Getting the most from your interactive whiteboard

A guide for primary schools
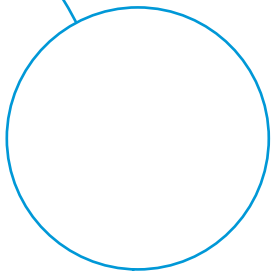
Interactive whiteboards are creating quite a stir in classrooms across the country. Pupils talk about enjoying lessons more and finding them more interesting. Teachers revel in the increased range of materials available and celebrate the tangible improvements in pupils' behaviour.

The introduction of interactive whiteboards raises a number of issues: how can whiteboards be used to greatest effect? How do they enhance learning? And what do schools need to consider when planning for the integration of boards into classroom practice?

This ICT Advice booklet aims to provide:

- practical information about interactive whiteboards

- advice on strategic management of the boards

- descriptions of how the use of the boards can benefit teaching and learning

- examples of effective use of the boards in classrooms

- evidence from research about the benefits of their use

- sources of further information, advice and guidance.
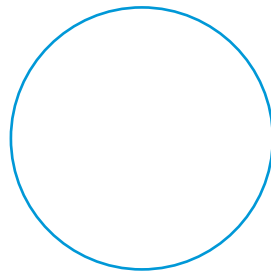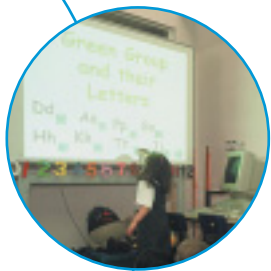
The content of this booklet is specifically aimed at senior managers and teachers in primary schools, and includes practical classroom examples and case studies. A separate publication is available for secondary schools.

Acknowledgements

Contents

Introduction

Interactive whiteboards are rapidly becoming a common classroom resource and many schools and local education authorities (LEAs) are already reporting benefits in terms of improved teaching and learning opportunities across the whole curriculum.

The integration of this technology in our classrooms is an exciting new development – it challenges assumptions on the role of technology in learning. Some may have perceived technology in our classrooms in terms of pupils working in pairs at a computer, with the teacher acting as the 'guide on the side'. This new medium turns that assumption on its head. The integration of the interactive whiteboard encourages teachers to manipulate the technology in order to encourage and develop active learning. Effective use of an interactive whiteboard encompasses and extends a range of teaching styles. It also supports and extends a wider range of learning styles – but, as with any ICT tool, its success depends on effective use.

The key feature of this technology is that it emphasises whole-class teaching strategies. These include teacher modelling and demonstration, prompting, probing and promoting questioning, managed whole-class discussions, review of work in progress to reinforce key points emerging from individual and group work, and whole-class evaluation in plenary sessions.

Interactive whiteboards as a teaching tool

Interactive whiteboards are powerful teaching tools. They have the potential to :

- enhance demonstration and modelling

- improve the quality of interactions and teacher assessment through the promotion of effective questioning

- redress the balance of making resources and planning for teaching

- increase the pace and depth of learning.

Enhancing demonstration and modelling

Teachers demonstrate in order to show pupils how to do something; modelling helps pupils to understand underlying structures, relationships and processes in abstract concepts. A good demonstration does not have to be supported by discussion as, for example, when a teacher demonstrates a 'cut and paste' technique on screen with little or no explanation. However, modelling without discussion is ineffective.

The interactive whiteboard enables teachers to demonstrate in a clear, efficient and dynamic way. As pupils visualise the techniques or instructions, for example, they use the visual and kinaesthetic stimuli to develop and reinforce their understanding.

Interactive software enables teachers to model abstract ideas and concepts. As pupils interact with a simulation, they respond to questions and pose others; they predict outcomes and learn 'what happens if…?' and they experiment with the variables in the model, because they see the effects taking place. They use the stimuli to make new connections and deepen their understanding of the concept.

In English, for example, the use of interactive whiteboards can support aspects of shared writing. The process of planning and composition is demonstrated by the teacher and writing is modified and adapted on screen through interaction and discussion with pupils.

In mathematics, interactive mathematical software offers dynamic representation of shapes and systems. Teachers and pupils can manipulate variables to see mathematical concepts in action.

Improving the quality of interactions and teacher assessment through effective questioning

The interactive whiteboard promotes increased interaction between the teacher, pupils, the subject and the technology itself. It allows all pupils to engage with the same central focal point in the classroom – something that is not easy to achieve with other types of technology. It also enables the teacher to easily refer back to previous learning and resources.

Pupils use the dynamic representation of systems, images and text to explain their methods; to support their reasoning; to demonstrate their understanding and to teach others. The ability to physically interact with the software, by manipulating the text and images on screen, stimulates 'on-task talk'. Pupils talk for longer than otherwise in their responses and use an extended range of vocabulary in their explanations. These are all features promoted in accelerated learning theory and it is these qualities of learning that teachers point to when they talk of the benefits of using this technology.

The interactive whiteboard encourages questioning and intervention at a range of levels, including open, closed and uptake questions along with probing and evaluative responses, all as part of the general flow of the lesson.

As the teacher leads the investigation, she asks pupils how variables might be changed and how these changes might affect the model. She pitches questions at particular pupils or groups of pupils; assesses what they have learnt through their answers and then tests their understanding by asking them to demonstrate what they know through manipulating the model on screen. She is confident that they have understood the key points and then adapts the next set of questions in order to develop deeper understanding. She poses a series of 'what if…?' questions and they are keen to try out new possibilities using the software to try out their predictions.

Redressing the balance between making resources and planning for teaching

There is now an extensive range of commercial and non-commercial digital resources that teachers can use to enhance teaching and learning, including the interactive teaching programs from the Primary Strategy. E-Learning credits are available to help schools purchase high-quality, curriculum-specific resources and the pedagogical quality of the packages available continues to improve. Teachers do not need to spend as much time creating their own resources but they do need to know where to find them, how to adapt them for their own lessons and how to develop their teaching strategies to exploit them.

Digital flipcharts and notebooks that come as part of the whiteboard's software can be adapted and re-used by teachers according to the needs of the class. These resources can be shared not only with colleagues in the same school but also beyond, through saving work to the local network, emailing it or saving it as web pages on the internet.

The section *Finding and using appropriate digital resources* on provides more advice.

Increasing the pace and depth of learning

The interactive whiteboard opens up new opportunities for presentation, re-presentation and communication. Information can be presented in exciting and engaging ways, creating more motivating outcomes.

Interactive whiteboards allow collective engagement with learning problems at greater depth. They encourage creative and seamless use of materials including:

- websites

- video and audio clips

- internet and email exchange

- interactive teaching programs

- interactive and electronic texts

- interactive software such as digital flipcharts

- use of additional peripherals such as electronic microscopes or digital cameras and scanners.

Texts can be written or created, and data and information presented in electronic and multimedia formats. They can be re-presented in ways that further explore, unpack or explain the content, and communicated through e-presentations, email and on the internet. This not only provides a medium for presentation and communication, but also opens possibilities of new, 'authentic' audiences and learning communities.

The software enables the teacher to quickly change and reconfigure information, to provide opportunities to engage with pupils at a higher and/or deeper level. Pupils are encouraged to deepen their level of enquiry and generate their own questions and hypotheses, which they can then easily test and confirm.

Effective use of the interactive whiteboard incorporates a variety of teaching techniques that support a range of preferred learning styles. Effective use of interactive whiteboards can also support visual, auditory and kinaesthetic learning. The use of the technology can undoubtedly increase learning opportunities; however, the technology does not replace effective teaching. In order to take full advantage of benefits of the technology, the teacher needs to combine knowledge of the subject, an understanding of how pupils learn, and a range of teaching strategies along with skilful manipulation of the technology. Schools should not

underestimate the time needed for teachers to become confident with the technology and to develop their teaching style and strategies. Headteachers should consider a long-term plan of training opportunities for teachers in order that they can develop effective practice.

Teachers' comments…

"We have a high proportion of EAL [English as an additional language] and SEN [special educational needs] children in our school. The interactive whiteboard provides them with the visual and physical stimulation they need. I'm really enthusiastic about the interactive whiteboards and feel that this has been a unique opportunity for me to develop professionally."

Primary teacher

The Schools Interactive Whiteboard Expansion Initiative

The Schools Interactive Whiteboard Expansion (SWE) project is an expansion of the primary pilots (see below).

Speaking at the London Education Show (Olympia, September 2003), Stephen Twigg, Parliamentary Under Secretary of State for Schools, announced a £25 million interactive whiteboard project which will help revolutionise teaching and learning, and raise standards.

He said: "Interactive whiteboards are revolutionising teaching and learning in schools, and we have seen that they have a significant impact on standards."

The initiative aims to increase the provision of interactive whiteboards in schools to improve, develop and enhance effective pedagogy using ICT and demonstrate that interactive whiteboard technology can make a significant positive contribution to embedding ICT in the classroom, raising standards through improved teaching and learning.
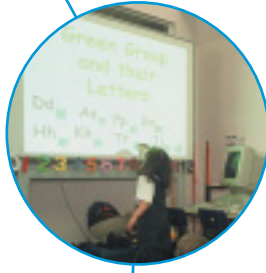
In 2003 Becta managed a procurement exercise to identify and award a number of framework contracts to suppliers who would provide a range of interactive whiteboard packages (board, projector, delivery, installation and basic operational training and software, telephone and email support and three-year on-site support) to a minimum specification at a competitive price and to a reliable quality standard. An online catalogue has been developed as a result of this exercise which, whilst supporting the expansion of existing primary pilots, can also benefit LEAs and/or schools which decide to adopt this technology. See the purchasing section under whole-school management issues, and the section entitled *Further information, advice and guidance* for further details.

Teachers' comments…

"Interestingly, two new girls have started in my class this term. Before the day started I asked them if they had ever seen an interactive whiteboard. Neither had, so I asked them to meet me at the end of the day and let me know their opinion. Both were amazed and commented on how the images make it easier to understand concepts. I used the fractions ITP [interactive teaching program from the Primary Strategy] and a digital flipchart I had made. They could easily see how to convert fractions into decimals because of the visual imagery."

Primary teacher

Other initiatives

A two-year pilot (2002-04) is under way to identify and disseminate leading practice in the use of electronic whiteboards in teaching and raising of standards of literacy and mathematics in primary schools.

The Interactive Whiteboard Pilot is now in its second year and is running in six LEAs (with approximately 15 schools in each LEA taking part) and 30 associate LEAs focusing on Years 5

and 6. The pilot has been extended to five additional LEAs in 2003/04, targeting Years 2 and 3, to enhance curriculum continuity and encourage liaison between Key Stage 1 and Key Stage 2.

From April 2004, a National Whiteboard Network is being established to support all LEAs that wish to participate in providing dedicated support to schools on making best use of interactive whiteboards.

Teachers' comments…

"I am finding the interactive whiteboard to be an invaluable tool in the classroom. Pupils seem to be far more engaged and all ability groups are able to access their own level of learning. Within literacy, I have seen improvements in boys' writing, both fiction and non-fiction. There is a similar improvement in pupils' level of success achieved in mathematics and children who were previously finding mathematics difficult have grown in confidence and achieve more. I have been using the interactive whiteboard for other areas of the curriculum and am now of the opinion that I couldn't be without it. My ICT skills have really improved and when I occasionally have 'difficulties' with the equipment my children are full of good advice! Their skills have grown too, and using the interactive whiteboard means that they are more actively involved in their learning."

Primary teacher
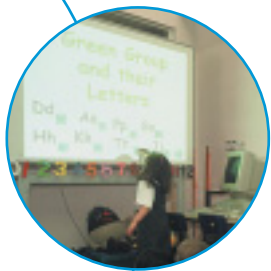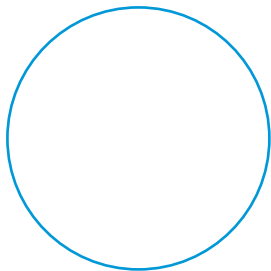
What is an interactive whiteboard?

Despite the fact that there are several different brand names and makes, all interactive whiteboards carry out the same function – namely, to enable the teacher or pupil to control the computer from the board itself rather than using a keyboard and mouse, although these can be used as well.

A diagram is the easiest way of showing how this works:

Projector: beams image of computer screen onto the whiteboard

Whiteboard: every touch on the board with a pen or finger is like a mouse-click on a computer screen. The whiteboard sends messages back to the computer – the required changes occur and the image on the board changes in response.

Computer: sends messages to the data projector and receives messages from the whiteboard

In the simplest terms, a multimedia projector allows the user to display anything that is on their computer for an audience, and to control the computer from the interactive whiteboard itself instead of having to return to the computer. This allows even a novice user to run applications such as CD-ROMs, word-processing documents, spreadsheets, presentations and the internet simply by 'clicking' in the right places on the board without losing engagement with a class. With a little bit of practice, teachers can then start to use 'floating tools' to add notes or comments and highlight sections of these pages.

The effective use of interactive whiteboard technology can radically transform the interaction between teachers and learners and allows for discussing and analysing in a visual, auditory and kinaesthetic medium.

Whiteboard types

There are three key types of technology and then variations upon these:

- **Infra-red/ultrasound kits**
  Infra-red or ultrasound kits fix to any standard whiteboard or any hard surface via clips or suckers. They use special pens (or pen housings to hold standard marker pens). This technology can also be used without a projector for simple save/print functionality. These kits are less expensive than a dedicated whiteboard, but not as robust or flexible. Some whiteboards can be purchased with this technology already installed and secured.

- **Passive whiteboards**
  These have a dual membrane resistive board which is touch sensitive. They can sense pressure on the whiteboard from any object from a standard whiteboard marker to a finger. On a very basic level these can be used without a projector to save/print the content on the whiteboard. Note that some passive boards do not advise the use of standard whiteboard markers as these could permanently mark the screen.

- **Active whiteboards**
  These solid-state impact-resistant whiteboards are operated with an electronic or cordless stylus to detect the content being drawn to the whiteboard. They are more accurate than passive whiteboards, but have the disadvantage of needing a projector to 'draw' the image on the whiteboard as the pen does not physically mark the board. They are also more robust than passive whiteboards.

There are also various types of alternative technologies such as graphics tablets that allow pupils to make changes to the displayed image without touching the whiteboard, as well as numerous 'add-ons' such as voting pads, and personal or mirroring devices which may assist with access issues.

Features of whiteboards

Most interactive whiteboards come with their own software, which will generally offer a range of functionality, including the following.

Pages

All whiteboards have a design area, or blank pages to create teaching materials. In most instances, the number of pages that can be used is almost unlimited. Teachers can either prepare these before a lesson, drawing on a wide range of digital assets such as images, video or audio clips, or they can be generated during the course of the lesson whilst the learning is taking place – again, using text, images and sound already saved, or starting with a blank page. The teacher and pupils move backwards and forwards through the pages at a suitable pace. This is useful for presenting and representing work. The flipchart can be run at the same time as other applications (web browsers, word processors, spreadsheets, and so on), allowing users to swap between the flipchart and other programs. All pages can be saved.

Pens and highlighters

These allow the user to handwrite on the board. This is not possible with a mouse on a computer screen. Different pen colours are available, which can be used to enhance the teaching and learning process.

Interactive activities

The whiteboard software allows teachers to create resources which pupils will find motivating and fun. Being able to 'drag and drop' text, images and sounds on screen allows for a variety of sorting, categorising and sequencing exercises. Hiding and revealing text, images and sound is also possible, allowing pupils to hypothesise and make suggestions, before confirming or re-assessing their original ideas. Reviewing work in progress through peer review and discussion allows pupils to reflect on their own and others' work in order to make improvements.
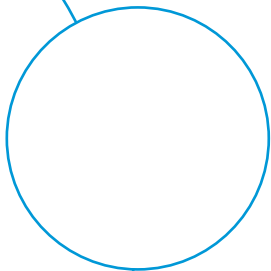
Templates or backgrounds

Using templates available in the software provides a structure (for example, graph paper or a music stave) or a framework (for example, PE pitches, flowcharts, and brainstorm templates) for teachers to manage the work on the board. These resources are time-saving and visual, enabling pupils to access resources which could be more difficult using traditional methods.

Shapes

Some whiteboard software provides visual functionality, particularly useful for mathematics and scientific subjects when dealing with abstract concepts or physical phenomena. Rotating, flipping and mirroring shapes can all be carried out by clicking on a button. This allows teachers to demonstrate these functions at the board. Pupils can predict and immediately confirm, or reassess, their own understanding.

Benefits of whiteboards

The benefits of interactive whiteboards are both practical for teachers and motivating for pupils.

Ability to prepare and access saved work

Graphs, charts, diagrams and text can all be prepared in advance in a suitable software package and accessed during the lesson. This allows teachers to provide models and demonstrate work quickly and efficiently.

Access to multimedia files

Sound, moving and still image files are readily accessible using whiteboard technology. This can be useful as an additional presentation of a concept or scene setting and helps to bring topics to life. (You may need audio facilities for some types of multimedia, however.)

Software choices

The range of software available for curriculum subjects is growing and specialist software supports learning in a variety of ways. For many topics, teachers now have access to a wide variety of materials, which can be explored on the whiteboard.

An increasing amount of software and content is designed specifically for use with interactive whiteboards, such as the

interactive teaching programs (ITPs) being developed to support the Primary Strategy. These can be downloaded for free from the DfES Standards site [http://www.standards.dfes.gov.uk/numeracy/publications/]. You may also already have software and content in your school that can be used effectively with an interactive whiteboard.

Involvement in the lesson

Pupils seem to enjoy using the whiteboard technology and quickly acquire the techniques to manipulate the software and actively participate in their learning.

Rapid response

Pupils receive immediate feedback on activity on the board – and they are not afraid to make mistakes. They become confident and take risks knowing that the flexibility and functionality in the software means that they can learn through trial and error, making 'mistakes' along the way and learning through the concept of 'what happens if…?'. This allows pupils to test and confirm ideas and work collaboratively with others in the class to make decisions. Discussion, debate, articulating what you know and understand and demonstrating what you can do are all key features of effective whole-class teaching with an interactive whiteboard.

Alternatives to whiteboards

There are many alternative or complementary technologies to use alongside interactive whiteboards, offering varying levels of interaction in the classroom environment.

Tablet PCs

You can use a tablet PC and a wireless link to either a wireless projector or computer incorporating wireless technology physically connected to a projector. This allows the content to be drawn directly onto the tablet PC and then projected onto a standard whiteboard or projection surface. This has the advantage of the writing surface being mobile, but suffers from the speed of the wireless link. In a lot of cases fast-moving images such as video have poor frame rates.

Touch-sensitive LCD tablet/TFT screen

This is similar to the tablet PC, but it needs to be connected physically to a separate computer, as it is simply a touch-sensitive flat monitor. It has the advantage of being cheaper than a tablet PC and able to display fast-moving images such as video, but has the disadvantage of being fixed and not mobile.

Wireless mouse and keyboard

Used in conjunction with a multimedia projector, a wireless mouse and keyboard give a limited level of interactivity but may be adequate for demonstrating the use of many applications.
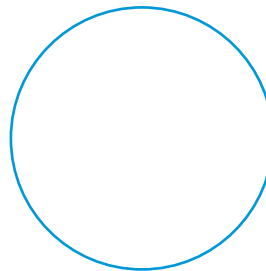
Whole-school management issues

The main elements for successful integration of interactive whiteboards

To ensure successful integration of interactive whiteboard technology in the teaching and learning environment, a number of key elements should be considered:

- Conduct a requirements analysis to ensure the most appropriate whiteboard and projector are purchased, and that the whiteboard is located in the best position firstly within the school, and within the classroom.

- Ensure that the interactive whiteboard and projector are appropriately installed, taking into account all health and safety considerations.

- Provide training for all teachers covering basic equipment operation, functionality and care of equipment.

- Follow up functionality training shortly afterwards with pedagogical training to ensure that teachers are fully equipped with knowledge and ideas for how to use the new technology to its full potential.

Defining your requirements

Considering the following factors will help to ensure that you choose the most appropriate whiteboard and integrate it successfully.

Choosing an interactive whiteboard

An interactive whiteboard is a major investment and a piece of equipment that the teacher is likely to work with every single day. The best advice is to try before you buy. Test different systems and find out which board teachers in your school prefer.

The functionality offered by, and resources included with, the software supplied with the board are very important – how easy is the software to use? Does it do everything you need it to?

Look at the full range of services offered by the supplier/vendor and how much support is provided after installation. Talk to other teachers and advisers as well. In general, having just one board type in school is much easier to manage.

If you are purchasing additional whiteboards, check that all users are happy with the functionality, reliability and usability of existing boards.

Choosing projection equipment

There are a number of technical issues to consider when purchasing and using a projector with an interactive whiteboard, and these should be identified as an aspect of your requirements analysis. Factors include:

- **Brightness**
  The amount of light output from the projector is measured in lumens. A minimum of 1000 lumens should ensure good clarity of image, while 1500 lumens will be more than adequate for most classroom environments. To minimise potential risk of eye damage from misuse, projectors over 1500 lumens should be provided with a method of reducing or filtering the brightness for when the projector is being used with a whiteboard. This can then be removed for other projector uses such as cinema type uses where it is not likely that a person will be standing in the beam. This may be achieved by the supply of a neutral density filter or brightness reduction function on the projector. This does not imply that projectors over 1500 lumens are dangerous: all projectors have the potential to cause damage if misused, but the risk may be increased with higher-powered projectors. Never turn to face the projector when standing inside the beam of light and always teach pupils to step outside the beam before facing the projector.

- **Contrast ratio**
  This is the contrast of the image: the higher the contrast, the more vivid the colours. For example 400:1 would provide a better contrast than 300:1. A recommended minimum of 400:1 contrast ratio should ensure a good image even on the lower lumen projectors.

- **Bulb type/lamp life**
  Projectors use special bulbs. These generally have a life of between 2000 and 4000 hours, and can cost £200–£350. Some projector bulbs may contain mercury. It is important to store any replacement bulbs securely to prevent breakage. Schools need to take care to dispose of bulbs safely. Bulb life may be dramatically decreased if the correct procedure for turning off the projector and allowing it to cool down is not followed.

- **Resolution**
  Generally a projector is either SVGA (800x600) or XGA (1024x768). Most modern computer monitors would run at 1024x768, however 800x600 is ample for general video use. Many projectors can simulate higher resolutions by squashing the image to fit their native resolution, although this will result in a much lower quality image.

- **Keystone correction**
  This allows correction of a distorted image caused by the projector not being vertically in line with the screen (for example, when ceiling mounted). Keystone correction stretches or shrinks the top or bottom of the image to give a true rectangle filling the screen.

- **Image throw distance**
  Projectors have a maximum and minimum throw distance (distance of the projector from the screen) for a specified image size. When mounting a projector it is important to make sure that the projector is fixed within its throw distance. Too close and the image may either be out of focus or not fill the entire screen; too far and the image may be too large for the screen.

- **Upside-down projection**
  A ceiling-mounted projector is usually mounted upside down. Most projectors have an option to invert the image so that it is projected the right way up. Some smaller, portable projectors do not have this option.

- **PAL and NTSC support**
  Many countries, including all of Europe, use a display system
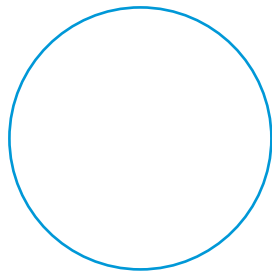
known as PAL. All video sources such as DVD players output this format. Other countries such as America use NTSC. Buying a projector that supports both PAL and NTSC sources will ensure full compatibility with both formats.

- Aspect ratio
  This is the shape of the screen used. A standard television and computer monitor is 4:3 and a widescreen television is 16:9.

- Remote control
  This is essential if the projector is mounted out of reach. Some remote controls include pointing devices such as laser pointers or a mouse to control an on-screen pointer. Replacements can be expensive.

- Input type
  Composite, S-Video, RGB and VGA are different input types. Composite is a standard round 1-pin video plug often found on cameras, S-Video is a round 4-pin plug found on some DVD/video players and offers better image quality to composite. RGB is often sent from a SCART or VGA plug. Many devices can output RGB via a SCART, but few projectors feature SCART plugs. VGA plugs are generally associated with computers, and would allow the projector to substitute a computer monitor.

- Stereo sound input and output
  Most projectors have built-in speakers, but these are generally small and quiet, and so an external sound source is advisable. If a projector has only one speaker, make sure it mixes both stereo channels into one, so sound is not lost.

- Economy mode
  This dims the bulb light to prolong its life. For example, a 1500 lumen projector may dim the bulb to 1000 lumens and extend the life of the bulb from 2000 to 3000 hours.

- Cooling
  Projectors produce a lot of heat and use fans to control their temperature. Care must be taken to keep filters clean and ventilation unobstructed. Failure to do this can damage the projector or shorten the life of the bulb. This is especially

important if you have an upside-down ceiling-mounted projector as there may be a vent facing the ceiling in which dust can gather.

- **Warm-up/cool-down time**
Some projectors may take several minutes to warm up before the image is stable and bright enough, and cool down after use (the bulb switches off but the cooling fan continues). This should be taken into consideration especially when mobile projectors are being used. Switching a projector off before the cool-down process has finished can damage the projector and bulb.

Positioning

Careful consideration must be given to the positioning of equipment, and this may affect your choice of interactive whiteboard and projector. Think carefully about location in the classroom in terms of visibility and accessibility, and ensure that the board is positioned at the right height for pupils to use.

Wall-mounted whiteboards are larger and more sturdy but ensure that anyone using the whiteboard can reach all areas of the board.

Mobile whiteboards are usually smaller and can be easily moved between classrooms. However, they take time to set up (up to 20 minutes), need calibrating if knocked during use and there is a much higher chance of damaging them if they are moved frequently. If a projector is being used with the whiteboard, ensure the surface of the screen is not in direct sunlight. Curtains or blinds may be needed to prevent this.

Fixed projectors are often ceiling mounted, as this maximises the space around the projector and reduces the chance of the projection beam being obstructed. The shadow of the operator is less intrusive when the projector is ceiling mounted as it falls below the tip of the pen. A low-level mounted projector leaves the operator trying to write in the middle of their hand's shadow. Special care most be taken to check for asbestos if the projector is to be ceiling mounted.

Mobile projectors will require a stand such as a pedestal or table. The time taken to connect cables between the computer,

projector and interactive whiteboard and to calibrate the interactive whiteboard must also be taken into account.

Depending on the positioning of the projector, long cabling may be required to get power and video source to the projector. Ceiling-mounted projectors will require cabling running across the ceiling and to a termination box. It is advised that when the cabling is fitted, a full complement of cables are installed, since adding cables at a later date may be costly. Termination boxes are available in both metal and plastic.

Mobile units will need more attention to health and safety as you will have cables trailing across the floor which need to be covered to avoid tripping.

Peripherals

Think about which peripherals you will need to go alongside the computer, projector and board. You may need to consider a printer, scanner, video player (connected to the projector), speakers, microphone, specialist equipment for your subject (such as data-logging equipment, microscopes, and a digital camera) and remote devices such as a keyboard, gyromouse or voting devices.

Software

As an interactive whiteboard is basically a pointing device (the same as a mouse), any software that requires just a mouse and not a keyboard to operate can be used on the whiteboard. Many specific whiteboard packages are available, and it is worth checking what bundled software comes with the whiteboard.

Computer connection and networking

You should look closely at the computer that will control the interactive whiteboard. Is it attached to the school network so teachers can share resources and pupils can access files they have worked on with the whole class when they are working alone or with a partner? Will you need the computer that controls the board to have access to the internet? You may also want to consider the facility of being able to attach a
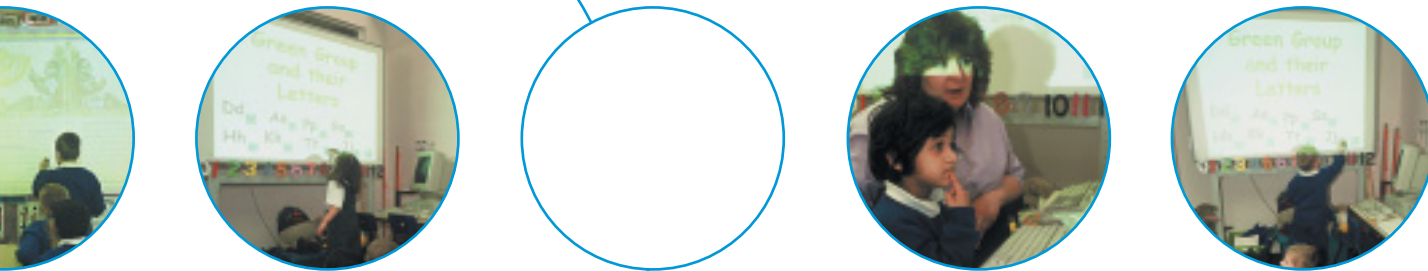
second PC or laptop without having to waste time disconnecting a permanently-connected computer.

Technical support

Before investing in interactive whiteboards, schools should ensure that they can provide or purchase an adequate level of technical support. Technicians may require some training and should be fully aware of the board's capabilities and fully competent in the software supplied with the board. They should also be able to install and manage software that is requested by teachers, and could look at undertaking tasks such as 'digitising' resources, for example converting audio cassette and VHS material into digital files, or downloading and saving purchased materials onto the local area network, subject to any copyright restrictions.

Additional costs

Other costs, such as curtains or blinds may be incurred. Even though modern projectors can function in a well-lit room, few can cope with direct sunlight hitting the projection screen. A computer to run the whiteboard, speaker set-up, additional software and pedagogical training also need to be taken into account when considering the total cost of ownership of whiteboards.

Purchase, supply and installation

Purchasing

Becta, in creating an OJEU (Official Journal of the European Union) compliant framework contract, has developed standards and performance specifications, and undertaken a full supplier evaluation process for interactive whiteboard solutions. This covers a broad range of areas such as: whiteboard and projector compliance to minimum functionality requirements; suppliers' installation process and approach; training evaluation; technical support; value for money assessment; provision of appropriate insurance cover; commercial factors and financial assessment.

Becta will also provide ongoing contract management and monitoring of suppliers' performance via key performance

indicators. All of the factors mentioned in this section will help to provide purchasers with greater confidence and peace of mind when selecting product/supplier combinations. An online catalogue will show a range of boards, projectors and services on offer from suppliers who have been awarded a framework contract. The catalogue will be updated with price and specification details that schools can use to inform their purchasing decisions. For further information see the Becta website [http://www.becta.org.uk/leas/whiteboards/].

In addition, IPAS (Independent ICT Procurement Advisory Service for schools) provides guidance for purchasing ICT products and services. The website contains advice, guidance, interactive learning resources and template documents to help schools make decisions about buying ICT equipment, understand how to use best procurement practices and gather information about what they want to buy. It will also help schools to identify and record total cost of ownership factors, manage suppliers and monitor purchases [http://ipas.ngfl.gov.uk/].

Installation

Most installations (other than mobile devices) will require installation by a trained professional. Close liaison with an installation team is essential. You may need to clear space on a wall, invest in blinds, install trunking for cabling, move electrical sockets and examine where your projector can be mounted. A good installation team should work in co-operation with the classroom teacher and the school, offering advice along with a pre-installation site visit to assess the best installation procedure. Care should be taken to consult the asbestos register, and schools should ensure that the supplier is made aware of the presence of any asbestos both at the time of the site survey and at the time of the actual installation.

Warranty

Always ensure that the system you choose has a full warranty. Pay attention to exceptions to warranties such as the bulb fitted to the projector, which can sometimes be covered by a shorter warranty.

Security

Please note that projectors are becoming increasingly desirable items for the criminal, so you will need to take appropriate precautions to safeguard your equipment. Standard security measures (such as ultraviolet pens/data tagging) and physical security (such as locks or cages) should be used to protect projectors. Ceiling-mounted projectors can be easily unbolted unless protected. Some projectors come with built-in security measures such as pin codes. The interactive whiteboard catalogue details various security options, and it is the responsibility of the school and LEA to take adequate care to prevent theft.

Training and support

Training

Training is not just a one-off issue. Training in how to maintain and use the equipment and software will be required. Make sure you receive written information from your supplier that can be accessed in the classroom and for whole-school training sessions.

Training in whiteboard skills is essential and a short course from your whiteboard supplier or LEA should cover this. However, learning to apply these skills is a long-term process and should be considered in conjunction with other aspects of teaching. You could, for example, learn to use the board in literacy and develop literacy teaching skills at the same time. Some teachers may still require training in basic techniques such as learning to organise files into folders and recognising different file types (.doc .jpg .wav .mpeg). These are essential skills for using digital resources effectively in classroom teaching and learning.

Teachers will need time to become familiar with the features of the technology and to start to consider how their teaching methods and strategies will develop through the use of the board. Whole-school training will need to be planned into the schedule for integration with classroom practice.

From April 2004, a National Whiteboard Network is being established to support all LEAs that wish to participate in
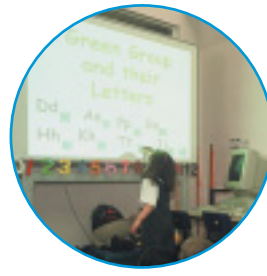
providing dedicated support to primary schools on making best use of interactive whiteboards.

Technical support

Teachers should also be confident that they have access to technical support when necessary. General maintenance such as cleaning and replacing projector filters and replacing bulbs can be carried out by simply following instruction guides and does not need a trained professional. Trouble-shooting and repair should be responded to swiftly, especially if the whiteboard is used on a daily basis.

Care and maintenance

Care must be taken to follow the manufacturer's recommended maintenance schedule for the equipment. This may include regular cleaning and replacement of the projector filters and the use of specific cleaning products for the whiteboard surface. Care must be taken to allow the projector to cool before replacing lamp units, unplugging or moving the projector.

Classroom management issues and examples

In order to get the most out of the interactive whiteboard in your classroom, you will need to plan for your use of digital and web-based resources. There is now a wealth of both free and priced digital resources available to make teaching and learning really effective – the most important thing is knowing how to find a quality resource, quickly.

Curriculum Online is an online catalogue of priced and free digital learning products to support the teaching of the national curriculum in England up to and including Key Stage 4. The catalogue is provided by the DfES as part of a programme to give £330m in electronic Learning Credits (eLCs), between 2002 and 2006, to maintained schools in England to spend on software and web services. Each maintained school is entitled to £1000 as a starting point plus nearly £10 for each pupil at the school.

You can use the search facility on Curriculum Online to find products by selecting from various criteria including key stage/school year, subject and QCA schemes of work. You can also look for cross-curricular topics, inclusive products, keywords and the various methodologies within the 'more search options' facility.

For more information visit the Curriculum Online website [http://www.curriculumonline.gov.uk/].

Finding and using appropriate digital resources

The following tips may help you to find and use digital resources to support interactive whiteboard use in the classroom.

Searching for resources

- When using search engines, use additional key phrases to narrow down and refine your search.

- Add the key stage – a teacher may have already published the resource you are looking for (for example, 'science Key Stage 2' or 'science KS2' / 'Brazil Key Stage 3' or 'Brazil KS3').

- Add the word 'animation' or 'flash', for example 'heart animation' – you will find pictures of a heart contracting and expanding as blood is pumped around the body.

- Add the words 'game' or 'fun', for example 'fractions fun' – you fill find several sites with games and resources for teaching fractions. If it doesn't provide you with a resource directly, it may provide good ideas for creating one.

- Some major search engines offer pre-set image searching from the home page. Type in an image that you need to illustrate a teaching point and it will bring up a wealth of images. From 'dovetail joints' to 'favela', you will immediately be able to show what you are talking about, rather than just explaining it. Images are useful for starting a lesson – asking the pupils what they think the picture, and therefore the lesson, will be about.

Saving resources

- Remember that even though you can download them from the web, images, sound and video files may be subject to copyright restrictions. You will need to ensure you and your pupils only use copyright-free files or that you have permissions to use copyright files.

- Once you have found and saved appropriate resources, make sure they are appropriately 'tagged' or named so that other teachers and pupils can search for them on your local area network.

Using the expertise of others

- Ask colleagues from other schools what they are using and what they would recommend.

- Subscribe to the 'ICT in your subject' electronic newsletter service by selecting 'newsletters' from the home page of the ICT Advice site. These contain news, reviews and suggestions of ways in which you can integrate ICT in your
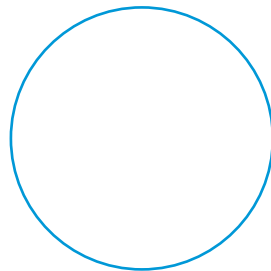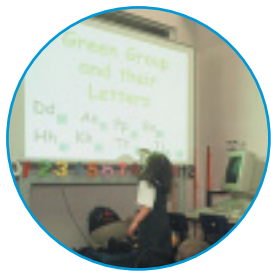
subject teaching and learning. They also include listings of national training events and conferences that you can take part in around the country and online. [http://www.ictadvice.org.uk/]

• The REVIEW Project website has details of software and websites recommended by teachers. [http://www.thereviewproject.org/]

• The Teacher Resource Exchange (TRE) is a moderated database of resources and activities designed to help teachers develop and share ideas for good practice. All resources on the TRE are checked by subject specialists to ensure that they are of the highest possible quality. [http://tre.ngfl.gov.uk/]

• Many local education authorities have their own grid for learning where they recommend web-based resources. You can always visit the websites of other LEAs as well.

Resources for teaching

Becta's ICT Advice service offers guidance for teachers on using web-based resources in interactive teaching for all subjects in the primary curriculum. The following examples are taken from these publications. Further examples, and an online order form for print publications, can be found on the ICT Advice site [http://www.ictadvice.org.uk/].

English/literacy
Stories from the Web (Key Stage 2)
http://www.storiesfromtheweb.org/index.htm
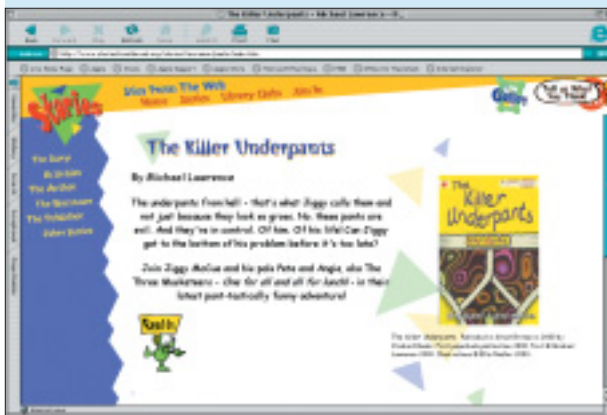
A Year 5 teacher used the story of 'The Killer Underpants' with the whole class. He asked different children to read different sections of the story.

He asked questions such as:
• Who do you think is narrating the story?
• Who said that? How do you know?
• What is a rule? Who do you think made up the 'Rules for Good Parents'? Why?

The teacher focused attention on a page of dialogue. He copied a section into a word processor and modelled how to change the format to that of a play script. For example:

Mother (screeching): 'Jiggy McCue! The state of your underpants!'

Jiggy: 'Have you ever heard of knocking? It's that little thing people do with their knuckles before barging into a kid's bedroom.'

History
The British Museum Children's Compass – Sutton Hoo (Key Stage 2)
http://www.thebritishmuseum.ac.uk/compass/ixbin/hixclient.exe?_IXDB_=compass&search-form=graphical/edu/gt/gtindex.html&submit-button=search - select Sutton Hoo
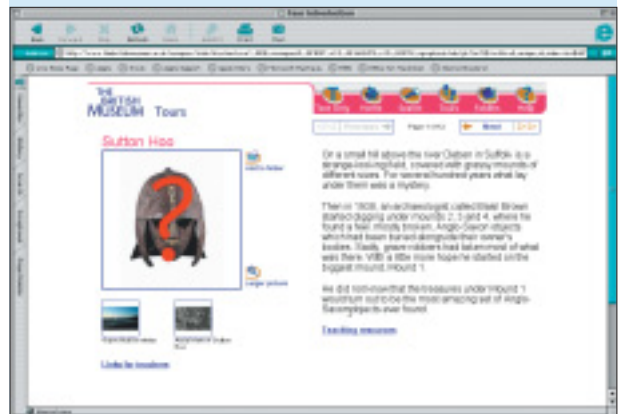
A Year 4 teacher used an interactive whiteboard to allow the class to experience the virtual tour, reading the text to them and posing questions as they moved around.

At the end of the tour he asked questions such as:
• How did the archaeologists know it was a grave?
• What shape was the grave?
• What do you think that tells us about the person buried there?
• What artefacts were found in the grave?
• What sort of person would have owned these? Why do you think that?
• If swords were often passed down from father to son, why was there a sword in this grave?
• Why are the artefacts that have been found made of metal?

The children then worked in groups to compose appropriate labels to annotate the exhibits in the class Virtual Museum.
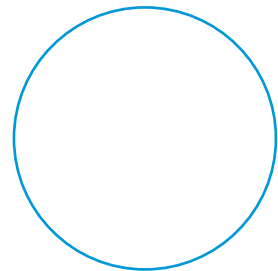
A Year 4 teacher used this program with an interactive whiteboard. The resource was useful as the school does not have a model skeleton. She asked the children to explain the function of their limbs and how they carried out different tasks. This led to a wider discussion on the structure of the body and the functions of the skeleton.

The children were invited to reconstruct the skeleton using the whiteboard. Different children were asked to label the diagram on the board while the others in the class copied the labels on to a worksheet showing a diagram of the skeleton downloaded from the internet.

Using the zoom function, the class were able to check the labels of their skeleton.

Hints and tips

- Make sure there is plenty of space both in front and to either side of your whiteboard so that you can move around it and access all parts of the screen easily without standing in the beam.

- Make sure the whiteboard is positioned at a height that the pupils can reach without over-stretching. You may need to have a sturdy step available for shorter pupils.

- Install wall-mounted speakers, rather than relying on the internal speaker within the projector. This means that sound is of better quality and carries better across the classroom. It will be cheaper if speakers are installed at the same time as the whiteboard and projector.

- Use a font type and size that can be easily seen at the back of your classroom – Arial, Comic Sans and Sassoon Primary are recommended fonts for schools. Always check it out from the furthest position before the lesson starts.

- Use background colours other than white – pale, pastel colours can help improve legibility. If you have a problem with glare from windows without blinds, try using a high-contrast combination such as a black background with white or yellow text.

- Make use of full-screen utilities within applications. For example when viewing a website using Microsoft Internet Explorer press F11 on your keyboard to remove all of the toolbars at the top of the page. This displays your web page in a much larger screen, and makes the page more visible.

- Place a wireless keyboard near to the whiteboard for times when you or the pupils want to add text. This saves moving back to the computer each time you need to enter text.

- If you are going to use a website in a lesson, add it to your favourites/bookmarks in order to access it without typing in complex web addresses. Remember to check the content of the site regularly to ensure that it hasn't changed since your last visit.

- Use 'floating tools' to add notes and annotations over any page on your computer screen: whether using word-processing software, presentation software or the internet, you can highlight text and use different coloured pens to add comments to any page that appears on your screen.

- Try to create documents where you do not need to scroll up and down – instead of three paragraphs on one page, add one paragraph to three pages. Space your work well to leave room for annotations and comments, which can be retained if you don't need to scroll up and down the document.

- If you are creating pages for pupils to use, place text into the lower two thirds of the page. This enables pupils to reach the items they need more easily.

- If you have annotated work during the introductory phase of the lesson, save the file to the network drive using an appropriate name so that pupils can access it when they are working on it later. Teach them to save their files with appropriate names so that they can find and demonstrate their work during a review activity or plenary session.

- When creating your own presentations use royalty-free images and sounds to illustrate teaching points and/or to provide a stimulus for a discussion. A picture can be worth a thousand words!

- Give consideration to the individual access needs of your pupils. High-contrast colours, personal and mirroring devices, and different teaching practices can help ensure that all pupils can benefit from the learning experiences offered by interactive whiteboards.

Adapted from *Tips for using your whiteboard*
[http://www.thereviewproject.org/]

Developing your teaching strategies with interactive whiteboards

This section describes how the use of the technology can replace existing teaching approaches by transforming teaching and accelerating progress in children's learning. Hooper and Rieber (1995) describe five different levels of adoption of technology in the classroom. These phases include familiarisation, utilisation, integration, reorientation, and evolution. Overleaf we use these levels to consider progression in teacher practice with whiteboard technology.
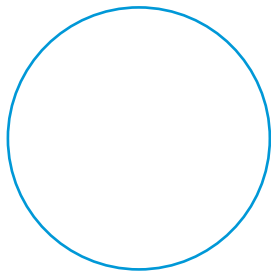
Replacement

At the level of **familiarisation**, the teacher is first exposed to an interactive whiteboard, for example, at a training session or during a whole-school Inset session. At this stage, the teacher gains an appreciation of what the technology can offer but does not have the opportunity to put this into action in a sustained way. It could be that although the teacher has an interest, they do not necessarily have appropriate access to the technology in their classroom. It could also be due to the fact that the teacher has received some training on the technical functionality of the board but has yet to understand its potential in terms of interaction and intervention. Teachers in this phase may be using the technology to support simple visual demonstration to the class.

Teachers in the next stage, **utilisation**, start to introduce the technology into the classroom environment with more regular frequency, but are replacing techniques and teaching strategies they would have previously used without the interactive technology. At this stage the teacher is replacing classroom resources such as an overhead digital projector connected to a computer or flipchart, but using the technology at this stage can still increase the efficiency or effectiveness of teaching and learning. The ability to annotate on screen, the clarity of text, the ability to save changes to work and the ease at which resources can be amended and adapted all contribute to improved learning. If technical problems occur, however, the teacher readily drops the technology as the value added is not sufficient to sustain interest.

Transformation

The **integration** or 'breakthough' stage is characterised by a teacher who has made the commitment to use the interactive technology and considers it an indispensable part of high-quality teaching and learning. A teacher at this level integrates the technology into their lesson planning and everyday teaching. The 'expendability' of the technology is the most critical attribute or characteristic of this stage. For many teachers this phase marks the beginning of an exciting path of professional development and desire to move even further in integrating the technology.

The fourth level is **reorientation**. Teachers at this level are seen as 'lead learners', continuing to learn through opportunities offered by this technology along with the pupils. They are beginning to explore what ICT has to offer and are excited by the development of their teaching strategies and the new opportunities that the interactive whiteboard offers them to extend their teaching and the pupils' learning.

Teachers in the **evolution** level take this idea one step further by continuing to evolve and adapt the teaching and learning experiences across the curriculum through the use of this technology. The teacher has created a flexible environment that is adaptive in order to meet the needs of individual learners. The teacher is confident in integrating ideas and a range of electronic resources to meet the needs of the learners. They are able to provide for the various needs of different learning styles and remain open-minded to new ideas and developments. They continually search for new strategies to improve the learning experiences offered to the pupils.

These stages should not be seen as discrete development points or as some sort of hierarchy of competence in using the whiteboard in subject teaching. Teachers cover many different areas of learning and are having to develop many new techniques to successfully integrate this technology with their classroom practice.

The following examples exemplify the above stages in relation to literacy and mathematics.

One teacher has transformed her teaching of number sequences in mathematics by developing their questioning skills using an interactive teaching program. She encourages the children to test and hypothesise about various statements; she asks 'what if…?' questions and facilitates these through the interactive nature of the program. While the ICT techniques required by the teacher are few, the demands placed upon the teacher's confidence and knowledge of the subject are high.

The same teacher is replacing her existing strategies when creating a checklist for a recount text in literacy. The teacher splits the screen and copies text from a sample text to the new checklist. The text can be edited, saved and adapted for use at a later stage. Here the ICT techniques required by the teacher are greater and, although this is an efficient and effective method of creating a checklist, the same lesson could have taken place without the use of the technology.
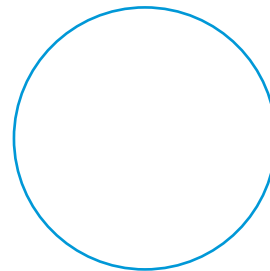
What the research says about interactive whiteboards

About the research literature

As interactive whiteboards are a relatively recent technology, there is not a great deal of literature relating to them in refereed academic journals. However, there are a number of research projects that have been undertaken by schools and LEAs, reports from which are often available on the internet. These projects often include surveys of teachers' and students' perceptions of interactive whiteboards.

The number of articles in the educational press and even national newspapers also shows the high level of interest in interactive whiteboards, though these articles tend to focus on anecdotal evidence and advice. It should be noted that although most of this coverage presents a very positive view of interactive whiteboards, as each school's needs are different, it is important to exercise judgement in assessing the wider applicability of such evidence.

This section provides findings from two main sources:

- Becta's analysis of the existing literature with key findings

- interim findings from *Embedding ICT In The Literacy and Numeracy Strategies Evaluation*, written by the University of Newcastle upon Tyne.

Becta's analysis of the existing literature

On the basis of Becta's analysis of the literature, interactive whiteboards are seen to have positive effects on teaching and learning in the areas outlined below. There are references for further reading supplied alongside most of the findings, and full bibliographic details are available in the appendix.

General benefits
- Versatility, with applications for all ages across the curriculum (Smith, A., 1999)

- Increased teaching time, because teachers are able to present web-based and other resources more efficiently (Walker, 2003)

- More opportunities for interaction and discussion in the classroom, especially compared to other forms of ICT (Gerard *et al.*, 1999)

- Increased enjoyment of lessons for both students and teachers through more varied and dynamic use of resources, with associated gains in motivation (Levy, 2002)

Benefits for teachers

- Greater opportunities to integrate ICT in lessons while teaching from the front of the class (Smith, H., 2001)

- Increased spontaneity and flexibility, since teachers can draw on and annotate a wide range of web-based resources (Kennewell, 2001)

- Teachers can save and print what is on the board, including any notes made during the lesson, reducing duplication of effort and facilitating revision (Walker, 2002)

- Teachers are able to share and re-use materials, reducing workloads (Glover and Miller, 2001)

- Widely reported to be easy to use, particularly compared with using a computer in whole-class teaching (Smith, H., 2001)

- Inspiration to teachers to change their pedagogy and use more ICT, encouraging professional development (Smith, A., 1999)

Benefits for students

- Increased enjoyment and motivation, giving greater opportunities for participation and collaboration, developing students' personal and social skills (Levy, 2002)

- Reduced need for note taking because users can save and print what appears on the board. Students are able to cope with more complex concepts as a result of clearer, more efficient and more dynamic presentation (Smith, H., 2001)

- Different learning styles can be accommodated as teachers can call on a variety of resources to suit particular needs (Bell, 2002)

- Students can be more creative in presentations to their classmates, increasing self-confidence (Levy, 2002)

- Students do not have to use a keyboard to engage with the technology, increasing access for younger children and students with disabilities (Goodison, 2002)

Factors for effective use

- Teachers need sufficient access to whiteboards so they are able to gain confidence and embed their use in their teaching (Levy, 2002)

- Whiteboards should be used by students as well as teachers (Kennewell, 2001)

- Training must be appropriate to the individual needs of teachers (Levy, 2002)

- Teachers need sufficient time to become confident users and build up a range of resources to use in their teaching (Glover and Miller, 2001)

- Ideas and resources need to be shared among teachers (Levy, 2002)

- Whiteboards need to be positioned in the classroom to avoid sunlight and obstructions between the projector and the board (Smith, H., 2001)

- A high level of reliability and technical support is available, to minimise problems when they occur (Levy, 2002)

Explanation of findings

As with ICT more generally, positive impacts depend on the ways in which interactive whiteboards are used. Although the literature on this technology is still emerging, there is evidence of good practice and positive outcomes across the curriculum.

Glover and Miller (2001) found that whiteboards were used to:

- increase efficiency, enabling teachers to draw upon a variety of ICT-based resources without disruption or loss of pace

- extend learning, using more engaging materials to explain concepts
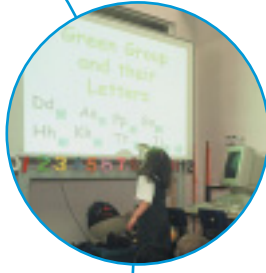
- transform learning, creating new learning styles stimulated by interaction with the whiteboard.

While the efficiency of whiteboards is an important advantage – in one school, teachers found they could significantly increase teaching time (Walker, 2003) – it is their use to extend and transform learning that results in the greatest gains. The literature gives numerous examples of such use in areas as diverse as literacy and numeracy (Smith, H., 2001), modern foreign languages (Gerard *et al.*, 1999) and special educational needs (Carter, 2002).

Motivation

Increased motivation in pupils is seen as a key benefit of whiteboards. Reasons for this include:

- their presentational capabilities – websites and video can be incorporated seamlessly in teaching

- the high level of interaction – pupils enjoy interacting physically with the board, manipulating text and images

- the capacity to present and discuss pupils' work – focusing on pupil-originated material helps keep the class on task and raises self-esteem.

Allowing pupils to use the whiteboards so they engage with learning materials is therefore vital in increasing motivation and learning gains (Kennewell, 2001). Studies report that motivational gains diminish as the whiteboards become more familiar, although pupils tend to view their educational impact more positively the more they are used (STCC, 2002).

Demands on teachers

Teachers have found interactive whiteboards relatively easy to use, but becoming confident in their use takes commitment in terms of both training and independent exploration. Developing multimedia teaching materials is a significant addition to workload in the early stages, though preparation time decreases once a range of materials exists. The expectations that the whiteboards engender in pupils, however, put pressure on teachers to constantly improve the presentation and content of lessons. The capacity to share

resources via the school network and internet could reduce workloads, but evidence suggests that this is currently under-used (Glover and Miller, 2001).

Practical issues

Teachers are hesitant about changing their pedagogy to incorporate interactive whiteboards if practical considerations hinder their use. Key factors include:

- ease of access – the whiteboards need to be a regular part of classroom practice if they are to be fully exploited (Greiffenhagen, 2000)

- reliability – studies report varying, though generally high, levels of reliability; the role of whiteboards in lesson delivery makes it essential that teachers have confidence in the board, its network connection and the provision of technical support

- visibility – problems can occur where sunlight shines directly onto the board (Levy, 2002)

- positioning – the board should be mounted at a suitable height and the computer and projector positioned to minimise the risk posed by trailing wires (Smith, H., 2001).

Research suggests that consulting teachers at an early stage can reduce practical difficulties and ensure the technology meets the school's pedagogical needs.

Value for money

The cost of interactive whiteboards makes value for money an important consideration. Only if they are used to extend and transform learning can their cost be justified relative to cheaper solutions such as plasma screens, or data projectors and conventional boards. Research indicates that while some teachers are making full use of interactive whiteboards, this is not yet generally the case. In one study (Glover and Miller, 2001) teachers were equally enthusiastic about lower-cost options.

These findings are taken from the Becta document, *What the research says about interactive whiteboards*. This series, aimed at teachers and school leaders, provides summaries of the available research evidence of the uses and effects of various

types of ICT in schools and colleges. A PDF version of this paper is available from the research area of the Becta website [http://www.becta.org.uk/research/].

Embedding ICT in the Literacy and Numeracy Strategies Evaluation

This research project, based at the University of Newcastle upon Tyne and running for two years from November 2002 to November 2004, is evaluating the use of interactive whiteboards for literacy and numeracy across six pilot LEAs. It is specifically examining the impact of classroom interaction, the impact on pupil attainment, progress and attitudes, and the impact on teachers' perceptions.
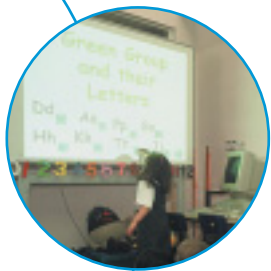
The study has so far involved observation of 116 lessons taught by 31 teachers. Most teachers were observed four times: once teaching mathematics with an interactive whiteboard, and once without, once teaching literacy with an interactive whiteboard, and once without. These observations took place just a few weeks or months after the interactive whiteboards had been installed and should be interpreted with this in mind.

Observations will be repeated with the same classes of pupils and the same teachers in Spring 2004, with a report on the pilot later in 2004, together with an analysis of attainment data in pilot schools.

Preliminary analysis of the observations indicate the following findings.

- More time was spent on whole-class teaching in lessons with an interactive whiteboard.

- In whiteboard lessons there were fewer pauses or interruptions. There were also more answers from pupils and these answers tended to last longer. The teachers used fewer explanations and asked fewer uptake questions.

- There were no significant differences in participation by boys and girls in whiteboard and non-whiteboard lessons. Although boys were more likely to be asked and to answer
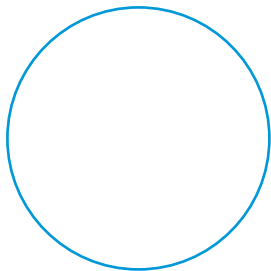
questions, to be the target of a refocusing remark, or an explanation from the teacher and to offer spontaneous contribution, these patterns of behaviour were similar in lessons with an interactive whiteboard and those without. This finding is different from the perceptions of teachers and consultants and will be pursued through interviews and the second set of observations.

- There were some characteristic differences between literacy and mathematics lessons (both those with and those without an interactive whiteboard). The use of the interactive whiteboard did not significantly alter these general characteristics. There were significantly more closed questions and fewer open questions in mathematics lessons. Teachers were more likely to repeat a question in a mathematics lesson and pursue a response (uptake question) in a literacy lesson. Pupils answered more questions in mathematics lessons. These patterns of difference between literacy and mathematics lessons are similar to those found in other research.

Higgins *et al.*, (2003), update report October 2003, Centre for Learning and Teaching School of Education, Communication and Language Sciences, University of Newcastle upon Tyne.

These findings are reproduced with permission from the Primary Strategy and the University of Newcastle upon Tyne. [http://www.ncl.ac.uk/ecls/research/projects/whiteboards/]

Further information, advice and guidance

Becta website information

In 2003 Becta managed a procurement exercise to identify and award a number of framework contracts to suppliers who would provide a range of interactive whiteboard packages (board, projector, delivery, installation and basic operational training and software, telephone and email support, and three-year on-site support) to a minimum specification at a competitive price and to a reliable quality standard.

The website provides:

• an online interactive whiteboard package catalogue

• supporting information

• links to other sources of information.

The catalogue (going live in late January 2004) shows the range of boards, projectors and services on offer from each supplier. Becta monitors the online catalogue and provides price and specification updates. It also provides ongoing contract management and supplier performance monitoring for the duration of the contract period.
http://www.becta.org.uk/leas/whiteboards/

Other sources of information, advice and guidance include:

ICT Advice Services

Becta's ICT Advice services offer a wide range of services to support teachers in their use of ICT in the classroom. Information about ICT and technologies, together with practical help, resources and inspirational ideas, aim to help all teachers to get the best out of ICT.
http://www.ictadvice.org.uk/

ICT Pilots

The Primary Strategy interactive whiteboard pilots were launched in September 2003 as a one-year project to support children, teachers and other adults to make the best use of interactive whiteboards as a teaching tool to enhance teaching and learning.
http://www.ictpilots.org.uk/

IPAS

The Independent ICT Procurement Advisory Service for schools (IPAS) provides guidance for purchasing ICT products and services. Their website contains advice, guidance, interactive learning resources and template documents to help schools make decisions about buying ICT equipment, understand how to use best procurement practices and gather information about what they want to buy. It will also help schools to identify and record total cost of ownership factors, manage suppliers and monitor purchases.
http://ipas.ngfl.gov.uk/

REVIEW Project

The REVIEW Project (Research and Evaluation of Interactive, Electronic Whiteboards) is a two-year research project, based at the University of Hull and funded by Nesta (National Endowment for Science, Technology and the Arts) and Promethean Ltd. The project has undertaken observations of more than 200 lessons in all subjects and phases and will be disseminating findings and advice from this work in an audio-visual CD-ROM, available in February 2004.
http://www.thereviewproject.org/
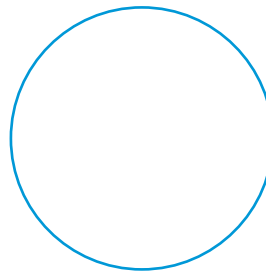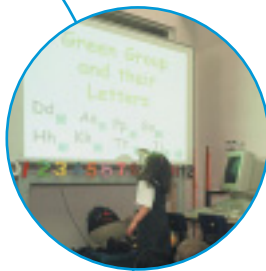
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