

Interactive Whiteboards in 1:1 Learning Environments

Defining public and private learning spaces in the classroom

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Introduction

Talk to anyone in education about one-to-one computing, ubiquitous learning and students in control of their own learning, and personal computing devices, such as laptops or PDAs, come immediately to mind. But what does this mean for shared display technologies such as the interactive whiteboard*? Will the advent of 1:1 classrooms mean teachers have less need for them?

With over a million interactive whiteboards in use in classrooms worldwide, and with numerous studies demonstrating their value to teachers and students, there is an important place for them in education today. But what exactly is that place in 1:1 settings? At the very least, the implementation of 1:1 learning environments should lead us to a thoughtful review of interactive whiteboards within this new context.

This paper offers such a review. It examines the critical role played by interactive whiteboards in 1:1 classrooms, particularly in the way they support differentiated or personalized learning.

Public and Private Learning Spaces

Teaching to the whole class, as well as to individuals and groups, is an important component of personalized learning, an approach to learning and teaching that “requires effective whole-class interaction, with good use of questions and fielding of pupil responses, as well as guided group learning and closer support and intervention for those pupils who need it” (Department of Children, Schools and Families, 2007).

With a need for teachers to shift between individual, small group and whole-class activities, learning can be usefully thought of as taking place in two kinds of space: public and private. Learning’s public realm is largely that of the classroom – lectures, demonstrations, whole-class discussions, debates and question-and-answer sessions. Its private realm is that of individual and small-group work in class, and individual study outside of school and curriculum boundaries, which could include homework and general exploration of a subject of interest.

* For the purposes of this paper, the term *interactive whiteboard* includes interactive whiteboards and interactive displays.

Different educational technologies help to define and support these learning spaces. If students' personal computing devices define private and semi-private spaces for individual and small-group learning, then interactive whiteboards define the public learning space of the whole class. Interactive whiteboards not only function as public display surfaces, but can also bridge personal and public computing space by enabling the sharing of information with students' personal devices. Used together, interactive whiteboards and personal devices can define the public and private learning spaces of the classroom, facilitate transitions between whole-class, individual and small-group learning, and encourage student participation and interaction.

Benefits of Personal Computing Devices

Personal computing devices, including laptops, PDAs and tablet PCs, offer numerous benefits that continue beyond the walls of the classroom for students and teachers. They help teachers personalize learning and embed one-to-one computing, and they can extend students' learning experiences outside of school. The increasing affordability of these products helps bridge the digital divide, and their portability, processing power and storage capacity make them useful and convenient tools for teachers and students alike.

Futurelab's "Handhelds: Learning with Handheld Technologies" (2006) summarizes the wide-ranging benefits of handhelds for students, noting "they can act as tools that are available to the individual learner to be managed and personalized by them and they are portable, supporting access to information and resources in all lessons and all educational and domestic environments regardless of the availability of desktop computers. . . . Student concentration and confidence blossom, and it seems the use of handheld devices can result in improved ICT skills, increased home/school links and better social interactions" (Faux, McFarlane, Roche & Facer, 2006, pp. 1–3).

The Becta report "Handheld Computers (PDAs) in Schools" (2003) concurs, noting that students using the devices benefit from universal access to learning technology, ubiquitous learning opportunities and improved ICT skills and interest regardless of social class or income level. Both students and teachers gain from improved organization, easily accessible data storage and retrieval and an interface that works at home and at school (Perry, 2003).

Benefits of Interactive Whiteboards

Interactive whiteboards have many advantages for students and teachers. Highly visual and engaging for today's tech-savvy students, interactive whiteboards create a focal point for whole-class learning. They also simplify the integration of multimedia in lessons and can improve student achievement.

The UK's 2004 *Evaluation of the DfES ICT Test Bed Project* (2004) notes that "interactive whiteboards provide a shared pedagogical space where teachers and pupils can interact with curriculum content and one another. Not only does it focus the individual pupils on the learning resource but it also provides a communal image and space and encourages socially supported learning" (Somekh, et al., 2004, p. 26).

Having interactive whiteboards in their classrooms helps teachers streamline the creation and delivery of media-rich lessons, and enables them to easily draw from a wide range of multimedia resources. In its research review, *What the Research Says About Interactive Whiteboards* (2003), the British Educational Communications and Technology Agency (Becta), concludes that an interactive whiteboard "encourages more varied, creative and seamless use of teaching materials" (Becta, 2003). By supporting their lessons with different types of media, be they visual, auditory, interactive or all three, educators can also appeal to a broader range of student learning styles.

The Becta review also finds greater engagement and participation levels among students with interactive whiteboards in their classrooms. According to Becta, the interactive whiteboard "facilitates student participation through the ability to interact with materials on the board," and "engages students to a greater extent than conventional whole-class teaching, increasing enjoyment and motivation" (Becta, 2003). These findings are echoed in *America's Digital Schools* (2008), which notes that using an interactive whiteboard enables teachers to get the most from whole-class instruction.

Interactive Whiteboards and 1:1 Learning in Action

The Taiwanese study “Do Handheld Devices Facilitate Collaboration? Handheld Devices with Large Shared Display Groupware to Facilitate Group Interactions” (2007) underscores the value of large displays in enabling and encouraging collaboration in classrooms where handheld computers are used (Liu & Kao, 2007). While acknowledging the potential of handheld devices in one-to-one computing environments to improve classroom dynamics, the authors argue that individual classrooms based on one-to-one computing alone can limit student interaction.

Liu and Kao compared three groups of students learning statistics and data-mining techniques in a think-pair-share learning activity. Think-pair-share is a four-step collaborative activity:

1. The teacher poses a question to the whole class
2. Students are given time to think about the question
3. Students discuss their thoughts with a partner
4. Each pair shares its thoughts with another pair or with the whole class

In this experiment, one group used tablet PCs only, the second group used tablet PCs with network file sharing and the third group used tablet PCs with a large shared display. The researchers found that the tablet-only group showed less interaction because “the screens of handheld devices, being designed for individual-user mobile application, limited promotion of interaction among group learners” (Liu & Kao, 2007, p. 285) and “led to fragmented and ineffective communication” (Liu & Kao, 2007, p. 296). These difficulties were due to the small, individual-user format of the tablet PCs, which made it difficult for students to share information, particularly with non-adjacent partners.

On the other hand, students “exhibited higher participation ratios in the environment with shared displays. Moreover, students easily viewed and compared the answers of all their partners on a shared display Therefore, in the environment involving shared displays, students demonstrated more equal participation rates than those in environments with only Tablet PCs and networks” (Liu & Kao, 2007, p. 294). Liu and Kao conclude that, because the large-format shared display allowed students to share information by simply

pointing to on-screen text, figures and diagrams, “shared displays enable students to interact with one another and refer to related information naturally” (Liu & Kao, 2007, p. 295).

In Liu and Kao’s ideal classroom, both handheld computers and shared displays have a role to play: “Handheld devices facilitate coordination and provide mobility for a new scenario of collaborative learning. Large shared displays create a workspace for student groups to cooperate and work on complex tasks” (Liu & Kao, 2007, p. 297).

Wolverhampton Learning2Go

The Wolverhampton Local Authority (LA) uses handhelds with interactive whiteboards and classroom-management software developed for PDAs. Wolverhampton LA’s Learning2Go project, which was awarded the Becta National ICT Best Practices award in January 2006, is the largest collaborative mobile learning project for students in the UK, and has distributed some 1,000 devices to year 6 students in 18 institutions. From the outset, the program was designed to integrate handheld computers with the existing IT infrastructure: “Handhelds were designed to be compatible, for example, with the schools’ interactive whiteboards, enabling shared viewing of teacher and student machines” (Faux et al., 2006, p. 14). The teacher can select any student’s screen and display it on the interactive whiteboard, and also redirect students’ attention by locking their computers. Students can use classroom management software to project their screens on the interactive whiteboard and lead the lesson. The result is an effective balance of teacher- and student-led learning.

Finding the balance

Where individual computing devices succeed as private learning spaces, interactive whiteboards excel as public learning spaces. When paired with the necessary software and wireless connections, they can make transitions between individual or small-group learning and whole-class learning smooth.

Used together, interactive whiteboards and personal computing devices can enhance the classroom by defining public, semi-public and personal work space. In whole-class, small-group and individual learning, students can use PDAs or laptops to work individually or in pairs. They can then turn to the interactive whiteboard as a metaphorical public gathering place. The result is a flexible

learning scenario such as that described by Andrew J. Milne in his discussion of learning space design for higher education – a scenario in which the net effect of using a combination of large- and small-format interactive work surfaces “is to define both personal and public interactive work surfaces and allow students to fluidly transition between them” (Milne, 2007, p. 22).

Information can be input directly on the interactive whiteboard using an on-screen keyboard, finger or pen tool. The class gains a large public display and the full functionality of the interactive whiteboard computer. In “The Psychology of Learning Environments” (2006), author Ken Graetz recommends a large public screen, along with classroom management software, to manage off-task computing. “It is preferable,” he writes, “to design classrooms and classroom computing policies that allow instructors to exercise greater social control” (Graetz, 2006, section 6.7). With classroom management software, teachers can view thumbnails of student screens and instantly broadcast any student’s screen to the interactive whiteboard – methods, Graetz argues, that motivate students to use their laptops for academic purposes.

The greatest benefit of using personal computing devices and interactive whiteboards together is that of improved collaboration. Liu and Kao’s research shows that using personal devices in combination with a shared display, such as an interactive whiteboard, greatly improves collaboration between students, compared to handheld use alone. Their study proposes “a design of classrooms that incorporates personal workspace and public workspace. Students use handheld devices as private workspace and work with peers on public workspace with shared displays through their handheld devices” (Liu & Kao, 2007, p. 296).

Conclusion

For one-to-one computing and self-directed and small-group learning, it is hard to think of a better option than personal computing devices. But classrooms still need a central site for sharing, evaluating and discussing ideas and information. And teachers still need to hold the attention of the class in order to facilitate learning. With handheld and laptop computers defining personal learning space and interactive whiteboards defining public learning space within the classroom, students and teachers have the best of both worlds.

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