

Beyond the 'wow' factor: developing interactivity with the interactive whiteboard

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Is the interactive whiteboard simply the next stage of development in methods of presenting information to pupils or can it make a significant impact on the quality of pupils' learning in science?

In spite of their high cost, the sales of interactive whiteboards (IWBs) to UK schools are increasing rapidly. About 27 000 were sold in 2002 and the predicted number for 2004 is 57 000 (Buyer's Guide, 2003). In a recent article in the *Times Educational Supplement* it was claimed that science, maths and ICT teachers are the most frequent users of interactive whiteboards (Stein, 2003). This leads one to believe that many teachers and senior people holding the purse strings in education consider that investment in this technology will make a significant difference in pupils' learning. There is research evidence to show that the use of ICT in teaching has a positive effect on learning, but most of this is based on pupils working individually on computers (Harrison *et al.*, 2002). The interactive whiteboard (IWB) is a relative newcomer to the classroom and the information we have on its effectiveness tends to be mainly anecdotal rather than research based – although recent work by

Thompson and Flecknoe (2003) in mathematics marks a first step in this direction. Becta (2003) has summarised the main research findings and identified the following benefits for pupils:

- Increased motivation.
- Greater opportunity for pupils to participate and collaborate.
- Pupils are able to cope with more complex concepts as a result of clearer, more efficient and more dynamic presentations.
- Increased capacity to cater for different learning styles.
- Enables pupils to be more creative when making presentations to fellow pupils.
- Pupils do not have to use a keyboard to engage with the technology, increasing access to younger children and pupils with disabilities.

Clearly the IWB is a lot more exciting than the blackboard and overhead projector, and pupils will be curious to find out about its functions and capabilities. As a result, they may pay more attention than in the past. However, once the teacher has exhausted all the IWB routines, and the 'wow' factor has passed, these pupils may revert to less attentive behaviour. The purpose of this article is to raise the issue of how teachers can maintain motivation through use of the IWB by increasing pupils' engagement with learning.

ABSTRACT

The use of interactive whiteboards in science lessons has the potential to support change in the way we teach. Once teachers become familiar with the various features offered by the technology, they need to consider how best to deploy them to create a positive learning environment. This article provides a basis for teachers to reflect on their practice and suggests a number of routines to promote greater interactivity.

What extra things can the IWB offer?

What can the IWB do that can't be done with non-interactive boards and conventional flipcharts? What are the advantages of using an IWB over the projection of *PowerPoint* slides on to an ordinary whiteboard? The power of the IWB lies primarily in its annotation capability and the ability to move freely and easily between flipchart pages revealing an infinite range of pre-prepared resources incorporating text, graphics, video and sounds, as well as direct use of the Internet if the classroom has a suitable connection.

Software tools

The IWB allows teachers and pupils to use any existing software loaded on to the connected computer, and this step is one of the first for teachers new to the IWB. In this respect the IWB is often used in the same way as a conventional overhead projector or whiteboard. However, the IWB also comes with its own specific software, which presents a challenge as another new application to master, but, more importantly, presents opportunities to staff and pupils. This software provides teachers with a wide range of teaching tools that enable them to perform certain techniques that have hitherto been impossible (see Box 1). The teacher can switch seamlessly (well,

Box 1 Interactive whiteboard software tools that provide teachers with opportunities to use distinctive teaching strategies

Ways of treating information *Whiteboard features*

Capturing	Copy and paste from other software, e.g. <i>Word</i> , graphics packages 'Photograph' screen images
Emphasising	Tickertape function (a word or phrase continuously moves across the screen) Large text Spotlight function (the view is restricted to a circular area of the screen)
Storing	Storing on flipchart pages to be revisited later on in the lesson or in subsequent lessons Recording as flipchart files Storing in the link library
Annotating and modifying	Using the pen, sometimes in conjunction with other features such as arrows or lines, to add writing to existing images and text Using the highlighter pen Carrying out DART activities such as: – using drop and drag to match labels to features – rearranging objects or text into a correct sequence – cloze procedure exercises (a coloured pen is used to cover text and the whiteboard 'rubber' is used to reveal the hidden text)
Linking	Linking to other pages in the flipchart Linking to files stored on the computer, e.g. <i>Word</i> , <i>PowerPoint</i> , <i>Excel</i> Linking to programs stored on the computer, e.g. <i>Crocodile Clips</i> , concept cartoons, concept mapping software, <i>Kar2ouche</i> Linking to Internet sites

almost seamlessly) between normal board work, video, other computer programmes and the Internet using the pen or computer mouse and the on-screen icons.

In the same way that using *PowerPoint* can help a teacher think about the sequencing of information, preparing IWB pages makes teachers think about the logic of their arguments and consider what additional teaching activities can be used. Good though it is, *PowerPoint* tends to be restrictive, leading teachers down a linear route and fostering a transmission mode of teaching (Parkinson and Hollamby, 2003). Using the IWB provides teachers with the opportunity to go off the linear track and look at a related topic (using one of the hyperlinking features) and then come back to the main line of argument. It is also easy to revisit ideas discussed earlier on in the lesson and check that pupils' learning is on course.

Focusing attention

The large IWB screen acts as a focus for pupils' attention and there are a number of ways that this can be used at the start of the lesson. Information can be pasted up, such as class notices, homework reminders and lesson objectives (see example pages in the general section of the ChemIT website). Alternatively, a starter activity for the lesson could be posted up, ready for pupils to get on with as they enter the room. Using the IWB widens the scope of starter activities available. For example, pupils can be asked to identify key features from movie or still pictures; they can be asked to answer questions based around a website image of a science-based newspaper article; or they could participate in a word game. *Blockbusters* (see for example *Raising achievement in science at 11–14 CD*), the element game (on the InsideOut website), *Family Fortunes* (ChemIT website) and *Word Splat* (science words are arranged randomly on the board and two teams compete to find the word that answers the teacher's question) are all popular games that work well on an IWB and are useful in helping pupils to become familiar with science words. The blind or the spotlight devices can be used to conceal part of an image which pupils are asked to identify by asking the teacher a series of questions. This could be used both to encourage pupils to ask questions of the teacher and to initiate a discussion on the nature and extent of evidence required to draw conclusions.

By encouraging children to come and manipulate words and images on the IWB, teachers are making the first moves towards using the board interactively.

Although teachers have always asked children to come and write on the board, the options offered by the IWB make such work much more varied. Even a simple cloze procedure exercise, involving words or symbols being dragged to fill in gaps in sentences, is much easier to manage – not to mention much cleaner! Pupils can drag their choices into a variety of places and then the class can discuss the choices before any number of other pupils do the same – all without a board rubber in sight! At the end of the activity, teachers can either save the results for future lessons, reveal the correct solution on the next page of the presentation, print the results or just scrap everything and be left with the starting page for future use. Try working out how to do this using a blackboard or an overhead projector and you will begin to see the potential of the IWB even used at its most basic level of functionality.

Scaffolding learning

The IWB screen can provide information that acts as a stimulus for classroom discussion, leading to the production of new information that can be stored on the flipchart pages ready for use in the next phase of the lesson. In the example shown in Box 2 the teacher initially uses some simulation software to show what happens when a solid (e.g. stearic acid) is heated. In this situation pupils do not have to concern themselves with setting up the apparatus and taking readings; they can concentrate on interpreting the results. Thus, the IWB and computer have reduced the overall cognitive demand made on the pupils, which is a very powerful facet of their use. They can provide an environment where focused pupil–teacher and pupil–pupil talk is promoted, leading to a situation where pupils' goals are achieved more readily.

Looked at in this way, the IWB and computer can be seen as one of the contributors to scaffolding learning alongside the teacher or a more competent peer. When one begins to unpick some of the distinctive features of scaffolding it becomes apparent that the features of the IWB fit the bill admirably. Woods, Bruner and Ross (1976) identified five distinctive features, all of which can be readily achieved through IWB use:

- **Recruitment**, i.e. motivating the pupils to carry out the task.
- **Reduction in the degrees of freedom**, i.e. breaking down the learning into manageable chunks.

Box 2 Part of a lesson sequence illustrating how a combination of IWB features can foster interactivity

<i>Teacher input</i>	<i>Group discussion</i>	<i>Group presentations</i>	<i>Confirmation of correct science</i>
The class observes a solid (e.g. stearic acid) being heated either as a simulation or using a data-logger. Running alongside the image of the heated substance is a table and graph plotting temperature against time. The changing phase of the substance is also recorded.	Groups are asked to explain what is happening to the particles as the temperature is increased. They are asked to prepare particle diagrams with a few words of explanation.	Each group presents its conclusions to the rest of the class using the IWB pen. Teacher and other pupils ask questions to clarify any points. No comment is made on the correctness of the information until all the presentations have been completed.	Teacher uses simulation software to explain particle movement at the various stages of heating and compares this with the pupils' suggestions. Where appropriate, the teacher discusses why the pupils' model is incorrect.

- **Direction maintenance**, i.e. keeping the pupils motivated.
- **Marking critical features**, i.e. highlighting key points on the road to a successful solution in order to help pupils judge the correctness of their work.
- **Demonstration**, i.e. the teacher models how to solve part of the problem, or shows how similar problems can be solved.

Changes in pedagogy

The IWB can portray strong images and rich information sources that promote whole-class or group discussion. It has the potential to help pupils to reason and think through scientific explanations alongside their teacher and fellow pupils. It is easy to go back through flipchart or *PowerPoint* pages and look at previous work, or to jump forwards to look at other examples to help keep pupils on track. If an appropriate connection exists, it is equally easy to explore resources from the Internet. The climate can be shifted from one dominated by teacher exposition to one where co-learning is seen as the prevailing force. This transition is complicated because it is not just teachers' ICT skills that need to be developed; they also need to accept changes in their role and in their interactions with pupils, whilst also supporting pupils as their roles change too (Harris, 2002). This adaptation to 'coach, observer and facilitator' arises as teachers transfer greater responsibility for their own learning to their pupils (Smeets and Mooij, 2001).

Teachers can begin to effect such changes in pedagogy by practical measures such as:

- The use of a wireless keyboard or mouse enabling the teacher to work from within the body of the class rather than standing in front of it. Some teachers sit at the back of the class so that all eyes are focused on the screen.
- The use of infra-red 'slates', which allow pupils to manipulate images and write on the IWB from their own desks. This also encourages an appropriate working pattern, as well as cutting down on potentially disruptive behaviour in movement around the classroom.

Perhaps the most important feature of those mentioned is the change in the pace of lessons and transitions between different parts of the lesson, together with the greater attention teachers can give to their class by using the support of an IWB.

Although there are many practical hardware and software developments that teachers can consider, the change in their own practice is perhaps the most important in developing long-term changes in pupils' learning styles. Although such changes take time, and should be seen as a medium- or long-term target, there are relatively simple changes that can be made to existing teaching styles and practices in the short term that can begin the process.

Part of the example in Box 2 illustrates how the IWB can help pupils to make the link between familiar forms of presentation (the practical activity) and new forms of presentation (the graphical display). This can,

of course, be achieved in a static form in a textbook and in a movie form in other ICT packages, but doing it on the IWB provides the teacher with the opportunity to annotate, cut out certain features, focus in on other features and generally adapt the screen to fit the learning needs of the class. For example, the teacher can display an image from a digital microscope on the screen, point out relevant features to the class and, using the IWB pen, model how the image should be represented and labelled in pupils' notes. The flexibility of the IWB enables teachers easily to modify what they are doing during a lesson in response to feedback from pupils. The use of a digital camera can also allow teachers to show work just completed by individuals or groups without moving children around the classroom. This process would also allow, and encourage, pupils to explain both their planning and their results, together with what it means in a wider context. Each child will thus be working at his or her own level and actively involved in the lesson as a co-learner.

Illustrating and explaining

The IWB feature that enables the teacher to use various paper backgrounds is useful when it comes to showing pupils how to carry out various tasks. On a simple level, using the lined paper, this could involve showing pupils how to set out their work, draw apparatus or set out a table. The background graph paper could be used to explain to pupils how to construct graphs from data. Alternatively, it could be used with a package such as the ASE's *Getting to grips with graphs* (Goldsworthy, Watson and Wood-Robinson, 1999) to promote class discussion about the construction and interpretation of graphs. The capacity of the IWB to help the teacher illustrate and explain is very powerful, but it should be remembered that it also provides pupils with the opportunity to undertake the same processes. Such a relatively simple change in pedagogy can have quite a profound impact of pupils' self-confidence and their perception of themselves as a learner. It could be argued that such a move to encouraging children to articulate their methodology, reasoning or understanding within a structured framework provided by work on the IWB can also be helpful to teachers in assessing whether learning objectives have been met – as well as giving pupils the opportunity to have greater responsibility for their own learning and that of others. As the IWB allows teachers and pupils to display work undertaken on other computer workstations in the classroom

(whether via a floppy disc or a network), or indeed handwritten work through a scanner, it adds a new dimension to teacher–pupil evaluation and modelling of patterns of reasoning, problem solving and constructing pieces of writing.

Problem solving

A possible danger in the above is that the IWB reverts to being a classroom projector and loses the interactivity that is essential in maintaining motivation and developing interconnections between areas of learning and previous work. The use of problem-solving activities can help to promote learning and ensure continued motivation. The IWB allows teachers to develop either single problems or a range of different challenges and display them easily and quickly to different groups. However, once the initial challenge has been set, pupil interest and interaction need to be considered. At a basic level this could involve pupils coming to write ideas or thoughts on the board (as separate items of text) that could then be dragged (by teacher or other pupils) into groups of common ideas or approaches. This has some ideas in common with constructing concept maps (e.g. using *Inspiration* software – see website), which can also be done on the IWB, where pupils are asked to provide the linking words or phrases for a set of words devised by the teacher. This 'brainstorming' also allows the introduction of another feature of the IWB, the ability to 'vote' on preferred ideas, options or solutions through remote devices.

Developing teaching with the IWB

As teachers begin the transition to 'synergistic user' (Beauchamp, 2004) of the IWB, it is important to remember that in the early stages it remains a tool to implement existing pedagogy. In this context, teachers will use the IWB as a substitute for their current resource (black/whiteboard or overhead projector) and will implement existing practice using a new method of presentation – often limiting their work to the generic IWB software allowing different forms of writing paper and measuring tools. As confidence grows, teachers can begin to explore new applications, such as *PowerPoint*. The teacher is then able to overlay skills developed in the generic software to, for example, undertake annotations of the presentation. This type of activity can, of course, be undertaken by pupils and supports interactive pedagogy.

As technical mastery increases in ways such as those outlined in Box 3, new possibilities become apparent and teachers begin to move away from a linear lesson progression to a more discursive model where the technology can allow ideas to move in many directions, whilst retaining the central spine (learning focus) of the lesson. This hyperlinking of ideas can then be modelled and developed by using physical hyperlinks within and between programmes, slides, websites and, indeed, pupils' work if available via a network.

As pupils begin to understand the use of hyperlinks they can begin to construct their own versions of tree diagrams and sorting keys using *PowerPoint*. This activity works very well at any level as the questions asked, and knowledge required, act as effective differentiation. As examples are displayed, interrogated and discussed by pupils on the IWB (using the interactive teaching pedagogy discussed above), teachers have a ready-made assessment

opportunity, where they only have to build time and opportunity into lesson plans for pupils to plan, construct and refine their presentations on PCs, before they are presented to larger groups via the IWB. As pupils use the pen to click on links and discuss outcomes, teachers can gain a good insight into the knowledge and understanding of individual pupils or groups who prepared the keys, as well as those using them, without the need for paper-based tests. The presentations themselves also act as evidence of work undertaken and can be printed and annotated by teachers if necessary.

By undertaking such activities, the potential of the IWB becomes apparent and teachers may begin to undertake a more fundamental reassessment of their own practice. As new skills are mastered, and teachers move beyond a technical apprenticeship, the IWB changes from being a rigid skeletal framework to a more fluid medium through which teachers can deliver not just ideas, but also challenges, opportunities and

Box 3 A possible progression of IWB skills

Progression in skills

- 
- Handwritten text on board in a similar fashion to the traditional use of a blackboard or whiteboard
 - Pre-prepared text and graphics used
 - Saving flipcharts for future use
 - PowerPoint* used with the IWB acting as the screen
 - PowerPoint* used and slides annotated using IWB software
 - Use of drag and drop to move text and graphics around the screen
 - Moving forwards and backwards between pages to create an effective learning sequence
 - Importing digital images and sound clips
 - Use of hyperlinks to switch between pages
 - Use of hyperlinks to switch between programs
 - Preparing a library of resources for the IWB and using this effectively

Box 4 A range of teaching methods using the IWB, starting from a didactic approach and moving to methods that include greater pupil involvement

Progression in interactivity

- 
- Information presented to the pupils by the teacher
 - Some class discussion followed by notes on IWB made by the teacher
 - Sharing of lesson objectives on IWB with class and revisiting them at key points of the lesson
 - Activities, such as labelling, drawing and constructing graphs, are jointly done on the IWB
 - A piece of written work, e.g. the conclusion to an investigation, is analysed by the class and suggestions for improvement are made.
 - Arguments and explanations are co-constructed on the IWB by members of the class

open-ended frameworks for pupils to develop metacognition (see for example the possible changes in pedagogy shown in Box 4).

The speed and scale of these developments will obviously vary from teacher to teacher, and to a large extent depend on success in mastering the technology. However, as teachers pass through their own 'wow' barrier, the impact on teaching pedagogy can be profound. The IWB, and programs such as *PowerPoint*, provide an initial crutch in this development.

However, teachers should not seek to impose their own practice on the IWB, but instead explore how the IWB can allow them opportunities to develop new strategies. In other words, teachers should not be seeking to interact with the technology, but rather to use the technology as another medium (besides themselves) to interact with the class, as well as allowing the class to interact with each other, in mutually developing new teaching and learning strategies.

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- InsideOut: <http://insideout.rigb.org/insideout/elements/periodic/index.html>
- Inspiration: <http://www.inspiration.com/home.cfm>

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