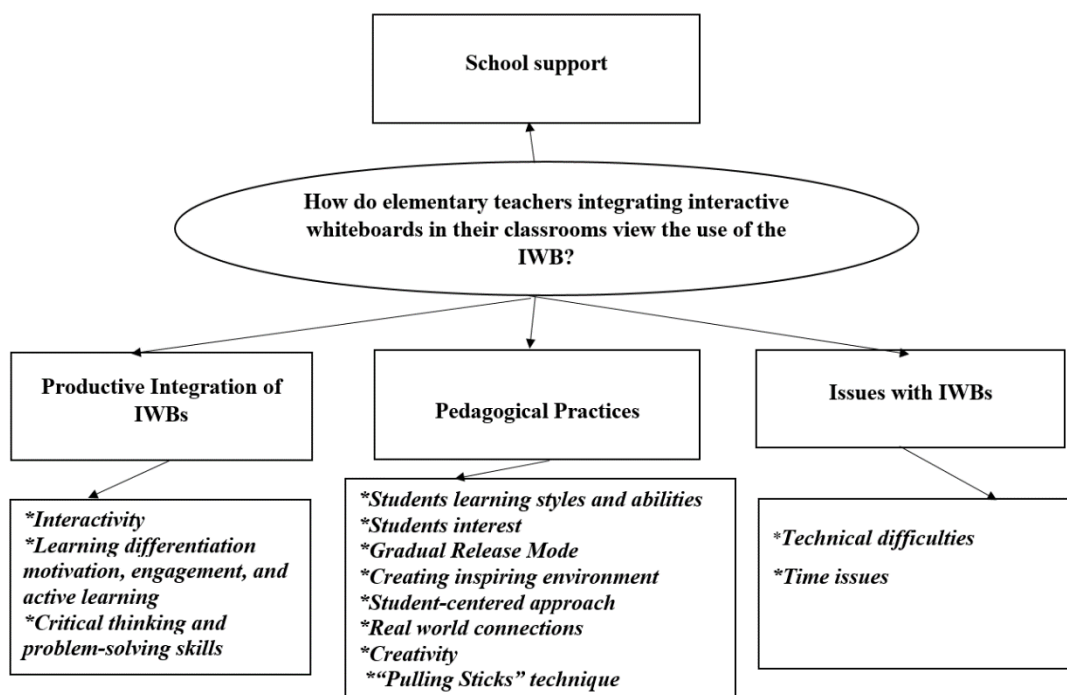


Figure 2: Coding concept map for Research Question 2

### Interpretation of the Findings

The purpose of this study was to find out the public school elementary teachers' experiences with IWBs and their views about implementing IWBs in the classrooms. Overall, the results showed that teachers perceived and used IWBs as a useful instructional tool, which confirmed the literature review findings and extended knowledge about the school technology integration process. For the first research question, "What are the experiences of elementary teachers

integrating interactive whiteboards in their classrooms”, analysis of data showed that the participants saw IWBs as an excellent tool for planning and creating lessons by incorporating videos, interactive games, graphics, images, and educational websites into the lesson content. They shared their experiences with the collaboration process during lesson development at their schools. The participants also cited several ways of using IWBs for different subjects and as an assessment tool.

For the second research question, “How do elementary teachers integrating interactive whiteboards in their classrooms view the use of the IWB?”, the teacher participants perceived the IWB as a tool that fosters lessons interactivity, learning differentiation, student motivation, engagement, critical thinking, and problem-solving skills. Also, some teacher participants recognized difficulties in using IWB for teaching. They suggested that administrators need to provide teachers with additional technical support and extra time for planning lessons with IWBs. Six teacher’s participants displayed positive attitudes toward school support in implementing IWBs; however, three participants recognized that there was no support. All research participants recommended technological and curriculum training, purchasing new software and updating the existing software, teacher collaboration, and more school-based technical support.

### **What are the Experiences of Elementary Teachers in Integrating Interactive Whiteboards in their Classrooms?**

Research Question 1 centered on the participant’s experiences with IWBs. The research data found that all participants used IWBs as a powerful teaching tool that provided resources for lesson planning, enhanced their lesson demonstration, improved the quality of their interactions with students and assessments through effective questioning, and increased the depth and the pace of learning. These results correlated with some researched-based practices and provided new insights into IWB use.

**Developing lessons with IWBs.** The results showed that IWBs enhanced the overall teaching experience. Teachers indicated that having access to IWBs increased their understanding of technology and that they were comfortable using IWBs as an instructional tool. The whiteboard software allowed participants to create resources that students would find fun and motivating

The participants’ experiences with IWBs were interpreted through Davis’s (1989) TAM definition of *Perceived Ease of Use*. The participants stated that the use of IWBs enhanced their lesson preparation and reduced the start-up time for lesson integration because they were easy to use. As found through the study, use of IWBs motivated participants to develop and incorporate more digital resources in their lessons. Also, use of IWBs enabled teachers to save notes for use in the following year and made it easier to create a collection of education materials that could be updated continuously, thus keep lessons interactive and fresh.

Currently, there is an extensive range of digital resources that teachers may use to enhance learning. The participants stated that they had access to a variety of resources for different topics which might be explored on the IWB. They also said that they did not have to waste time creating their resources. However, new teachers said they were concerned that they spent too much time finding these resources, adapting them to their lessons, and developing teaching tactics to



deliver this material. This result is similar to Bidaki and Mobasheri's (2013) finding that it is complicated for educators to select useful information from the Internet.

Media resources, such as videos, games, educational websites and graphics, and educational software were cited as tools that provided diverse teaching methods for learning. The participants believed that media resources could be used to simplify and clarify problems and let students access the learning material as often as they want. According to the participants, a range of educational software is now available for any school subject, and schools are purchasing high-quality curriculum-specific resources for teachers. Confirming Erbas, Ince, and Kaya (2015) findings, this study emphasized that better IWB integration with proper software would support whole-class demonstrations, discussions, and students' investigations.

Participants indicated an absolute preference for using PowerPoint and Notebook presentations to structure and present their IWB lessons. Each participant mentioned that by using a moderately short-term investment of time at the start to create these presentations; they received long-term benefits in both the quality of the presentations and the ease of updating and maintaining these presentations for their teaching; thus, using Notebook and PowerPoint were perceived as very positive activities. Studying Engineering undergraduates' perceptions about IWBs and PowerPoint lecturing, Yee et al. (2017) also concluded that IWBs and PowerPoint tools complemented each other.

The research data showed that IWB lessons could be reused and adapted by teachers according to the students' needs, and shared with colleagues at the same or different schools through saving the lessons as web pages. This collaboration could happen over the Internet, the local school network, or email. The Karsenti's (2016) study found that planning lessons with the IWB took too much time and suggested teacher collaboration as support.

Three study participants mentioned that such collaboration was school policy. Nevertheless, there were some participants who did not have cooperation in their schools and cited that teacher collaboration in the development and usage of IWB lessons would be beneficial for them. There are always hitches, predominantly among the older and less technology-orientated teachers, to adopt new technologies (Bakadam & Asiri, 2012; Korkmaz & Cakil, 2013). They often need extra support from colleagues and school administration.

**Teaching with IWBs.** All teacher participants mentioned that they used IWBs for teaching most of the elementary subjects and aligning their lessons to the common core standards; however, one of the teacher participants only used the projector functions of the IWB, with traditional features as an advantage. In their responses, they specified that in planning lessons that use IWBs to increase students' achievement, the teachers' focus should be on the content substance and not on the flashiness of the features. The participants also indicated that the IWB lessons should include and identify national, state, and local education standards; long-term goals; and short-term objectives.

Teachers identified that students collaborating and communicating were necessary because by design the interactive whiteboard is not a one-person tool (Hadadi, Abbasi, & Goodarzi, 2014). Most of the participants mentioned that the students not only became involved with the IWBs and learning, they also

became involved with one another. They suggested that reasoning, discussing, and explaining solutions are critical to deep understanding; the learning process became reciprocal and verbal.

**Assessing with IWBs.** The research data results indicated that the participants included different types of assessments, such as informal, formative, and summative, in their instructional practices with IWBs. The IWBs encouraged intervention and questioning at a range of levels, as well as closed, open, and interest questions, besides with evaluative responses and probing as part “of the general flow of the lesson” (Teck, 2013, p.6). IWBs also enabled the teachers to quickly assess students and to refer to resources and previous learning. According to the participants' responses, students used the dynamic demonstration of systems, texts, and images to clarify their thinking, to demonstrate their understanding, to support their reasoning, and to teach other students. Confirming the study results, Kyriakou and Higgins (2016) stated IWBs affected summative assessments and classroom talk and suggested enhancing the theoretical framework. They also added the notion that the summative assessments offer considerable insights into students' learning.

Some participants mentioned that IWBs were extremely good for scaffolding - teaching through assessing with guidance from the teacher; students gain skills to build on prior knowledge and corrected mistakes. Two participants included the use of scaffolding using IWBs for mastering writing skills and learning hard concepts in Language Arts. The support provided by the IWB tools allowed students to learn these concepts faster and let teachers modernize lessons and reach students in ways never before conceivable. The De Vita, Verschaffel, and Elen's (2014) literacy review supported these findings underlining that IWBs sustain the lessons progression in achievement and learning to offer structures for assessments, activities, and immediate feedback. The authors noticed that using IWBs; teachers could prompt discussions and explanations in the lessons by getting students to illustrate, direct, and explain from IWBs.

### **How do Elementary Teachers Integrating Interactive Whiteboards in Their Classrooms View the Use of the IWB?**

Research Question 2 investigated the participants' teaching beliefs about the IWBs. The themes that emerged in Question 2 were: productive integration of IWBs, pedagogical practices, issues with IWBs, and school support. The research data found that all participants viewed IWBs as a beneficial instructional tool.

**Productive integration of IWBs.** Theory of planned behavior (Ajzen, 1991) supported this study identifying that positive beliefs about IWBs produced favorable attitudes toward the IWB usage and normative (administration or colleagues) trusts established subjective norms toward the IWB usage. Teachers agreed there are benefits to using IWBs in the classroom. According to the data found, the IWBs promoted increased interaction involving the students, the teacher, the subjects, and the technology itself (Bidaki & Mobasher, 2013). It allowed all students to be engaged with the same central point in the classrooms which was not easy to accomplish with another type of technology (Şad & Özhan, 2012).

The results of the current study clearly showed that manipulating the images and texts on the screen, i.e., *physically interacting with the software*, stimulated “on-task talk.” In Murcia’s (2014) research, students talked much longer than otherwise in their answers and used rich vocabulary in their explanations; being able to “drag and drop” text, images, and sounds on screen allowed for a variety of sorting, categorizing, and sequencing exercises.

*“Hiding and revealing text, images, and the sound is also possible, allowing students to hypothesize and make suggestions”* (Murcia, 2014).

Most of the participants felt that IWBs enhanced better practices in inclusive education. *Planning for differentiated learning* within lessons helped meet the needs of all learners with diverse learning needs. Numerous of these learning styles might be attended to when lesson delivery and education activities involve the IWBs usage (Mead, 2012). Cabus, Haelermans, and Franken (2015) displayed similar notions about learning differentiation and IWBs. They studied the effects of using IWBs on math proficiency and found that the IWB allowed educators to differentiate among secondary education Dutch students. Students in their study helped each other and the extra time was spent with low performers while higher achieving students received additional tasks.

The research participants mentioned that IWBs offered *interactive learning experiences* with topic discussions, concept demonstrations, and opportunities to touch IWBs motivated students to learn. Higher motivation led to greater participation (Begolli & Richland, 2015). An engaged and active learning style matched the needs of a current generation of students who are comfortable as active participants, which supported Fraser and Garofalo (2015) and their findings. In Fraser and Garofalo’s (2015) research, the teachers used IWB programs, PowerPoint files, powerful software packages, and student response systems because they felt that IWBs’ features offered students valuable activities and opportunities to provide timely feedback to students and educators. The researchers stated the IWBs’ advantages could inform educators about the students’ achievements and made the learning process fun and encouraged student engagement.

The study participants agreed that *the adaptation to the students’ means of learning* was needed so they could enjoy learning. IWBs could be the incentive to get them involved (Begolli & Richland, 2015; Fraser & Garofalo, 2015). They believed that students were more engaged in learning when the IWB technology was integrated into instructional activities. *Student engagement*, well known as student investment in education, was recognized as the most substantial aspect of the learning process (Tertemiz et al., 2015).

In the study, the participants cited that involving students in the process was vital to attentive learning; students have to be active participants in their education and take ownership in the learning process. Using an IWB’s ability to display collected information helps students meet *the critical thinking and problem-solving educational standards* by letting them shape the information in diverse ways and by assisting them to process what was exposed. These findings were consistent with the Boubour, Vigmo, and Samuelsson’s (2015) study where the IWB was used to engage young students’ engagement and reasoning in problem-solving activities. The authors found that some IWB features, such as

its colors, touch-sensitive board, and visual nature, could enhance young children's learning and reasoning skills.

**Pedagogical practices.** The research participants came into agreement that the IWB technology use with effective teaching techniques could undoubtedly increase learning opportunities. De Vita, Verschaffel, and Elen (2014) suggested that there is a want to deeply investigate what kind of learning goals and activities IWBs might promote. Are they different from those in a traditional learning environment? An experimental study is needed in this regard.

The results of current study displayed that *seven learner styles named by Gardner* could be addressed by the IWB usage, including visual, kinesthetic, musical, interpersonal, intrapersonal, linguistic, and logical-mathematical (Alonso Suárez, 2013). Teaching students with IWBs, the participants revealed the importance of knowing students' unique perspectives on the world and appreciating the students' interests. Katwibun (2014) specified that it is crucial for the educators to assimilate the IWBs with the learning theory and pedagogy that cater to learners' individual needs. Teachers must take the time to know the students individually by asking about their interests and using this knowledge in creating lessons on IWBs.

*Gradual Release Mode* instructional framework for moving from teachers' knowledge to students' application and understanding was named by participants as an efficient technique for implementing the IWB lesson. This model includes focus lessons when teachers model their understanding of content, establishing the purpose and cluing students into the learning standards. Next step is guided instruction when teachers question and lead students through the lesson content, increasing their understanding. Collaborative learning follows, and students work with their peers using the clues displaying on the IWBs. Then, the last step is independent work, when students transform their ideas and apply them in new ways. There is no research on using this technique in teaching with IWBs so further investigation would be helpful.

*Creating an inspiring classroom environment* was the next active pedagogical practice cited by the participants. The teacher participants stated that teaching lessons with IWBs, teachers have to ensure that a learning environment is valued, respected, and safe for students for them to achieve and establish full potential. The learning environment includes adequate materials and classroom management and ensuring that all students are treated equally in the classroom and feel supported in the content, discussion, physical/structural aspects, and class meeting times.

According to the study participants, to meet 21st century expectations, educators have to depart from yesterday's pedagogies and become advocates of new educational standards and techniques. It has been found that the participants determined a *student-centered approach*, where teachers become resource persons and facilitators, as one more tactic for teaching lessons with IWBs. They stated that students must have full responsibility for their learning, be involved, and participate. Herreid and Schiller's (2013) research supported the participant's views. Their findings specified that the student-centered learning strategies usage led to the point when students had to take responsibility for learning and, consequently, became more liable. Skill development, active learning, retention,

and information collection was reported by researchers as well. Besides, quiz scores in the student-centered classroom were significantly higher compared to the traditional method.

*Participants cited creating real-world connections* as a technique that encourages students to engage more deeply in lesson materials that are related to real life. The participants mentioned that through IWBs students are shown concrete examples - the real world in the classroom. The outcomes of the current study presented that streaming videos on IWBs or using YouTube are much easier to gain students' interest and bring the material to life. There is no sufficient research, and this topic requires further investigation.

IWBs provide opportunities to meet the standards for skills needed to succeed in a digital age and *creativity* is one of them. The participants stated that creativity is especially important for creating lessons and teaching with the IWB. The IWB exploration, generation of the new ideas, creative behavior directed toward the IWB usage, and applying new knowledge were cited as essential practices in teaching.

Finally, according to the research participants, all methods listed above would be unsuccessful in teaching with IWBs without *behavior management systems* in place. The "pulling sticks" technique, when teachers were managing the students turns in the IWB use, was cited as most effective for teaching with IWBs. In addition, two participants mentioned that the IWB itself could be a powerful tool for classroom management. Active students would be much less disruptive interacting with the IWB, and specialized software could enhance classroom management and be used as a behavioral management tool (i.e., Class Dojo).

In confirming the study results, Van Laer, Beauchamp, and Colpaert (2014) aimed to map the quantity of IWB usage in secondary schools to find how IWBs were used and to measure the teachers' growth in the IWB skills developing inside of the classrooms. As a result, the majority of educators did allow the students to use IWBs, organizing this usage before permitting students to take better control. The authors suggested further research in developing higher levels of pedagogical IWBs usage.

**Issues with IWBs.** The participants identified problems with the integration of IWBs into their classrooms. The research participants mentioned technical issues when working with IWBs and considered technical support as a substantial factor for IWB integration into the teaching and learning process. They also named time issues and a lack of school support as additional problems that appeared through the technology implementation process. The participants were more concerned that they did not have enough time for IWB lesson development and collaboration with the colleagues, or that there is no teacher collaboration at school at all.

**School support.** An unexpected finding was that some schools had mandatory teacher collaboration time for IWB lesson preparation as school policy. The participants named professional development; the purchase of IWB materials, including new software and boards; updating software and technical support of existing smartboards; and supporting teacher collaboration as needed support. Once educators have established professional development and an education technology installation, it is operational that the IWBs integration would mesh

effortlessly with the curriculum and assist the lesson preparation and, in that way, grow teacher productivity (Yang & Teng, 2014). Confirming these findings, Karsenti (2016) stated that IWBs had better not be mounted in classrooms until tutors are fully ready for it. The author underlined that educators need special days so they could take group or individual preparation sessions for learning how the IWB functions, particularly in the fostering student engagement interactive aspects.

### **Limitations of the Study**

The teachers who contributed in this study were selected because they were elementary and public-school teachers. However, middle, high school, and higher education teachers were excluded from the research, as well as charter and private school teachers. Another limitation of the study was the elimination of school administration and students from the analysis. The inclusion of these members would add more understanding of the benefits and usage of IWBs. Also, the small number of participants limited the transferability to other educational contexts.

The methodology limitations were related to the data collection procedures as well. The interview questions may exclude some essential questions and topics. Thus, collecting a limited amount of IWB lesson snapshots, some lesson aspects may have been overlooked. In addition, the interviews were conducted over the phone or Skype. During the six Skype interviews, the facial expressions of the participants were noted. However, during the three phone interviews, their facial expressions were not available for inclusion in the data.

### **Recommendations for Further Research**

This case study found that only some schools had teacher collaboration time for IWB lesson preparation as school policy. A grounded theory study for future research would be essential to define the role of school administration in supporting the integration of the IWBs. Grounded theory studies could provide a unifying theory on the most effective strategies for integrating technologies into schools. De Vita, Verschaffel, and Elen (2014) suggested that there is a need to deeply investigate what kind of learning goals and activities IWBs might promote and if they are different from those in a traditional learning environment. School districts could be involved in future research to ensure its transferability and to support the establishment of school policy requirements from state to state.

Different types of IWB assessments were used by these teachers. A mixed methods design would be recommended for future research to understand the use of IWBs for assessing and scaffolding students. The quantitative data collected could be used to validate which assessment techniques might be more appropriate to address students' educational needs, while the qualitative data could be used to understand the instructional methods used to scaffold students using the IWB.

There is limited research on using IWB technology learning resources in lesson development and using IWB teaching methods and procedures in elementary schools (Lopez & Krockover, 2014). The study participants cited PowerPoint and Notebook presentations as mostly used for structuring and presenting the IWB

lessons Recommendations for further research would be a case study on how teachers develop these presentations, including how they select all of the resources they use. The outcomes of the current study suggested that streaming videos on IWBs or using YouTube is much easier to gain students' interest and bring the material to life. There is no sufficient research, and this topic requires further investigation.

A case study approach on how to develop IWB lessons using *Gradual Release Mode*, real-world connection techniques, student-centered procedures, and behavior management practices, which have been cited as most useful for teaching with IWBs, would support the creation of future lessons with IWBs as well. There is no research on using this technique in teaching with IWBs so further investigation would be helpful. Another recommendation for future research would be a phenomenological study of strategies teachers use with their special education students for planning and developing lessons with IWBs. The future research should contain specific tactics for meeting students' various cognitive, behavioral, and physical needs.

## Conclusion

Technologies like IWBs are a disrupting innovation and challenge educators to develop pioneering methods of teaching (Samsonova, 2017). Consequently, the introduction of new technologies into teaching when they are not linked to pedagogy and practice does not change learning and teaching (Warwick, Mercer, Kershner, 2013).

*“To promote IWB integration in elementary education and develop programs to support the teachers' success in the technology integration process overall, an understanding of the experiences of elementary teachers in developing, delivering, and assessing lessons using IWBs is needed.”* (Samsonova, 2017)

This study used a qualitative case study methodology to identify the real-world experiences and responses of teachers integrating new technology into their daily classroom experiences. As a result, this research defined practical issues relevant to the use of new technology in classrooms and found those teacher participants had positive attitudes toward IWBs and considered them very beneficial. Besides, this study found that IWBs enhanced practices in innovative classrooms by providing differentiated learning models, thus meeting the needs of diverse learners with more personalized learning environments (Yakubova & Taber-Doughty, 2013).

The study participants stated that the IWB is an excellent tool for planning and creating lessons using PowerPoint or Notebook templates, and that collaboration in the creation of IWB lessons is essential. Each participant described the importance of assessing with the IWB and using it for informal and formal assessments. Sharing their pedagogical practices and beliefs, the participants named the ability to respond to their students' learning styles, abilities, and interests as an important feature of IWB use. New knowledge about the teachers' preferences in the form of IWB lesson plan formats, pedagogical practices, assessments, and support required for further technology integration may help educators integrate IWB technology, and other technologies, into their classrooms.

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