

# Interactive Whiteboards and Learning

Improving student learning outcomes  
and streamlining lesson planning

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SMART Technologies Inc.

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# Summary

Interactive whiteboards affect learning in several ways, including raising the level of student engagement in a classroom, motivating students and promoting enthusiasm for learning. Interactive whiteboards support many different learning styles and are used in a variety of learning environments, including those catering to students with hearing and visual impairments. Research also indicates that notes taken on an interactive whiteboard can play a key role in the student review process, leading to higher levels of student attendance. In addition to the observed positive impacts on student learning, research shows that designing lessons around interactive whiteboards helps educators streamline their preparation, be more efficient in their Information and Communication Technology (ICT) integration and increase their productivity overall. This paper brings together interactive whiteboard research and case study observations from the United States, the United Kingdom and Australia.

# The Interactive Whiteboard in Education: An Introduction

## What is an interactive whiteboard?

An interactive whiteboard is a touch-sensitive screen that works in conjunction with a computer and a projector. The first interactive whiteboard was manufactured by SMART Technologies Inc. in 1991.

Educators were the first people to recognize the interactive whiteboard's potential as a tool for collaboration, improving student learning outcomes and streamlining lesson planning. Educators continue to comprise the largest user base for this technology, particularly in the United States and the United Kingdom.

## How can an interactive whiteboard be used in a learning environment?

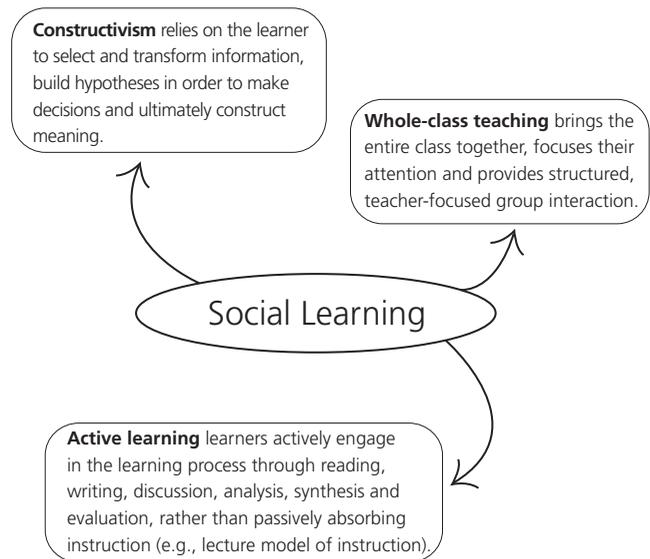
Interactive whiteboards are an effective way to interact with digital content and multimedia in a multi-person learning environment. Learning activities with an interactive whiteboard may include, but are not limited to the following:

- Manipulating text and images
- Making notes in digital ink
- Saving notes for later review by using e-mail, the Web or print
- Viewing websites as a group
- Demonstrating or using software at the front of a room without being tied to a computer
- Creating digital lesson activities with templates, images and multimedia
- Writing notes over educational video clips
- Using presentation tools that are included with the whiteboarding software to enhance learning materials
- Showcasing student presentations

## Connecting to Learn: Student Engagement

Most people need to reinforce their beliefs and understandings by asking others questions, thereby

making learning an inherently social activity. Current education theories are grounded in the notion of the social learner and position student engagement as a key component of knowledge construction. These learning theories are shown in the following chart.



A common thread between these three learning theories is the understanding that student engagement is crucial to learning and, as a growing collection of international research proves, interactive whiteboards promote student engagement. Educators can use digital resources while maintaining dynamic interaction with the entire class, provide computer-based learning without isolating students and encourage a higher level of student interaction in both teacher-directed and group-based exchanges.

Perhaps one of the biggest challenges of integrating ICT into learning environments is maintaining dynamic interaction with students as they focus on their individual computer screens. Interactive whiteboards promote interaction among the students, the learning materials and the teacher, and enrich ICT by providing a large work space for hands-on work with multimedia resources. Having a display surface large enough for everyone to see encourages a high level of student interaction. A teacher and a student can interact with the interactive whiteboard at the front of the class and the rest of the students remain involved.

As research from the United States, the United Kingdom and Australia indicates, the functionality of the interactive whiteboard and its accompanying software allows for the development of classroom activities that are engaging for

students, so they encourage greater focus, participation and interaction, and improve student learning outcomes as a result.

## Observations from the United States

Gerard and Widener (1999) find that “the SMART Board interactive whiteboard supports interaction and conversation in the classroom; it helps with the presentation of new cultural and linguistic elements.”

Solvie (2001) investigated the correlation between the use of an interactive whiteboard as a delivery tool for literacy instruction in a first-grade classroom and student attention to and participation in the literacy lessons. Her research found:

The SMART Board [interactive whiteboard] was novel and created enthusiasm for learning on the part of the students as evidenced in remarks made during the lessons presented using the SMART Board and during individual student interviews, such as “I like touching the SMART Board,” “my finger is magic,” “I like when the lines get different,” “it’s a lot more easy using the interactive whiteboard, but I don’t know why,” “we used the SMART Board and it went ding, ding, ding,” “every part of the word is special” and “the board is magic.” Students were engaged when they actually touched the SMART Board or manipulated text on it.

In 2004, Solvie again focused her research on interactive whiteboards, and in an article originally published in The International Reading Association’s journal, *The Reading Teacher*, she reported, “It engaged my primary students in literacy learning.... I was able to interact with the class, demonstrating, modeling and manipulating what was on the board by touch. I was not confined to, or focused on, a computer that separated me from the class.... Visual display in the form of diagrams, webs and pictures, as well as use of colors and shapes to highlight text, prompted engagement.”

Additional U.S. research focusing on middle-school students and teachers, and their attitudes towards interactive whiteboards indicates a strong preference for the use of interactive whiteboards in the classroom. As Beeland (2002) asks, “Does the use of an interactive whiteboard as an instructional tool affect student engagement? The unequivocal answer, based on the results of both the surveys and questionnaires, is yes.... The results of the survey indicate that interactive whiteboards can be used in the classroom to increase student engagement during the learning process.”

## Observations from the United Kingdom

Interactive whiteboard research is also being conducted in the UK, where Reed (2001) studied students’ initial responses to use of an interactive whiteboard during classes:

The immediate advantage of this arrangement compared to seating students at individual workstations has been that websites can be examined as a group activity so that communication between members of the group continues, whether in English or in a foreign language. A further benefit is derived from the fact that several members of the group are not especially computer literate and are daunted by the prospect of seeking out and using websites on their own, particularly interactive sites which require regular responses from them.... It allows members of the group to ask and hear others’ questions and reactions before starting tasks individually.

Other UK researchers have also found correlations between interactive whiteboards and student–teacher engagement. Ball (2003) details the increased potential for teachers to concentrate on student responses during lessons where an interactive whiteboard is used, and Cunningham et al. (2003) point to the benefits of the fast-paced, engaging interactive-whiteboard classroom. Edwards et al. (2002) highlight the in-class opportunities that the flexibility of interactive whiteboards allows students and teachers, and Latham’s (2002) teacher-focused research finds “two-thirds of the teachers felt that the whiteboard offered strategies for teachers to develop interactive teaching. One-third stated that pupils from all ability groups were now more willing to take part in lessons.” In addition, Cox et al. (2003) have concluded that interactive whiteboards allow teachers to gain a deeper understanding of their students’ needs, and students are better able to learn through collaboration with each other.

British Educational Communications and Technologies Association (Becta)-funded research from Cogill (2003) supports these claims in a research project focusing on the use of interactive whiteboards in primary schools. According to a primary school teacher participating in the project, student attention and focus on lessons is improved with the introduction of digital images and text on the interactive whiteboards. This teacher adds that students are “just glued the whole time and they do get a lot more from it.”

## Observations from Australia

Australian researchers investigating interactive whiteboards have also found an increased potential for interactive engagement in classrooms where ICT is integrated (Kent, 2003) and indicated that teaching with interactive whiteboards is “more fun, more engaging, more exciting and [is] impacting on the enjoyment, speed and depth of learning” (Lee and Boyle, 2003).

# Getting Focused: Motivation

Motivation in the context of the classroom is measured by a student’s drive to participate in the learning process. Although students may be equally motivated to perform a task, the sources of their motivation may differ. Some students are intrinsically motivated to learn because they are driven to understand through reflection and enjoy participating in learning activities. Others are extrinsically motivated by enticements, rewards or teacher-defined objectives.

Interactive whiteboards appeal to both intrinsically and extrinsically motivated students.

### Intrinsically

motivated students volunteer to demonstrate knowledge on the interactive whiteboard in front of their peers as a means of showcasing individual achievement.

### Extrinsically

motivated students are enticed by the “wow factor” of the technology and are motivated learners as a result of the enjoyment they experience from using the product.

## Observations from the United States

According to a case study of the Jennings School District (2005) in St. Louis, Missouri, the former superintendent of schools, Dr. Terry Stewart, and his staff believe student performance should not be defined by test scores alone, but also by attendance levels, motivation and behavior. Since putting technology in the hands of properly trained staff, Jennings has noticed improvements in each of those areas. Greater classroom enjoyment and motivation – particularly

on the part of extrinsically motivated learners – can in turn lead to fewer student absences. Getting students to remain task-focused is difficult in an age where young people are inundated with consumer technologies, such as cell phones, gaming devices and MP3 players; however, interactive whiteboards are garnering enthusiasm and providing additional motivation for students to attend class. More than a diverting gadget or game, interactive whiteboards successfully promote the computer skills students require for success in the 21st century.

As noted by Miller et al. (2005b), the “[h]igher standards of presentation with [interactive whiteboards] mean that both the teacher and the subject have more credibility, due to the advanced nature of the supporting technology. The [interactive whiteboard] also has credibility for pupils, in that it is a similar medium to that used and watched by them in their everyday lives, though on a much larger scale.” Further evidence is provided by a teacher interviewed by Glover et al. (2005), who stated, “We appear cool, we offer a technology that competes with the other media in their lives in a professional and bright way.”

As educators and researchers in the United States have observed, interactive whiteboards bring “true excitement to the classroom” (Gerard and Widener, 1999) and motivate students to volunteer to be quizzed for the chance to engage with the technology. Bell (1998) adds that “answers to open-ended questions indicated that students were more involved, attentive, and motivated when lessons were offered using the board rather than using other teaching methods,” and Blanton and Helms-Breazeale (2000) offer the following insight:

[R]esearch shows that if students have the opportunity to view someone they like or respect perform a behavior they need [to] acquire, then they stand a much better chance of acquiring that behavior... [T]he SMART Board [interactive whiteboard] allowed the students to watch peer leaders prompt and perform the appropriate behaviors, which made the ownership of those behaviors much more enticing... [R]esearch also has shown that people with short attention spans can attend to any situation as long as it is on a television or computer screen. The SMART Board provided these students with this type of viewing.

In addition to making learning more enjoyable and interesting for students, interactive whiteboards have been

found to entice students to learn: “With the use of whiteboards, teachers can develop many creative ways to capture students’ attention and imagination” (Reardon, 2002). The notion of increased student motivation and attendance when using an interactive whiteboard in a learning environment is developed by Tate (2002), who finds that “students in the technology-enhanced sections reported more enthusiasm and interest in the course than did the students in traditional sections, and, perhaps as a result, the retention (student attendance) rate in the experimental sections was much higher than in the control sections.... [T]he retention rate – 97.1 percent – was markedly higher in the interactive whiteboard-enhanced sections.”

### **Observations from the United Kingdom**

In the UK, observation research has yielded similar findings. Bush et al. (2004) find “the boards made teaching more visual and learning more interactive, in turn encouraging greater participation from the pupils, improving their motivation and concentration,” and Cooper (2003) posits:

The children are absorbed and empowered, with numerous opportunities for interactivity of different kinds.... Implicit in here are the positive emotions of success and pride in being able to operate the large screen and the status it has in the eyes of adults.... [Interactive whiteboards] engage children and focus their attention in a multi-sensory and varied way, allowing them to be absorbed and emotionally involved in the learning process. This [was] seen in observations, and teachers articulate this in interviews.

According to Cunningham et al. (2003), it is the visual nature of the interactive whiteboard that keeps students on task; everyone in the class is more attentive, and it is big enough for everyone to see. Other researchers and educators have noted that students are actively involved in the lessons. Greenwell (2002) reports that “pupils have been lining up to answer questions [and are] eager to try.... I feel I am providing a more informative and interesting curriculum,” and Latham (2002) notes improvements in response and attitude, “In their questionnaire responses, 66 percent of the teachers noted a significant improvement in pupils’ attitude, and response to mathematics lessons, while 16 percent stated that pupil response was high prior to the introduction of the project.”

Several other researchers have commented on the correlation between using an interactive whiteboard in the classroom and increased motivation, including Richardson (2002), who offers that “children are always enthusiastic and show heightened motivation when [an interactive whiteboard] is used in the classroom and ... it causes greater attention and enthusiasm to participate and respond.” Salintri, Smith and Clovis (2002) state sustained motivation is key to improving learning outcomes, and Smith (2000) reports 78 percent of students observed were motivated by an interactive whiteboard and experienced increased understanding of subject matter when it was shown visually on an interactive whiteboard, instead of simply being told. Smith also states that “students thought it was cool ... [they] could take an active part in class teaching by coming up and demonstrating to the whole class, and [they] gained confidence in their skills by doing so.” Cox et al. (2003) make similar observations and find that students who are usually reserved in class were more motivated to engage in discussions with their peers, and noted that “interactive whiteboards promote class discussions and [improve] pupils’ explanations and presentation skills.”

### **Observation from Australia**

In Australia, similar improvements in student motivation are noted by Lee and Boyle (2003), who found that “when one can sit and listen to five-year-old children in kindergarten express what is distinct about whiteboard-focused learning ... and how it assists them to learn more, faster and in a more enjoyable and interesting way, ... one senses something rather special is happening.”

## **Reaching Out: Learning Styles and Special Needs**

Educators continuously strive to develop strategies and tools that will reach students with unique or diverse learning needs. Many of these learning styles – even the requirements of visual, hearing-impaired and other special needs students – can be addressed when lesson delivery and learning activities incorporate use of an interactive whiteboard.

**Visual learners** benefit from notes taken on the interactive whiteboard in addition to diagramming and manipulating objects or symbols. As the interactive whiteboard is easy to use, it enables students of all ages to see their own writing and objects of their own creation.

**Kinesthetic or tactile learners** are typically difficult to engage in traditional classroom activities that are usually more visual or auditory in nature. They are able to reinforce learning through exercises involving touch, movement and space on an interactive whiteboard.

**Deaf and hearing-impaired learners** rely primarily on visual learning, and the interactive whiteboard facilitates the presentation of visual material with the use of sign language simultaneously in front of students.

**Visually impaired students** with some vision ability can manipulate objects and use large text on an interactive whiteboard's big surface and participate in computer-based learning in ways that would not be possible on a smaller computer screen.

**Other special needs students** with learning challenges, such as physical ability needs and behavioral issues, e.g., Attention Deficit Disorder (ADD), also find the large interactive surface helpful. Its large size and touch sensitivity facilitates ICT learning beyond the standard keyboard-and-mouse type of computer interaction, and its appeal can be used to promote good behavior.

## Observations from the United States

Observations from researchers and educators in the United States indicate interactive whiteboards help with the multisensory learning needs of a wide array of students. A third-grade student with short-term memory issues found

color-coding words and emphasizing phonetic values useful when recalling and repeating material (Salintri, Smith and Clovis, 2002). An interactive whiteboard transformed formerly "lifeless" students into eager, active learners. Students with Attention Deficit Hyperactivity Disorder (ADHD) are better able to control impulsive and disruptive outbursts when an interactive whiteboard is introduced as a behavioral control mechanism (Jamerson, 2002). Visually-impaired students benefit from the size of the interactive whiteboard and, according to Cooper and Clark (2003), when a teacher plays videos on an interactive whiteboard, students who would not normally be able to see the images "are finally able to see and interact with a computer image, which is very valuable."

In detailing the specific advantage of having students draw on the interactive whiteboard with their fingers rather than the pen tool, Solvie (2004) states, "Writing with fingers allowed the children to feel the shapes of words they outlined, feel and see letter components that created sounds they uttered, and experience a true hands-on approach to creating and erasing text. The board allowed use of multiple senses, leading to increased levels of engagement and greater understanding."

## Observations from the United Kingdom

In the UK, research also indicates the benefits of having students interact directly with the interactive whiteboard, whether physically, visually or aurally. Beeland (2002), Cunningham et al. (2003) and Latham (2002) all point to the range of uses of an interactive whiteboard for a wide variety of learners. "Allowing students to physically interact with the board can assist with meeting the needs of tactile learners" (Beeland 2002). The use of text and pictures, animations and videos promotes visual learning and, as one teacher noted, "[w]ith our kids, what you want is visuals. You need something to grab their attention" (Cunningham et al., 2003). In his Becta-funded research, Pugh (2001) also finds the interactivity and visuals of interactive whiteboards are complementary when teaching students with specific learning difficulties or disabilities. He states that "to participate in the learning process helps students to engage in a way that would not normally be possible in a classroom situation, adding to the richness of the learning experience."

In a case study of deaf, bilingual children and their experiences with an interactive whiteboard, Carter (2002) finds that making presentations on the interactive white-

board aided the development of self-esteem and pride. The researcher further states that “having a projector and whiteboard in class provide[s] many positives, but the interactivity of a SMART Board enhanced teaching and learning even further.”

In research funded by a Becta ICT Research Bursary, Miller et al. (2005b) find that interactive whiteboards provide a clear focus in the classroom and “seemed to support pupils’ understanding, reducing the behavioural problems that spring from frustration and the ‘switching off’ that can result from not being able to keep up with the lesson.” Previously, in a questionnaire developed and analyzed by Miller and Glover (2002), teachers responded that “distracted children pay attention for longer periods ... [and now] have a zest for learning that stems from the element of surprise we (and the software) can maintain.”

### Observation from Australia

Lee and Boyle (2003) reinforce the notion that it is the tactile nature of the interactive whiteboard that makes it such an attractive medium for teaching children, due in part to “that ready ability to engage with the material on the board and for the children to use their finger ... to open files, to write or simply to highlight a point.”

## Making the Grade: Review and Understanding

There are many variables that factor into student retention of information, and studies of interactive whiteboard use in education are both statistical (quantitative) and observable (qualitative) in nature. The majority of interactive whiteboard research, however, is based in qualitative research methodologies, such as interviews and observation analyses.

A student’s ability to retain and recall information presented in class is subject to several conditions, including the availability of accurate notes after class to review. Learning with interactive whiteboards in the classroom enables effective student retention and review as shown in the following chart:

Lessons are more memorable because students are more engaged and motivated. Students are able to focus more on the learning moment rather than on worrying about capturing everything through note taking.

Several different learning styles are accommodated when learning is delivered with an interactive whiteboard, improving chances of student understanding during class.

### Review and Understanding

Notes generated on an interactive whiteboard can be printed or e-mailed for distribution after class, ensuring the student has good review material to support information retention.

### Observations from the United States

U.S.-based research further elucidates these points, and researchers and educators are in agreement that interactive whiteboards improve a student’s ability to retain and recall information presented in an interactive-whiteboard lesson activity. As Clemens, Moore and Nelson (2001) find, the heightened engagement in such lessons is experienced by both student and teacher. “The SMART Board interactive whiteboard used as a tool, in combination with an effective teaching strategy, [brings] about dramatic results. ... The teacher shared the enthusiasm of her students and thought of various ways to promote interaction, stimulate discussion and make learning easy and enjoyable in the process.” One of the basic functions of the interactive whiteboard allows teachers to write over digital documents and Internet pages, thereby allowing students to keep track of ideas introduced in lessons. As forwarded by Gerard and Widener (1999), “[students] are not so easily lost, and they know what the teacher wants them to select. Because the teacher can emphasize any particular structure by highlighting, underlining or circling with different colors, it is easier for students to organize new concepts.”

This level of enthusiasm and student–teacher engagement is an important precursor to improving student scores, especially among those students who traditionally have difficulty learning. While Reardon (2002) states that it is difficult to draw a direct link between improved grades and the use of interactive whiteboards, Zirkle (2003) reports that interactive whiteboards produced “positive grade changes from six-week to six-week period as well as from unit to unit. Use of the SMART Board interactive whiteboard appears to be a positive tool for assisting

functional math achievement [for] struggling learners.” Improved grades suggest a strong link between delivering lessons on an interactive whiteboard and increased retention of information.

### Observations from the United Kingdom

In the UK, increased retention and recall among students who are taught using an interactive whiteboard is a prevalent theme in contemporary education research. Latham (2002) finds interactive whiteboards “offer significant potential to raise attainment through developed, well-structured interactive teaching and learning,” and Greenwell (2002) states, “[student] retention of the skills taught has been excellent.” While Ball (2003) says lessons using an interactive whiteboard are “easier to understand,” Towilson (2003) points to the practical advantage of Notebook™ software in conjunction with a computer and an interactive whiteboard, “Had a child arrived late to the lesson after the initial introduction, [the teacher] would still have a copy of what that child had missed.”

In their analysis of 55 video-recorded classroom lessons, Glover et al. (2005) find evidence that suggests students are aware of three key benefits of lessons taught with the aid of interactive whiteboards:

- Brighter and clearer presentation of material
- Stepped learning and the ability to recall earlier material
- Rapid responses to interactive examples so that learning is reinforced or revisited

Additionally, in a paper presentation at the Third Conference of the European Society for Research in Mathematics Education, Miller, Glover and Averis (2003) find that mathematics concepts, such as geometry, are well suited for lessons on an interactive whiteboard because they are “most easily taught through visual representation, and the use of logical and spatial manipulation,” and further stated that the integrative nature of interactive whiteboard lessons “appears to enhance classroom control, pupil stimulation and the development of pace in lessons.”

### Observation from Australia

In their study of the effects of placing interactive whiteboards in a primary school in Canberra, Australia, Lee and Boyle (2003) report:

The large visual-stimulus facility was seen as particularly important, as was the ready ability to “replay” work. The boards and a scanner allow the teacher to transform an A4 page into a very large image, to then manipulate that image and, if desired, to “play back” work done. For example, with children’s handwriting, the system can replay, in slow motion, the child’s writing of a letter. This kind of facility not only engages the children, but also holds their attention

## Getting Ready: Teacher Preparation

Efficient use of technology by educators is an essential component of the successful enhancement of student learning in the 21st-century classroom. Once educators have received professional development and an education technology installation is operational, ICT integration should mesh seamlessly with the rest of the curriculum and help streamline lesson preparation, thereby increasing teacher productivity. Interactive whiteboards enhance lesson preparation by:

- **Shortening start-up time** for integration into lessons because they are easy to use for both teachers and students
- **Motivating teachers** to incorporate and develop more digital resources and include them in lessons. Teachers respond enthusiastically when they observe positive attitudes and behaviors from students using interactive whiteboards.
- **Enabling teachers to save notes** for use next class or next year. Interactive whiteboards make it easier to build a collection of learning materials that can be constantly updated and written over, keeping lessons fresh and interactive.

### Observations from the United States

Researchers and educators in the United States have found that while more females than males attend SMART Board™ interactive whiteboard training sessions, the SMART Board interactive whiteboard’s “user-friendly features and advantages as perceived by most of the participants [mean] this emerging technology can have a widening impact upon educational instruction” (McNeese, 2003). In their separate research undertakings, Gerard and Widener (1999) report the use of interactive whiteboards “promotes the organizational skills of the teacher,” and Solvie (2004) offers that

interactive whiteboards are proving to be “an organizational tool for lesson preparation and an effective way to follow up on instruction.”

## Observations from the United Kingdom

In the UK, research focusing on increasing teacher productivity is closely aligned with the research findings in the United States. Latham (2002) reports that 84 percent of teachers polled felt more effective in their course planning and preparation when an interactive whiteboard was introduced into their classroom, and Cooper (2003) finds that teachers were more positive in their positions because the interactive whiteboard enabled them to teach more effectively. Cox et al. (2003) highlight the advantage teachers felt in being able to save their notes and whole presentations, and Bush et al. (2004) report similar findings:

A number of teachers indicated that the interactive nature of the board was freeing them from the time-consuming task of making resources, such as number cards, again reducing their preparation time and reducing duplication.... There was clear evidence of teachers saving entire whiteboard lessons for future use. Nearly all teachers reported that in the long run, the ability to save and edit lessons would reduce preparation time and save unnecessary duplication.

At Worth Primary School (2003) in Kent, Notebook software is used by teachers “to prepare written problems ahead of time for the children, enabling them to quickly and efficiently explore different solutions to given problems. They could also annotate and save these annotations quite simply as they occurred.” Similarly, a teacher surveyed by Miller and Glover (2002) states, “It’s a good thing to be able to build up your materials across the year and then to plan the work for the coming year knowing that a great deal of the introductory board work has been done already.”

Miller, Glover and Averis (2005) note that of the 12 secondary school mathematics departments studied in their two-year research project, having the ability to save lesson materials “meant that basic lessons could be refined from class-to-class or year-to-year, in light of changing pupil need and context.” They also find that there was a “general view ... amongst those interviewed that it was possible to use the [interactive whiteboard] to generate efficient and more effective learning [through] tighter planning and the implementation of lesson plans.” In addition, by having the ability to plan lessons in

advance, teachers report having “greater freedom to attend to individual needs during [lessons].” In an earlier conference paper, Glover, Miller and Averis (2003) report that “the ease of use of [interactive whiteboards] mean that teachers have an opportunity to explore new ways to develop topics based on pupils’ thoughts and ideas. This might have positive implications for pupil empowerment.”

## Observations from Australia

Similarly, in Australia, teachers who use interactive whiteboards in their lesson activities also report increased productivity. According to Kent (2003), “interactive whiteboards have allowed teachers to take advantage of the power of ICT within ... the teaching and learning process in ways that are just not possible with the traditional personal computing approach to ICT in schools.” Lee and Boyle (2003) observe that “[a]ll the teachers using the boards commented on their need to shorten their program timelines. The children would appear to be completing work faster and in greater depth [using interactive whiteboards].”

## Conclusion

The interactive whiteboard has been incorporated into learning environments for over a decade, and an increasing flow of research into its impact is emerging from the United States, the United Kingdom and Australia. From the available body of research, several themes and patterns have emerged, including the positive effect interactive whiteboards have on student engagement, motivation, the ability to accommodate a variety of learning styles (including special needs students) and the capacity to enhance student understanding and review processes. Observations also indicate that designing lessons around interactive whiteboards can help educators streamline their preparations and be more efficient in ICT integration, thereby enhancing their overall productivity.

This review of education case-study findings and research literature was compiled by SMART Technologies Inc. to help educators weigh the benefits of using interactive whiteboards in the classroom. It includes findings from the longest running interactive whiteboard education research program – SMARTer Kids™ Research ([www.smarterkids.org/research](http://www.smarterkids.org/research)) – sponsored by the SMARTer Kids Foundation of Canada.

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