

The Interactive Whiteboard as a Force for Pedagogic Change: The Experience of Five Elementary Schools in an English Education Authority

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This article details an investigation into the use of interactive whiteboards undertaken in five elementary schools in an English education authority. Evidence was collected by using a questionnaire containing closed and open questions, lesson observations, and structured interviews of teachers and head-teachers. Potential benefits in the introduction of interactive whiteboards as an integrative technology within schools were found when the following three conditions were met: (a) there was a will to develop and use the technology; (b) the teachers had to be willing to become mutually interdependent in the development of materials; and (c) there had to be some change of thinking about the way in which classroom activities were resourced.

Although many secondary schools had been equipped with one or more interactive whiteboards in the past five years their use within the elementary sector in England and Wales had been more limited. This was partly a reflection of the comparatively high cost of the technology. Even with educational discounts, a system for one classroom costs about £3,000 (\$4,200) at

2001 prices in the United Kingdom. Further, elementary teachers had been under great pressure to adopt curricular and pedagogic change to meet national targets for improved literacy and numeracy. There was also a resistance to involvement in the further developmental training that was necessary for the effective deployment of the technology in elementary classrooms.

The interactive whiteboard system consisted of large free-standing or wall mounted screens up to two metres by one metre in size. The system required a computer linked to a projector and also to a "touch sensitive" whiteboard. Images from the computer were then displayed onto the whiteboard, but there was reciprocity so that the computer could be controlled from the whiteboard. This was done using an appropriate electronic "pen" in much the same way as a mouse controls the cursor on a computer screen. The advantages of such a system were that the teacher remained at the front of the room and controlled the computer from the screen thus maintaining traditional "control" of the class. The system also offered the opportunity for the board to be used as a normal whiteboard with highlighting, superposed comment, or explanation, and labelling. These could all be on top of the images from computer software data, a video clip, a PowerPoint slide, or an Internet connection, and so the process of editing, recording changes, and building a sequential lesson flowed seamlessly from the one control point. Even more helpful was the way in which the screen content could be saved to the computer and then printed off either as material for the group or as a record of the lesson for the teacher or absentee pupils. The availability of "slates" for use by pupils, which could also be added to the system, enabled pupils to work in small groups or individually and then transmit their work to the board for whole class discussion.

The system had its origins in commercial use where it was considered a means of encouraging group participation in decision making but it had been used, to a limited extent, in the higher education and secondary school sectors for some years. This had prompted some investigation of its pedagogic effectiveness with consequent warnings about the practicalities of its use. Effective teaching required that the teacher was aware of and responded to the diversity of learning needs and learning styles within the group being taught as shown, for example by, Tuohy (1999) and Joyce, Calhoun, and Hopkins (1997). Existing software available for use in conjunction with computers and associated systems in classrooms may be no more flexible and responsive to pupil needs than conventional text and board sustained teaching. For Guimares, Chambel, and Bidarra (2000) new technology could enhance learning only through a "process of co-construction" sustained by "organic, adaptive, and generative" learning material. The limited

availability of such material for the elementary sector had led to some resistance from teachers who were apprehensive about the technology anyway. McCormick and Scrimshaw (2001) had indicated that the teaching potential might not be realised unless technology was more than an aid to efficiency, or an extension device. For them pedagogic change was necessary so that the technology became a transformative device to enhance learning. Earlier researchers (Greiffenhagen, 2000; Malavet, 2000) had highlighted problems in the use of interactive whiteboards even where such a transformative aim was the pedagogic goal of the teacher. These included:

- inadequate staff training and limited development of interactive whiteboard teaching skills;
- the use of considerable teacher time in the preparation and presentation of lessons;
- the use of inflexible approaches with limited student interaction driven by the prepared material; and
- the possibility that after a period of time the technology would lose its novelty value and teachers would revert to conventional methodology.

RESEARCH

Researchers from the Department of Education at Keele University had been charting the introduction, use, and subsequent development of interactive whiteboards in elementary, secondary, and higher education contexts. This report draws upon their work with 35 staff in five elementary schools in one local education authority in northern England. The area under investigation was one that had been given considerable financial support as an Education Action Zone (a term used for a group of schools who had successfully bid together for additional funding under a particular government initiative; only schools in certain eligible areas were allowed to bid). As a result the elementary schools concerned had the systems installed at heavily subsidised rates. Although as one headteacher said “this may have taken away the challenge of finding the money because we really wanted the technology” it had allowed the schools concerned to concentrate their efforts on the necessary training and development work for staff to succeed. The investigation consisted of the use of a 30-item questionnaire with a combination of closed and open questions and opportunity for respondent comment, and the subsequent visits, observed lessons, and structured interviews with headteachers and teachers in the schools. Of the five schools, three were for pupils aged 4-11, and two were only for pupils aged 4-7. All

were comparatively small in size with between five and eight full-time teachers. Three of the schools were in areas of marked social deprivation with over half of the pupils entitled to free school meals. Of these, two catered for pupils for whom English was not the language of home use.

USE

It had been argued (Greiffenhagen, 2000) that the availability of interactive whiteboards as a teaching aid was only of value where it became part of the regular pattern of classroom life—the novelty value might provide a temporarily heightened interest but it was only when the full potential was realised that all teaching could be enhanced. Of the respondents 34% used whiteboards in most lessons, and 25% at least once per day. Of the remainder, 13% used it at least once per week, and 23% made occasional use of the facility.

If over half the users only made limited use it could suggest that either the whiteboards were standing unused for much of the week, or that the small number of installations in any one school inhibited frequent use. The data suggested that where the boards were available they were fully used—42% of the respondents were in the two schools that had at least six boards and 20% had less than three available in the school. As a result, 25% of the teachers had to book the facilities in advance. Examination of the relationship between the need to pre-book and use showed that the 75% who could access the boards at any time made the most positive comments on all aspects of use. Their enthusiasm had a positive influence in that 60% of respondents believed that facilities should be further developed in the school. The implication of this for teaching organisation was considerable. In the two schools with a board in each teaching room there was no distinction in the minds of the staff between the interactive whiteboards and any other teaching resources. One class teacher of year one (5-6 year olds) commented that:

After one full year of developing the materials to use for teaching we had got to the point where neither the children nor myself think of the board as anything special. It is used in the course of every day and they have learnt a discipline whereby when I say “whiteboard” they pick up their “slates” and move to the carpet area and we are ready to move ahead.

In one of the other schools where the system was installed but not such an ingrained part of classroom routine a teacher commented that

The use of the whiteboard is of great value especially when you are teaching topics with a visual content—for example telling the time—but I do feel that the disturbance created when we move our seats so that all the class can see is upsetting both for the children and the class next door.

Classroom management clearly needed to take account of issues of visibility and movement. It was significant that one of the problems noted by Greiffenhagen (2000), that of underuse of facilities because of lack of appropriate training, had been overcome in this sample with 97% of the teachers given general training for interactive whiteboard use. Although there had been some subject specific training for the use of the whiteboard in numeracy and literacy work staff were critical of the “whiz kid presentation by the commercial people who fail to understand that we are learning on the hoof and are much slower than they realise.” Comment indicated that staff would prefer to use a high level of mutual support—“hands on rather than demonstration” and use in this group of schools had been facilitated by the appointment of a support teacher. This teacher worked with every teacher in the five schools over a two-year cycle to ensure that usage was helped by the availability of personal basic training.

Impact on Teaching Method

Respondents were asked to rank the five advantages most frequently claimed for the interactive whiteboard as a teaching aid. The results are shown in Figure 1. The use of the board had to be thought through beforehand at least in the early stages of the development of personal confidence by the teacher. As a result lesson planning was thought to be tighter with a clearly defined structure and planned progression. Although more evenly ranked than other features it was clear that teachers recognised that this occurred. Improved presentation was seen as the most frequent impact of the technology, and although this was predominant teachers were aware that they were more able to respond to individual pupil need by using the facilities and ranked this second to presentation. Appreciation of multimedia use was fairly evenly ranked. Surprisingly the sales pitch that argued for the off printing of lesson notes for later use by children was ranked as least significant. One teacher had however, developed the use of this as a conclusion to

each of the “Big Book” sessions of whole class reading. This may be an element of use which was underdeveloped, but might change.

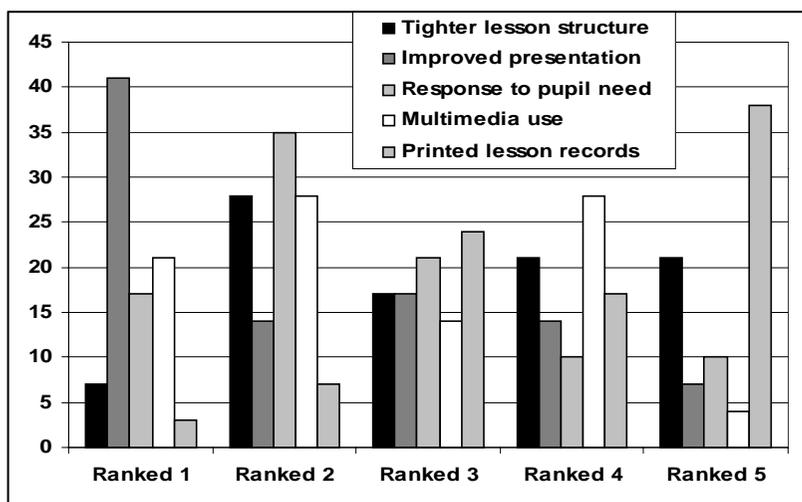


Figure 1. The advantages of interactive whiteboards for teaching

Open comment from 28 respondents indicated that the value of the technology was seen to be in the use of saved work (7 replies), the ability to develop interactive learning (8 replies) and flexibility in use (15 replies) as indicated in the following comments:

It is a good thing to be able to build up your materials across the year and then to plan the work for the coming year knowing that a great deal of the introductory board work has been already done.

It is a versatile system with the ability to make a quick flip to earlier charts and the possibility of over-writing earlier material and so reinforcing parts of earlier lessons.

Teachers who used commercially produced software programmes for numeracy commented upon the versatility of approaches. For one:

the fact that I can use the same programme in different ways with each table of children means that I can respond to what they need and if understanding is slow to develop then I can move at their pace...but to do this you need to develop a great deal of confidence in the material.

The use of saved work was a fundamental gain from the system. Of 35 elementary teacher respondents 53% always stored their work, and 30% mostly did. This had been helped by the development of a whole school approach to the sharing of lesson materials and all lesson planning was a corporate activity with individual staff undertaking the development of materials to be used in the course of a year by the other seven colleagues. In another school this was seen as of great value in the development of a library of materials for history, geography, and science teaching. Retrieval was seen as the basis of lesson planning on subsequent occasions either with the use of the last board as the starting point for progression or because it could be: “very useful as a means of planning on the basis of past teaching and following review with colleagues we could share, adapt and develop according to needs.”

One elementary teacher pointed out that, “It has provided a more efficient start to subsequent lessons, provided the means of running off material for pupils who have been absent, and it gives pupils a chance to be responsible for going over ideas or material they may have not followed the first time.”

Some of the comments referred particularly to the capacity of the system to enhance ICT skills (two mentions), and to ensure that access to the Internet was available to all (three mentions). Under such circumstances one teacher referred to, “the instant access to a variety of media and to make use of demonstration programmes for the whole class without the usual hustle round a monitor.”

MOTIVATION

Although the distinction between teaching and pupil motivation may be blurred it was evident that those who had made use of the technology saw these as separate features. “The big thing is that we can attract the interest and then we can move on to cope with the teaching...and they don't know that it had happened.”

The detail of the responses is given in Figure 2. Attracting interest was the biggest gain in a world where:

the youngsters are so used to slick presentation and something going on that the use of a teaching approach where right answers can be rewarded by cartoon characters on the board, or where the use of sound clips to correct, enthuse or signify repeated errors are a source of fun for the kids.

Enhanced presentation was also seen as a considerable advantage. One teacher of an upper junior (9-year-old) class commented that she had developed her facility in the whiteboard use through the *PowerPoint* program on her home computer. By introducing this to the class and then seeking their help in making the basic teaching points more evident, enhancing their presentation quality and then using colour and sound there had been a surreptitious consideration of how good work should be presented. And, she commented, “this had also achieved a great deal of the ICT syllabus along the way.”

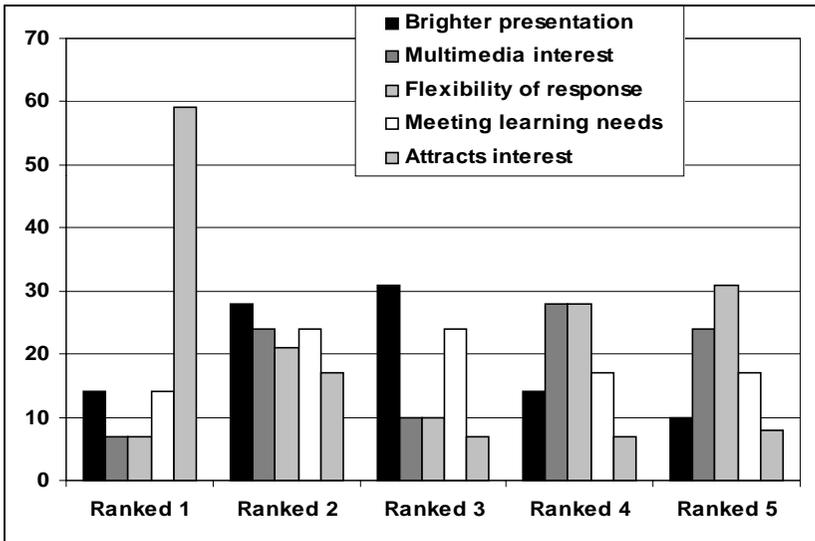


Figure 2. The advantages of interactive whiteboards for pupil motivation

Observation of a full class literacy lesson showed that teachers had adapted the system to meet the needs of individuals. In the course of the lesson there was whole class reading of the “Big Book” story, highlighting of words that had presented difficulty, reinforcement activity at three levels using the board as three work screens, discussion of comprehension with each group in turn, and then a “fun run” when the teacher used a rapid fire questioning related to pictures and words and with appropriate sounds according to success or error. The teacher commented that:

it is much easier to keep everyone working at the appropriate pace when we are working with the whiteboard as their focus. They are too young to appreciate the technology but they do know that when I press the key on my computer they will be challenged and respond with real interest.

Open comment further developed these ideas. Motivation was connected with the modern image for three respondents with words such as “cool” and the “modern image,” but 11 made reference to the enhanced interest arising from professionally produced material, pictures captured from the Internet, and the use of video clips. Other teachers commented that the technological challenge presented to the staff actually offered even the youngest children a chance to shine because of their home-learned skills with computers and video machines. One infant teacher referred to, “the way in which it engages the pupils, maintains their enthusiasm, motivates the less able and then inspires technological research through the use of a variety of approaches.”

Teachers in the secondary sector schools had suggested that there would be a time when the pupils would tire of the approach when “it becomes just another sort of chalk and talk and as you run out of prepared ‘glitzy’ materials you revert to traditional and board centred approaches.”

There was no sign of this occurring in the elementary schools. Where the system was in full use as a classroom resource in every lesson children no longer saw it as a novelty but rather as an entitlement. This could be because all the teachers in these two schools had worked to develop the resources and classroom management techniques to ensure that every pupil was challenged in an interesting way—there was a whole school pedagogic policy. It could also be that the younger children were less sophisticated and accepted whatever was contributing to their enjoyment of school. One parent helper was aware of the potential for the excitement to wear off but expressed the worry that when the children moved into the associated junior school they would revert to a more didactic approach to learning and she feared for consequent loss of interest at that time.

Three elementary teachers outlined ways in which pupils became more engaged with the work because of the use of the technology in front of the class, “they are happy to come out and use it, whether boy or girl, and they are keen to show that they know more about things than I do.”

Motivation was clearly enhanced and there were 14 references to improved behaviour for some or all pupils from the 35 respondents to this section of the questionnaire.

Distracted children pay attention for longer periods.

They have a zest for learning that stems from the element of surprise we (and the software) can maintain.

Pupils are more ready to participate and are less self-conscious in front of others.

Above all, “pupils learn quicker because they are able to follow the teacher at the same time and we can pick up on problems of learning at the point of occurrence rather than at a later stage...so they don’t lose interest and we keep them on task.”

Problems in the Use of the Technology

Although the impression from the teachers in the two schools where the system was readily available for all lessons was that it had made a great contribution to the development of a brighter and more pupil-related pedagogy there were reservations about its use in the other three schools. With the limited distribution of equipment in these schools it could be thought that there would be problems arising from access. However, room booking was not ranked as a first priority problem by any respondents and was rated as the least significant overall. Comparative figures are shown in Figure 3. The use of the equipment for full class visibility, although indicated in two of the elementary schools, was not problematic. “Getting to grips with the technology” was ranked highly by two thirds of the respondents, but overwhelmingly teachers felt that they had insufficient time to develop the technology and the materials for its successful use—a first priority for 55% of the respondents. One of the problems was that the use of linked multimedia took time to organise and required further training. This ranked alongside technological ineptitude as a concern but had been recognised in local training programmes.

Open comment detailed many aspects of technological problems. These were a concern of four respondents.

small day to day errors like not charging the pen

the whiteboard was not a problem, only the linked hardware

we had awful problems in getting the technician from the centre to come out at a time when we want it—especially when you realise that we were using the whiteboard in almost every lesson.

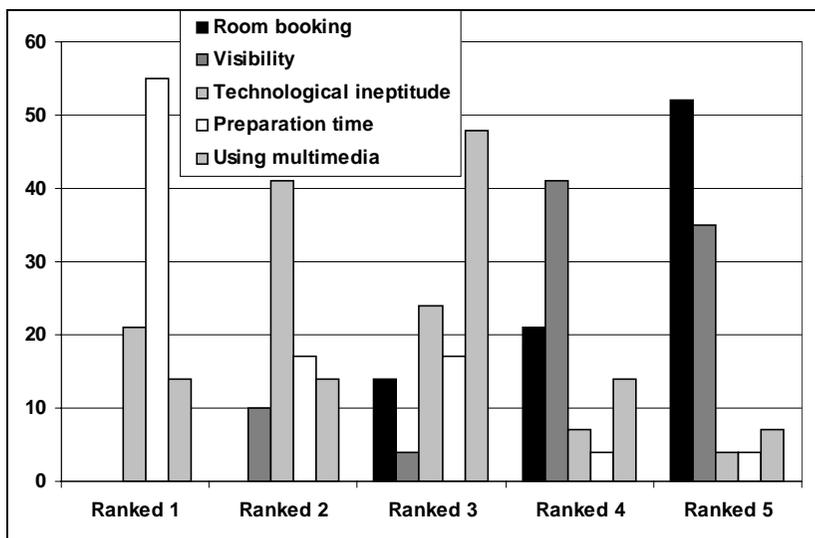


Figure 3. Problems encountered in the use of interactive whiteboards

There were also problems with the use of multimedia materials and hardware mentioned by three respondents including “odd software problems,” “the time taken to make links to the Internet,” and “crashing just when we thought we were underway.” However these were not considered to be of major importance and in the two schools with the most limited access to interactive whiteboard resources all staff were so keen to gain facilities for their own rooms that “we don’t want the head to think that we couldn’t cope—we had got to be on top.”

There were also concerns with the environment in which the equipment was being used. Four elementary teachers mentioned difficulties with the height of the board that preclude pupils using all but the lowest section. Two others spoke of the health and safety aspects of trailing wires “made worse by the use of a mobile system.” Light reflection was mentioned as a problem by three teachers; also mentioned was inadequacy of equipment, for example the availability of only one mouse. All these inhibit the attainment of optimum use. That said the ranking of such problems was low on the list overall and teachers did not make too much of the problems and one commented very positively “Problems? None, it’s fantastic.”

The key to improved use was found in the nature of further training. The elementary teachers felt that they needed to know more about the use of the technology in conjunction with other resources. Already one third of

the teachers questioned were using video, and Internet sources as an adjunct to their teaching. Three teachers were also conversant with the use of CD-ROM materials, and three had attempted to use a digital camera in science lessons.

When asked to specify their training needs only two of the 35 teachers mentioned difficulty in learning the techniques and in planning lessons. One commented positively that problems had been overcome because of the availability of laptop computers for staff use at home and the use of *Power-Point* as a simple home-based resource for lesson development. Additionally she said that "it will not be half as difficult in two or three years time as I build up my materials."

Generic skills were also as important as time to some respondents. One commented that "as with all teaching I feel that I want to share and see how it was used by others" and another noted that "I would like to see one used to its full potential so that I know what to strive for."

Making a Difference

The research team endeavoured to see whether or not the availability of the interactive whiteboards had made a significant difference to the experience and attainment of the children involved. In this respect the staff of the two schools with access to whiteboards for every lesson were clearly more enthusiastic than the staff who had limited use of such facilities and used it rather as an add-on instead of an integrated part of the teaching process. This echoed the findings of McCormick and Scrimshaw (2001) in the secondary sector. Although the sample had been limited to 35 staff in five elementary schools the 15 responses from the two schools immersed in the technology revealed a changed approach to teaching. This could be summed up from their comments as moving forward because:

- the integration of the technology into all aspects of teaching had required a reconsideration of the way in which children were learning;
- this had enhanced understanding of the learning process, had led to an increased individualisation of learning programmes and there was strong evidence that teachers were more aware of individual learning styles;
- this had led to a period of planned change in each of the schools with introduction taking place in a measured way over five terms and involved parents in the learning process; and

- this had been achieved within a framework of corporate planning, shared resources, and peer support so that all staff had been involved in the process of change.

In these two schools there had been a significant improvement in achievement as measured at key stage one (5 and 6-year olds) but as one headteacher pointed out:

you cannot say that the whiteboards have brought about change of themselves. They have been part of a new approach which has involved us in looking at how children learn; they have been in the classrooms as we have sought to implement broader improvement strategies, and they have become the focus for a great deal of lively and stimulating teaching with a consequent fall in absenteeism and an increase in the will to learn. That said ... they have made a difference!

It was significant that one head had commented that such technology would be introduced “over my dead body.” She later accepted that the initial success of one whiteboard in one room used by an enthusiast with the available software so changed her opinion and that of the governors and other staff, that the momentum for change became unstoppable. Anxieties about the cost of such technology had been overcome because:

we know that we have to teach in different ways—one set of materials on the board becomes available to all, one set of materials on a computer are accessible to all classrooms and we have no longer got to buy full sets of material that goes out of date when we can use the technology to the full. Its not so much lack of resources—it’s just that you have to think differently.

The impact of the whiteboards in the other three schools was less easy to judge. Two patterns of use had emerged. In one school the facilities were available in four rooms and teachers arranged mutual changes so that they could have access to technology for one of three timetable sessions per day. This had presented some problems because elementary teaching was so “room” based and one teacher commented

“I only use the whiteboard because I feel that if I don’t my kids will think that they are missing out...but it is a problem to move them, me and the other materials we need—it’s just a frill.”

The second model was that the headteacher and governors had given an undertaking to all staff that they would resource further purchases over a three year period. This had brought with it an inevitability of gradualness

and teachers had become linked in teams for development working with those who already had the technology. In this way, “we share the development problems of finding materials and making them as interesting as possible, we learn to use the technology from each other, and we prepare ourselves for the changes in classroom management that will be necessary when our turn comes.”

This model of development ensured whole staff involvement, reduced the feeling that some colleagues were enjoying favouritism from the head in the allocation of resources, and allowed change to be programmed into the School Development Plan. One head had commented that “it also means that we are committed to a new way of teaching and an awareness of the way in which children learn that should underpin all our attempts to get better grades and that is surely what this is all about.”

CONCLUSION

This article has summarised the experience of a group of five elementary schools of modest size. Potential benefits in the introduction of interactive whiteboards as an integrative technology within schools were found when the following three conditions were met:

- There had to be a will to develop and use the technology. In our sample this was shown to stem from the work of an enthusiast “missioner” who was prepared to develop the necessary materials and their use, to convince headteacher and governors of the potential pedagogic benefit of new approaches to teaching and learning, and then to use this so that it was part of the everyday classroom experience.
- There had to be a willingness on the part of teachers to become mutually interdependent in the development of materials. Where only one or two teachers were involved in this work they appear to be marginalised within the school, colleagues were unconvinced of the benefits and misapprehension and problem seeking bedevilled successful introduction of change.
- There had to be some change of thinking about the way in which classroom activities were resourced. The views of the headteacher were fundamental to this and

there is not much point in trying to make a difference unless you can plan to do it for one year group or pair of classes and then introduce it to the others over a finite period...and that means that you have to

convince a lot of people to think radically. Once you have done that you can begin to regain something of the fun that we remember we experienced in the infant classroom.

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