

How is the interactive whiteboard being used in the primary school and how does this affect teachers and teaching?

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ABSTRACT

The purpose of this small study is to investigate the use of the interactive whiteboard in the primary school and its effects on teachers and teaching. During the course of the research I also became interested in the relationship between the pedagogical skills that define good use of ICT from established research and the skills that emerged from my research on good whiteboard practice.

Since there is little published research on the interactive whiteboard, a qualitative approach was adopted. I considered that there was insufficient established data on which to base questions for a quantitative study. Five teachers, three of whom have full-time access to a board in their classroom were observed teaching, and interviewed before and after the observation.

The two major research questions of the study are:

1. What is happening in the whiteboard classroom?
2. What is the pedagogical approach of teachers using an interactive whiteboard?

The participants were each using this new technology in different ways, which partly reflected access and experience, but more particularly their pedagogical approach to teaching in general. All teachers were enthusiastic about the tools this new technology offers: to help structure their lessons; to save time scribing; to attract and retain children's attention and to provide large attractive text and images. Two of the participants were making more extensive use of the resource to enable collaborative work with the whole class and foster children's cognitive skills.

The facility to use the interactive whiteboard as a whole class resource appears to alleviate some of the issues established from prior research that teachers have in using ICT with individual learners: the whiteboard enables teachers to use the technology in accordance with their existing practice and to gradually build up their confidence and competence.

The study raises several areas for further investigation through a longitudinal study: the relationship between teachers' use of ICT before whiteboard access and their subsequent whiteboard practice; the effects the whiteboard may have on teachers' pedagogical approach and their integration of ICT into the curriculum over a longer period of time.

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CHAPTER 1

The investigation

1.1 New technology in the classroom

For the past 20 years computers have been used increasingly for teaching and learning in schools. During this period, it is not surprising that access and the sophistication of the technologies available has developed, particularly over the past 5 years, as a consequence of increased funding through the Government's National Grid for Learning initiative (OFSTED 2002), (DfES 2001).

The interactive whiteboard is just one of many technological and software developments which have recently become available: networks and the use of computer suites in primary schools, the use of laptops, wireless technology, more sophisticated and less expensive software and potentially faster, easier Internet access through broadband. Though few of these new technologies are yet widely used in the majority of schools (DfES 2001), each raises practical and technological issues for educational use and have become the current focus of much research and debate (Impact2 2001), (Pathfinders 2001), (OFSTED 2002), (BECTa 2002a).

The interactive whiteboard which provides a large image for collective viewing, differs from other initiatives in so far as it is a tool for use by teachers. Unlike other technologies it is not intended for individual learning but for use by a teacher with the whole class. The question I am interested in relates directly to teachers and teaching. 'Will the whiteboard have an effect on whole class teaching and on the professional lives and pedagogical outlook of teachers themselves?'

As this technology has only recently been introduced into schools (Kenny 1998), little is yet known about its effects on teaching and learning. Hitherto it was difficult to use ICT in the context of whole class teaching as images, even with a large TV screen, were too small for viewing. Nowadays an LCD projector, in a similar way to an interactive whiteboard, provides large attractive, interactive images at a much lower cost (Wood 2001). The debate on whiteboard versus LCD projector is not intended as a major component of this research project but will be briefly considered in chapter 5. Notwithstanding, the whiteboard provides much more than just a large bright attractive image for whole class viewing. The flip chart facility enables teachers to move backwards and forwards between pages; text and shapes may be manipulated on screen; class work may be saved for later use and some boards feature graphic facilities to provide maps, 2D and 3D shapes and graph drawing tools.

1.2 The research questions

The aim of this small scale study, involving two schools and five teachers is a preliminary investigation of the use of the interactive whiteboard in the primary classroom; to see how it may affect teaching and how it may affect teachers. How is this interactive tool being adopted for use in the context of whole class teaching?

The two major research questions are:

1. What is happening in the whiteboard classroom?
2. What is the pedagogical approach of teachers using an interactive whiteboard?

Both the major research questions raise secondary issues, which I hope to investigate in asking questions concerning use and pedagogy.

- 1b. How does the whiteboard create whole class engagements though ICT?

- 1b. Does use of a whiteboard affect the integration of ICT into the curriculum?
- 2a. How does whiteboard use relate to a teacher's own pedagogical stance? Do they consider it has changed their classroom practice?
- 2b. What are the attitudes of teachers towards the whiteboard and how do these relate to their previous attitudes towards ICT?
- 2c. How does it affect teachers' professional lives? What training is considered appropriate? What are the effects on lesson planning and classroom management?

The use of the interactive whiteboard is intrinsically linked to the use of ICT. In order to use a whiteboard teachers require some computer skills and many resources for the whiteboard require the skills to manipulate software applications. The next chapter considers findings from previous research into teaching and learning with ICT. These will be used to give guidance on how to investigate the issues raised by both the major and secondary research questions of this study.

CHAPTER 2

The research context

There is little published research literature on the use of this new technology in schools and both ERIC and BEI searches have proved unsuccessful in tracking down relevant papers. Recently some research from teachers has become available on the Internet. In section 2.4, I will report on this evidence tentatively, (given the possible lack of rigour) to provide information from recently documented views on whiteboard use.

This research particularly concerns teachers' use of and attitudes towards whiteboards, which suggests the need for a study of the research literature on pedagogy and pedagogical skills, especially in the context of whole class teaching. Pedagogical behaviours however present a very wide literature base and given the confines of this small scale study, I felt it necessary to focus particularly on the pedagogy and effective teaching behaviours associated with using ICT. Consequently relevant issues on teachers' use of and attitudes towards ICT and the pedagogical skills associated with using ICT in the classroom will be reviewed to find out existing views.

Evidence from prior research was used to form the basis of the interview questions for teachers and to provide pointers for classroom observations as discussed in Chapter 3 on research design.

2.1 Teachers' use of ICT

The most usual style of use of ICT in schools has been either with a class in a computer suite or with one or two machines in the classroom. In a primary school the latter scenario was by far the most common up to 1997 but many primary schools now deploy their ICT resources in dedicated computer suites (OFSTED 2002). The DfES (2001) survey suggests that approximately two thirds of primary schools now have a computer suite. Thus there is a mixed economy in terms of access to teaching with ICT in primary schools (OFSTED 2002), (DfES 2001), (BESA 2001), (BECTa, 2002b). This may be:

- in the classroom with one or two machines
- in the computer suite though often for quite a limited time, for example, an hour per week (OFSTED 2002)
- in the computer suite for a considerable amount of time the teacher is the ICT co-ordinator
- substantial access if the school is one where children have access to laptop computers, currently a rare occurrence (OFSTED 2002)
- through the use of an interactive whiteboard in the classroom, similarly a rare occurrence (OFSTED 2002), (DfES 2001), (BESA 2001), (BECTa, 2002c)

I have some concern that the context in which research into ICT is reported is not always made clear and this may present difficulties in clarifying issues for teachers and teaching. What a teacher does in one context and how they behave may change under given different conditions. Many texts: Cook and Finlayson (1999), Freedman (1999), Leask and Meadows (2000), Leask (2001) and OFSTED (2002) raise the issue of spatial organisation of computers as an influencing factor. The preliminary report from ImpaCT2 (2001) suggests that a mix of ICT suites with clusters of machines in the classroom is the ideal solution.

Much of the research concerning teachers' use of computers appears to relate to use in the computer suite (Peacock 1993), (Sandholtz et al 1997) (Andrews 1999), (Crawford 1999), (Hinostroza and Mellor 2000). The role of the teacher in this context is variable but may take two extremes. At one end as the director of children's learning

where the teacher may adopt a child-centred constructivist approach. At the other end, Hinostroza and Mellar (2000) suggest that the teacher's role may have become one of monitoring how children, working in pairs, should take turns at the computer with little regard to the learning activity undertaken. The teachers in this study conceived the computer as a professional resource but only at an abstract level, without articulating any link to the classroom strategies and practice they otherwise use while teaching.

This last view is supported by NGfL Pathfinders (2001). The report states that in observations during ICT use, teachers often only talk to pupils about technical issues rather than the subject that is the supposed focus of the lesson. It is felt that in some cases the use of ICT, particularly in secondary schools is pushing teaching towards being directive, routine and lacking in imagination.

Classroom use of ICT may similarly vary considerably depending on the role the teacher plays in the learning process. It may be used to engage, motivate and promote discussion and collaborative learning (Somekh 2000), (Selinger 2001), (Smith H 1999), (Loveless and Taylor 2000), (Pachler 2001), or merely as a reward for good behaviour or having completed work before other children.

Eraut (1991) reported large gaps between good practice in the use of computers in schools and use observed in the majority of schools. The issues relating to teachers' use of ICT in schools are well documented by Handy and Aitken (1986), Crawford (1999), Cox et al (1999), Eraut (1991) and Russell and Bradley (1997). Amongst those cited are:

- difficulty of access
- reduction in control over learning and monitoring progress
- different classroom organisation
- change of relationship from transmitter of knowledge to enabler of learning
- lack of proficiency in use of ICT
- less autonomy; just implementing other ideas
- change in working habits
- pupils' questioning of received knowledge may undermine the traditional authoritarian role of the teacher.

I will return to these issues later in the report. What are the similarities and differences between the way a teacher uses ICT with an interactive whiteboard and a teacher uses ICT in a suite or with one or two machines in the classroom? Do the same problems emerge regardless of access to this new technology?

2.2 Pedagogical Skills

This focus of this research is on the pedagogical approach that teachers may adopt in using an interactive whiteboard. Consequently it is important to ascertain from previous research what is understood by good and poor practice in teachers' use of ICT. Later in this section I will also address prior research into *Discourse and ICT* and identify from this a possible framework to support discussion when teaching with ICT.

Watson (1993) found that the role of the teacher was central to good practice in teaching and learning with ICT. Successful teachers were willing to experiment with the software in use and adopt IT to support their existing pedagogy. Practice was often innovative and teachers considered collaborative work and discussion an important aspect of teaching. Furthermore, the use of the technology by pupils reflected the teachers own enthusiasm and confidence. The implementation of ICT activities was primarily dependent on individual teacher initiatives. The enthusiastic ICT teacher

demonstrated patience, a willingness to experiment and flexibility in their approach to teaching.

In contrast, those teachers who had problems using IT had difficulty in understanding its role in the lesson and considered that its use should complement rather than integrate with existing pedagogic practice. They were concerned about how use of the software contributed to the demands of the curriculum and national tests. They did not always understand the learning behind the software and found it difficult to promote collaboration amongst pupils. ImpaCT2 (2001) suggests that the integration of ICT into teaching still varies widely and that many teachers have yet to develop confidence and competence in ICT.

More recent reports (OFSTED 2002), (Moseley et al 1999), (Somekh 2000), (Hinostroza and Mellar (2000), (Wegerif et al 1998) also raise important issues relevant to this research focus: pedagogy in primary ICT practice, collaborative work and the role of discourse in teaching and learning with ICT.

Pedagogy in primary ICT practice

Wragg (1999) emphasises the need to define terms clearly so that what is meant by 'good teaching' is clear at the outset and stated within the research report.

OFSTED (2002), states that good teaching in ICT begins with clarity of purpose. This is followed through by thoughtful planning and collaboration between teachers in integrating ICT into a scheme of work. Teacher intervention is required to ensure that pupils do not become distracted by the technology and to let pupils know that teachers have high expectations.

The OFSTED report also notes some weaknesses in teaching using ICT that I consider are of relevance to whole class use:

- Unclear objectives: ICT is used where other modes of learning would be inappropriate.
- The potential of the ICT application is not fulfilled, for example individual work on a computer would be more appropriately conducted as a group discussion or vice-versa.
- Glossy computer graphics are used with no real purpose
- There is failure to use the full potential of particular ICT applications, for example, the power of data handling or graphic facilities.
- Teachers fail to intervene in children's learning when computers are used in three part literacy and numeracy lessons

Moseley et al (1999), from a synopsis across a range of previous research, identify five effective teaching behaviours: lesson clarity, instructional variety, teacher task orientation, engagement in the learning process and pupil success rate. This useful analysis also suggests features of effective teaching that I believe may be particularly appropriate to good practice in whiteboard use:

- placing the lesson in the perspective of a past or future lesson
- checking for prior learning relevant to the task at the start of the lesson
- using a variety of illustrations, demonstrations and visual aids to explain and clarify
- using attention gaining devices
- incorporating pupils' ideas in aspects of the instruction
- providing direction and control of pupils' work through structuring, questioning and probing

- gradually shifting some of the responsibility for learning to pupils themselves through encouraging independent thinking, problem solving and collaborative work

Somekh (2000) reports several courses of action from early research through which ICT has the potential to transform learning. She states that these are generic and still relevant despite changes in technology. Many support a constructivist approach. Her view is that:

- The presence of ICT in the classroom has the potential to change the culture and relationship between teachers and children. She notes the use of a teacher and children working around a large screen enabling collaborative tasks and the opportunity for the teacher to provide scaffolding.
- It is important that teachers conceive the role of technology in a new way, as a cognitive tool that can be used by students in many ways.
- Teachers need to recognise the potential of computers to take some of the labour out of learning and use it for higher level tasks eg drawing graphs
- Teachers should integrate ICT into classroom practice through framing tasks rather than use as an add-on extra.

Unfortunately, according to Hinostroza and Mellor (2000) teachers may be misunderstanding their role in using ICT.

‘This gives us some insight into what these teachers saw as progressive teaching methods, they considered their role while using constructivist methods was to manage the classroom and did not see their actions as involving scaffolding, counselling or tutoring pupils.’ (page 405)

I suggest that it is perhaps the endorsement of ICT for children's independent learning that is confusing teachers and a lack of clarity as to what their role should be in the computer suite. The use of an interactive whiteboard may give teachers greater control of learning process, though comments in Wood (2001) and Smith H (2001) also suggest that there is a danger that a teacher's exposition may dominate the lesson and take away children's own learning.

Discourse and ICT

Moseley et al (1999) consider that one of the most effective ways of creating variety during instruction is to ask questions and that the effective teacher needs to be confident in the art of questioning and discriminating between the various question formats. Dawes et al (2000) propose that children need to be taught how to talk and listen and that ICT in particular provides opportunities to focus on a task and share understanding.

Much of the research on interactions using ICT has concentrated on those between pupils rather than conversations between teacher and pupil. Wegerif et al (1998) put forward a framework for the integration of pedagogy and software design to support discussion in the primary classroom. Though this was constructed for pupil discussion I suggest that the changing role of the teacher when using a whiteboard with a whole class may equally benefit from the framework recommended for children's discussions:

- Asking task related questions
- Giving reasons for statements and challenges
- Considering more than one possible position
- Drawing opinions from all in the group
- Reaching agreement before acting

Just as pupils may share their work in group learning the whiteboard provides the opportunity for a teacher to share her /his understanding and learning with a large group, ie the whole class.

The evidence from prior research provides a wealth of information on what may be considered good and poor use of ICT and the related issues. I used these findings from the literature on pedagogical skills, practice and discourse to help define both the interview questions and the categories for the analysis of pedagogy in the classroom observations.

2.3 Teachers' attitudes and beliefs in using ICT in the classroom

To use of an interactive whiteboard beyond just use as a chalkboard, requires prior experience in using a computer and some prior skills in manipulating software applications. Consequently for this research study it is necessary to be aware of the factors that may affect teachers' confidence, competence, beliefs and attitudes in using ICT, as these factors may in turn affect how they adopt the whiteboard for teaching.

The percentage of primary school teachers in England who now feel confident to use ICT within the curriculum is 76.4% (DfES 2001). Recent qualitative information from ImpaCT2 (2001), Pathfinders (2001) and OFSTED (2002) does not support this figure. Perhaps there is a tacit assumption even by teachers themselves that if they are competent and confident in using ICT then they will necessarily use it well and integrate it into their teaching. As access to computers increases, the confidence and competence of teachers' use of ICT may become commonplace but there is insufficient evidence as yet to suggest that successful integration of ICT in the classroom will follow.

Andrews, (1999) states that many teachers appear ambivalent towards computers: unable to reconcile professional beliefs concerning the value of teacher-student interactions, with the perception of the computer as teacher. Crawford (1999) adds that the traditional relationship between pupils and teachers is undermined by the shift from teachers as 'gods of knowledge' to directors of learning. Many others, Somekh and Davies (1991), Eraut (1991) and Handy and Aitken (1986) endorse these views. Some of the difficulties involved in the use of ICT are highly dependent on teachers' individual constructs: loss of control, change in teacher-student relationships, change in working habits, loss of autonomy and threats to knowledge base.

Veen (1995) showed that teachers' beliefs change very slowly and that teachers best adopt new media if they can use them in accordance with their existing beliefs and practices. He advocates that initial ICT course materials should provide a good fit with teachers existing classroom practice to enable them to adapt their existing way of teaching and move towards professional change. The use of a whiteboard may provide the transition for those teachers reluctant to adopt new practices.

OFSTED (2002) supports this view at primary level since the whiteboard potentially allows the use of ICT for front of class teaching that may alleviate teachers' feelings of loss of control.

'Many teachers find it easier to use ICT during a literacy hour or mathematics lesson when a projector and screen are available for whole class instruction. Typically, the whole class activities – shared reading and writing, word level work, or oral and mental mathematics – are followed by pupils using computers in pairs or individually.' (page 9)

Helsby (1999) points out that teachers vary considerably in their response to change. While some may restructure imposed change to fit in with their own views of teaching, others may simply replicate in an unthinking way what is demanded. She concludes that whatever structural changes occur, teachers' pedagogical decisions are dependent on their own professional beliefs and levels of professional confidence. Yet both factors may be heavily influenced by the culture in which they work. Consequently there are three importance considerations in relation to change for whiteboard implementation if it is to give rise to a change in pedagogy:

- the culture in which the new technology is introduced
- the beliefs and confidence of individual teachers as they implement change
- the support of management in any implementation

It is necessary for this study to try to understand what the beliefs are of both individual teacher participants and the schools in which they work, in order to explore the effects the whiteboard may have on his or her teaching.

2.4 Recent research relating directly to interactive whiteboard use

Quantitative studies suggest that approximately 20% of all schools in the UK have an interactive whiteboard (BESA 2001). An earlier study (DfES 2001) which differentiated between an interactive whiteboard and an LCD projector put this figure at 14% of schools. Of course this may not imply that many teachers have access, even on a part-time basis. The most recent information available from the report on 'Young people and ICT' claims that out of 1119 pupils, 24% stated that their teachers use an 'electronic whiteboard' for teaching (BECTa 2002c). This reduced to 14% of the 369 KS2 pupils questioned and KS1 pupils were not consulted. Since this figure is not pursued further in the survey, neither frequency of use nor how many teachers use is known, nor is the term 'electronic whiteboard' as opposed to an LCD projector made clear.

There is more qualitative data available though much of this is web based rather than reported via journals. Smith A (1999) produced a paper on interactive whiteboard evaluation in the secondary school, which largely focused on the attributes of different whiteboard models, for example, differences in their touch sensitive systems and the ease of portability. The paper did not address pedagogy. Moseley et al (1999) made passing mention to whiteboard use in the literacy hour as 'an opportunity to extend existing teaching approaches as well as developing new practices.' More recently the preliminary findings of ImpaCT2 (2001) report that teachers and pupils have very positive comments on the learning potential of whiteboards and that:

'while they have the potential to be used very effectively in teaching and learning, some observations indicate that at present they are not yet used to their full potential and tend to be used primarily for demonstrating how to use software.' (page 14)

Similarly the NGfL Pathfinders Report (2001) suggests that use of whiteboards in the classroom is 'patchy'. Unfortunately neither of these preliminary reports indicates the context of use ie whether observations were made in an ICT suite or a classroom.

OFSTED (2002) on the other hand reports a different viewpoint:

'There is an increasing use of data projectors with presentation software to present information to pupils as a focus for discussion. ... Teachers are thus able to produce resources that exactly match their objectives and use them in such a way that

encourages interaction with pupils. Such resources also enable pupils to be given clear instructions and demonstrations, which are crucial to successful teaching.’ (page 15)

The NGfL cites over 500 references in response to an ‘interactive whiteboard’ search but links are frequently repeated and mostly commercial. A few short case studies, written by teachers on their experience of using a whiteboard are available on both the NGfL (2002) and BECTa (2002a) websites. These largely concern explanations of how whiteboards function, the different types available and practical hints and tips. Two such reports however cite findings from several teachers. Smith H (2001) an NGfL Adviser, presented evidence from a group of six primary teachers and Glover (2001) conducted a survey using both open and closed questions among 35 primary and 18 secondary whiteboard users. In addition a published report by Wood (2001) collates views from teachers and ICT advisers on interactive whiteboard use. This evidence presents snapshots of correspondence from the NAACEtalklist (2002). It represents therefore a sample of opinion rather than hard-edged research.

Each of these reports presents views from a number of teachers and advisers, thus providing some degree of triangulation; I will use them to seek out the most common views presented from current practitioners. Both positive and negative effects of whiteboard use were reported. Where points below are not specifically referenced it indicates that all three reports cited relevant evidence.

Positive Factors relating to teaching

- Improved presentation through using ICT with the whole class without loss of eye contact
- Whole class access to a wide variety of resources and moving graphics through large scale images
- The potential to recall previous work through the flipchart element of the boards’ software. Glover quotes one teacher’s view: ‘retrieval to revise, revisit, adapt or consolidate’.
- The facility to respond to individual children’s needs through the immediate manipulation of shapes and text, following appropriate questions (Glover and Wood)
- Teaching ICT skills (Glover and Smith H)

Positive factors relating to teachers

- Better planning and more effective lesson management both on a day-to- day and year-to-year basis (Glover and Wood)
- The potential for a teacher to feel more in touch both literally and metaphorically when teaching with ICT and consequently more relaxed when using ICT in the classroom (Smith H and Wood)
- The facility to share work with colleagues (Glover)
- The ownership of resources by the teacher – which if used by a good teacher will be shared with pupils (Wood)

Positive effects relating to children

- Children’s motivation and their involvement in teaching as well as learning. Glover also noted improved behaviour.
- Increased communication and collaboration between children
- The presentation of children’s thoughts clearly and attractively (Wood)

- The facility to encourage handwriting in the early years (Smith H)

Negative effects were also observed though these were less consistent across all three reports. This may be because some comments referred to only part-time whiteboard access. Others comments referred to particular software provided with the board or whether the board was being used as a movable or fixed system.

Negative factors relating to teaching

- The potential for teacher exposition to dominate the lesson (Smith H) (Wood)
- Difficulty for children in reaching the board (Glover and Smith H).

Negative factors relating to teachers

- The problem of getting to grips with the technology and the need for training or for constant practice with the board (Glover and Smith H)
- Lack of software and or difficulty in downloading resources from the Internet (Glover and Wood)
- Preparation time and time required to develop materials for optimum success such as linking multimedia resources (Glover and Smith H)

In addition Glover (2001) noted that those teachers who had full-time access gave far more positive comments than part-time users. This may in part stem from the difficulties of using a portable system. Smith H (2001) reports that if a board is moved between classrooms and needs reassembling then the task takes 15 minutes. Wood (2001) whose paper cited comments from advisers as well as teachers, noted the cost of boards, the possible reliance on visual material for learning and whether or not a whiteboard provides considerable advantage over an LCD projector. He concludes not surprisingly by suggesting that there is need to analyse the teaching and learning that arises from the use of whiteboards as these devices are increasingly adopted. The focus for this research is the impact on teaching and teachers.

CHAPTER 3

Research Methodology

The use of both qualitative and quantitative methods was considered for this study. As Bryman (1984), points out, there is often confusion between epistemological positions and technical issues in arguing for use of qualitative or quantitative methodologies. This whiteboard research was founded on an interpretivist epistemology since there is little existing knowledge on whiteboard use and consequently few pre-conceived views on effective practice exist. It was felt that the relatively low use of the technology, (OFSTED 2002), (DfES 2001), (BESA 2001) and teachers' possible lack of experience in its use over any considerable period of time would largely disqualify attempts to define what is happening more objectively. It would be difficult under these circumstances to address issues such as generalisation and replicability via positivist methods. Put another way, I considered that at the present time the many variables which may be involved in the use of an interactive whiteboard are as yet largely unknown.

3.1 The research design and methods

To answer the research questions I felt it was necessary to interview teachers pre and post observation, observe teachers using the whiteboard and interview children post classroom observation. The aim was to get 'under the skin' of what is and is not effective practice when using a whiteboard and how it affects teachers' pedagogy.

The pre observation interviews

Many of the existing comments on interactive whiteboards are generally favourable (OFSTED 2002), (Wood 2001), (Smith H 2001), (Glover 2001). Consequently there was the danger that my own perception would be coloured by previous studies. Silverman (1993), Siedman (1998), Hammersley (1992) and Kvale (1996), with many others, state that interviews are social events based on mutual participant observation. The views of the interviewer cannot be detached from the research investigation. By recognising that my own beliefs may be a feature of the interviewing process I acknowledged that I might have a preconception, but equally I aimed to minimise subjective effects. A previous pilot study I had undertaken had raised a few issues concerning possible negative effects of the board as had the reports from Wood (2001), Smith H (2001) and Glover (2001). Consequently I was careful to include some questions which might raise a range of considered responses.

In much educational research it is potentially difficult to differentiate the variables (Cohen et al 2000). Teachers themselves are a complex variable. They each have particular beliefs and constructs, pedagogical style, different attitudes towards the use of ICT, they work within different school cultures and have had different teaching experiences (Fullan 1991), (Helsby 1999), (Burniske and Monke 2001), (Wragg 1999). Consequently the purpose of the pre interview questions was first, to probe these variables and to investigate the individual factors that may affect each participant's professional life. Second, to discuss how they are using the whiteboard; to assess teachers' attitudes to its use; what they feel it may add to their teaching; their use of ICT; their views on preparation and planning and any perceived change in their teaching since use of the board.

As little previous research exists, I devised a framework for the interview questions from previous research into teaching and learning: Moseley et al (1999), Simpson et al (1999), Williams et al (1998) alongside evidence from the reports by Wood, Smith H and Glover (2001).

The interviews were semi-structured. I aimed to reduce my role to a minimum to allow the participants as free a response as possible. Each pre interview lasted 30 to 40 minutes and not all questions noted in Appendix 3 were asked directly. Often answers arose naturally from the participants' discourse.

Classroom observations

The purpose of this stage of the fieldwork was to probe more deeply into the relationship between what may be considered effective pedagogy and whiteboard use. What was actually happening in the classroom? What were the interactions and was use of the board encouraging questioning and children's thinking skills? Do teachers' reports of how they teach with the board match the reality of what happens in the classroom? There is discussion of this phenomenon in Askew et al (1997) relating to primary numeracy and in Moseley et al (1999) which discusses how teachers think about their use of ICT and their actual pedagogy.

The use of both a semi-structured and unstructured observation schedule was considered. Moseley et al (1999) suggest that the use of a planned schedule renders observational procedures that are more reliable and replicable than ethnographic or less structured observations though the authors accept that there are many criticisms of such methods. They may just 'simplify and reduce the complexity of the classroom to manageable (research) proportions'.

Cartwright and Cartwright (1984) and Cohen et al (2000) assert that high inference potentially reduces reliability: observers may acquire a halo effect, whereby the observer's knowledge of events exerts an influence on judgements; there may be observer tendency to avoid extreme categories and observers may be influenced by most recent events.

In addition classroom observations can only be considered as freeze-frame snapshots (Cohen 2000) which take no account of progression over time. This has to be accepted with research into use of such an innovative technology. Without question, whiteboard pedagogy will evolve and change. There is little software available at present to support this style of pedagogy (Fox 2000), much having been created for individual, closed exercises.

A further influence for bias concerns the Hawthorn effect which is general to all observations (Wragg 1999), (Cohen et al 2000), (Hopkins 2002). For observations in a whiteboard classroom it was felt this may be less of an issue at least as far as pupils' were concerned since their attention is often firmly fixed on the board when in use. However the teachers in some instances went to considerable effort to prepare the lesson for my observation.

After consideration of the points noted above, an unstructured observation schedule was adopted with 'observer as participant' (Bell 1999), (Birley and Moreland 1998), (Wragg 1999), (Cohen et al 2000). I felt that this would be more appropriate than a structured schedule given the potential range of subjects being taught, the difference in year groups and the possible range of teaching styles. Classroom activity and whiteboard images were noted approximately every minute and the teacher's and children's interactions recorded on audio to aid analysis. The audio recording proved particularly valuable in providing an accurate record of the conversation between the teacher and her class and a memorandum of the ambiance of the class room. I felt the facility increased the rigour and reliability of the observation data as it enabled me to cross check my observation notes with the audio material.

Post observation interviews

Cohen et al (2000) point out the potential for behaviourist reporting of observations: the lack of mention of the intentions of those observed; the assumption that observed behaviour provides evidence of underlying beliefs and that the lesson purpose may be lost in the subjectivity of the observer. The aim of the follow-up interviews was precisely to help overcome some of these problems ie to give teachers the opportunity to comment on the observed lesson, to confirm the lesson's intentions, to verify the observation report and to investigate the teacher beliefs that underlay classroom actions.

The post observation interviews were conducted in a similar way to the pre observation interviews though each was shorter, lasting 15 to 20 minutes. Hopkins (2002) recommends that discussions on classroom observations should take place as soon as possible after the lesson and that interpretation from the teacher should be sought in a two way discussion. These recommendations were adhered to.

Interviews with children

I was keen to conduct interviews with children to investigate if the child's eye view differed significantly from that of his/her teachers about the facility of the whiteboard in general and about the particular lesson observed. This stage of the research was always intended as experimental to discover if children's comments would add to the data.

The children to be interviewed were chosen by each class teacher after consulting my needs. My main criteria was to talk to children who the teacher felt would respond to questions and respond in a thoughtful way. The interviews with children were semi-structured and undertaken immediately following each observed lesson in groups of three. I deliberately asked for a small group so that children would feel less inhibited and perhaps trigger responses from each other. The interviews were recorded.

3.2 The data gathering context

I had hoped to gather data from three schools but access proved to be more difficult than I had envisaged owing to the demands on teacher time. Even in the Spring term primary schools are very concerned nowadays about the National Tests or the Optional Tests that are taken by some schools at the end of each year. One particular comment from a Year 6 teacher stood out. Although she had a whiteboard in the classroom, she would not be using it from April until after the tests mid-May, as revision had priority!

For consistency I would have preferred participants to be from the same or similar year groups but was dependent on teacher volunteers and consequently this was not possible.

The two schools involved each had a different context of whiteboard use:

- Devon School has one whiteboard which is situated in a classroom rather than the computer suite. Although the board itself is fixed, since the room is used for other purposes, the projector requires setting up when the board is used. There are plans to install a second whiteboard in the staff room so that all teachers can have easier access. Three teachers each with several years experience were interviewed, the ICT co-ordinator, Mary and two teachers. Jane is a Year 2 teacher at the early stages of using the board and Angie a Year 6 teacher with more whiteboard

experience. All teachers were also observed using the whiteboard in class and a group of 3 children interviewed following each classroom observation.

- Wessex School has a whiteboard in every classroom. Consequently each teacher has full-time access to both the board and an Internet linked computer. The school also has a computer suite where children can access machines in pairs. Interviews were conducted with the head teacher, Heather and two teachers experienced in whiteboard use. Anne is a teacher of Year 4 and Carole a teacher of Year 3. Two lessons were observed and a group of three children interviewed following each classroom observation.

Summary of sample data

School	Teacher interviews	Classroom observation	Children's Interviews
Devon	Mary ICT co-ordinator	Y 5: PSHE	3 children
	Jane	Y 2: Numeracy	3 children
	Angie	Y 6: Music	3 children
Wessex	Head teacher		
	Anne	Y 4: Numeracy	3 children
	Carole	Y 3: Literacy	3 children

3.3 The analysis process

The interview data was recorded and transcribed. Analysis followed the structure outlined by Kvale (1996) using meaning categorisation, meaning condensation and meaning through narrative. The data was interrogated and the analysis written using four broad themes: what teachers said about their classroom activity, factors affecting pedagogy and teaching, the effects on teacher professionalism including training and planning and how teachers perceived the effect of the whiteboard on children and learning. Each theme was then broken into smaller elements:

- ease of access
- use of software
- ICT experience
- early whiteboard use
- planning issues
- attitudes to whiteboards
- training issues
- pedagogy: classroom interactions, questioning
- change in pedagogy
- advantages and disadvantages
- effects on children and learning

These themes were then examined extensively to identify similar and different views across respondents and the analysis is reported in chapters five and six.

The interview with Heather, the headteacher, was transcribed but not analysed in detail as I eventually focused on classroom pedagogy and teachers themselves for this study rather than management issues.

The classroom observation data was assessed alongside an audio recording and the teacher's own views of the lesson from the post observation interviews. The categories of analysis were as defined in Appendix 3 from previous research reports.

The post observation interviews were analysed in a similar way to the pre observation interviews and information added to both the classroom observation and earlier interview data.

The interviews with children were listened to but not transcribed. Children's views were found to largely confirm the views of their teachers and the observation data but add little new data of significance to this study which relates particularly to teachers and teaching. Consequently the children's data has not been used for further, deeper analysis but rather as an informal validation of teachers' views.

3.4 Triangulation of the data

Through triangulating these processes (Cohen et al 2000), (Wragg 1999), Hopkins (2002) it was hoped that lack of objectivity during the observations, interviews and process of analysis would be made more apparent and the reliability of the data checked.

The research instruments: pre and post observation interviews, respondent validation of the interview data, the observation data, subsequent discussion of the observation data with respondents and audio recordings were interrogated to assess the confirmatory and contradictory stances both within and across correspondents. Although this is a small study, which makes no claims to generalise the findings, I felt that within the brief of illuminating the research questions, cross checking in this way provided increased rigour and confidence in the data.

3.5 Ethical and confidentiality considerations

The following procedures were adopted to ensure that the purpose of the research was clear, to involve the participants prior to the research and to alert them that confidentiality and anonymity would be maintained.

- Permission was initially sought via the headteacher of each school. A letter was sent to each head outlining the purposes of the research and listing the semi-structured interview questions.
- A letter was sent to the teachers involved to obtain their permission to be interviewed and observed and to inform them that interviews and observations would be recorded on audio.
- A draft letter to parents was provided for the schools taking part in case they wished to inform parents that their children might be interviewed.
- Transcripts of the interview material were sent to each teacher taking part so that they had the opportunity to adjust their comments.
- All participants were informed that pseudonyms would be used in any reporting process and that confidentiality would be assured.

CHAPTER 4

The interviews and observations

In this chapter I will first of all describe some general outcomes relating to whiteboard access and the resources used within the context of whiteboard use. Next I will recount the views and attitudes of each participant towards the interactive whiteboard and then describe the different ways each teacher employed it in the lesson observed. My reason for doing this is to provide an in-depth explanation of each teacher's perceptions and actions. Later, in Chapters 5 and 6, I will analyse these perceptions and actions against both the research questions and my findings from the literature.

4.1 Whiteboard set-up and access

I feel it is important that the context of use in each school is clear from the out-set. At Wessex school, Carole and Anne each have a fixed board in their classrooms. Consequently they have virtually no access or set-up problems. They each use the board every day.

Devon School has one whiteboard in Angie's classroom where the projector is not permanently set up. As Smith H (2001) reported, setting up the system can take 15 minutes and this was echoed by Angie, Jane and Mary. Problems raised by Jane concerned not only the set-up time but the help needed to do this, health and safety issues with regard to the free standing projector and the demands on children to be patient at the start of the lesson. These circumstances were also making it difficult for other teachers to access the board. Even though eight staff were interested in using the whiteboard only three had used it for teaching over twelve months.

4.2 Classroom activity: curriculum and software applications

An earlier pilot study that I had undertaken and reports from Wood (2001), Smith H (2001) and Glover (2001) suggest that use of the whiteboard in the computer suite is often by the ICT co-ordinator. Within this context it is largely used for software demonstration purposes rather than for more general curriculum needs. This application was also noted by some participants in the current study. The aims of this report however, are to investigate the use of a whiteboard in the classroom and its use within subject teaching rather than ICT.

Of the five teachers interviewed and observed Anne and Carole with full-time access to a whiteboard were using a full range of software across all subjects except PE:

- *PowerPoint, Publisher, Word and Excel* to prepare presentations or to display information for the children
- *Word* templates, particularly for literacy, so that children can come up to the board and they can build a whole class presentation together
- The *Activ Board* software for shapes and graph work which enables mathematical precision and different scales to be used
- The facility to scan in text for reading so it is large and clear on the screen
- Video, to provide case study material.

Both reported having access to a much larger range of materials.

Jane and Mary, at Devon School both had very limited opportunities to use the board. Mary was using the resource chiefly for staff training and for occasional use with children and Jane for only one numeracy lesson per week. Angie with full-time access spends much of her time teaching music across the school, so was using the

technology chiefly for music programs to provide illustrations of instruments and for music notation software graphics.

Use of the Internet was frequently cited by participants particularly for Literacy, Numeracy, science and history resources.

4.3 Stories of five teachers' use of a whiteboard

In this small study each teacher was observed once using the interactive whiteboard in the classroom and interviewed both before and after this observation. This section recounts the five teachers' views and experiences of using an interactive whiteboard and the pedagogy they adopt in the classroom.

Carole: Year 3 teacher

Carole has been teaching for several years and joined Wessex school 18 months prior to this research. Access to interactive whiteboards in the classroom was one of the reasons she 'took the job'. Her background in ICT on arrival at Wessex was knowledge of Word, Splosh and some CD ROMs. She described how 'I was the sort of person that you could give me a package and I'd learn it to death but that'd be the package I knew.' Going further back in her career she relates how when she started teaching, if children had finished their work they could then go onto the computer 'and we've all been there.'

Her first use of the whiteboard she describes as:

A personal challenge ... I saw them and I thought wow the kids are gonna love this. And I don't think I felt apprehension at all because you can use the board as a basic board, so you can find your way....there was a steep learning curve but it was a gradual one.

Carole tells how in her early days at the school she would arrive at 7.00am because she wasn't used to typing, using the computer or scanning images.

For the first term it took me a long time but it didn't matter because I enjoyed it, 'cos it made it so much better. The children's eyes were bright ...and it was like I want to invest this time, I want to make it so they're looking at the board.

Now she feels that the whiteboard, Power Point, Word, Excel, and the Internet are just part of her day and 'you know I couldn't function without them... I just can't imagine not having it (whiteboard).'

She characterises the whiteboard

as a blackboard but a blackboard with many pages ... and they can go backwards and forwards as you need to go. ... You can insert pictures in and it just brings everything more alive.

In particular she relates how programs on the Vikings had encouraged children to make decisions. It had really got them thinking about what it was like to be in a Viking boat and changed their perceptions of such a journey.

She spoke of adapting Internet resources to her own class by cutting and pasting 'and the second year of whiteboard use is much easier than the first 'because I've got lots of files on there and I can just amend them.'

Her view of using the whiteboard is that:

We're still teaching but you've got the attention of all the children and its making it come alive and involving them. ... I still do believe that the best learning is learning that children want to do and when it comes from them. If I can get an image up there that makes them think 'Oh, I'm excited', then that for me makes for better teaching. ... They're just glued the whole time and they do get a lot more from it.

Carole does not feel that the whiteboard has changed her teaching as she always taught interactively but it has made it better. The board allows her to jump from page to page and there is 'just more time for teaching'. The whole class can discuss an artefact and can all take part; 'children are a lot more specific as well. They come up with the tiniest of details.' It also saves time in class that was just spent scribing or handing out pieces of paper.

Some things don't change however:

You do have to make sure you've found the right resource, you know you find a big book for reading. Is it the right mix? Is it the right reading ability? Is it applicable to what I wanted to teach, my objectives?

Still within the context of literacy she spoke of the appropriateness of whiteboard use or the 'when and when not to use':

I'll use it (the whiteboard) for my big shared reading and I use it for word and sentence level but the independent writing activities lean themselves to children actually going away and writing.

Carole was the only participant to mention assessment in the whiteboard context. She sometimes uses web software (as illustrated in the earlier part of the lesson I observed) for assessment purposes rather than use a more traditional written approach. She felt that this approach, particularly in science helped to intertwine observational skills into assessment requirements.

I observed Carole teaching Literacy to a Year 3 class of 28 children. The interactive whiteboard was being used in two contexts:

For whole class consolidation and assessment using an NGfL test on plurals which was revision following a lesson earlier in the week. After a short recap of 'plural rules', introduced by Carole asking children what they could remember, 10 nouns were presented and children typed the plurals into the computer. The whole class sat on the floor and viewed the answers with full attention while this was happening. This was followed by much discussion as to whether plurals were right or wrong. As Carole remarked in the post observation interview, this activity would have been similarly appropriate for small group computer work. However, with only one Internet linked computer in the classroom which was frequently in use with the whiteboard, she usually used such exercises for class work as opposed to small group work.

The main teaching of the lesson focused on performance poems and in particular adapting nursery rhymes. Use of the board including class interactions lasted for about 30minutes and then children set about creating their own nursery rhymes followed by a performance with actions from each of the six groups. In all eight rhymes were displayed on the board in turn, some with animations or illustrations, some with sound

effects and several in which the rhyming words had been changed which caused much amusement as children read them aloud together. The aim was to show how words could be changed to personalise a rhyme. The resources had been put together by Carole from a variety of web-based texts and nursery rhyme materials used in the First School (easily available through joint ICT access to school resources). She thought it had taken about 30mins to prepare though added that sometimes she didn't really notice this as she enjoyed the task. The children were totally involved. Interactions with the class involved reading the rhymes aloud, discussions on changing the rhyming words with many suggestions from the children and making changes on the board. There was much laughter throughout the activity and at one time I noted that the teacher was enjoying the lesson as much as the children.

Following the lesson I asked how long she usually spent with the board during a lesson. She explained that in this case she'd actually had several more examples but had not used them all as the children had obviously caught on to what was required and they weren't needed.

Following the group work to devise their own rhymes, the lesson ended with the children's performances which they applauded enthusiastically. Carole said she would try to put them into the class 'Activ book' (a sequence of pages for the whiteboard) and find a picture to go with them for the next lesson when they could read them through again. The children left the lesson still creating their own rhymes. To provide a flavour of the children's work, an example of one of the rhymes they produced is given below:

Little Miss Bee
Sat in a tree
Eating her apple and pear
Along came a bear
Who wanted her pear
So she growled to give him a scare.

Angie: Year 6 teacher

Angie has taught at Devon school for several years. She teaches mainly music throughout the school with some history. The whiteboard has been in her main teaching room for about 12 months and it is because of this that she learnt how to use it.

If it had been somewhere else I perhaps wouldn't have, but I use it quite a lot now for teaching ... at least 2 or 3 times per week. Bearing in mind that mine's a practical subject so you know so it doesn't always warrant it but it depends what I'm doing.

Although she feels she is fairly computer literate she described her feelings on first using the board as:

Frightened to death ... I think it was just the fear of something going wrong and no-one being there but the more you use it the more confident you become. I tried to access the Internet and it just wouldn't play ball and the children were a bit 'come on get on with it' but that hasn't happened for a long time. ... I suppose it took 2 or 3 goes to get used to it ... it's so similar to using a computer anyway.

Angie describes the whiteboard as 'such a useful tool'. She uses it for software which she adapts for her own use and to illustrate and demonstrate instruments of the

orchestra including sound. Both she and the children frequently use the board with software to display music notation. When children have created their own compositions they can quickly display these using a graphics score onto the board so that the whole class can play them and the score is easily changed if necessary. She explained that if just using pencil and paper it is often easier to start again rather than rub out and all the children's compositions can easily be saved for the next lesson.

She finds that children 'love it, they love using the pens and the colours, just the whole experience of it I think is very exciting for them. ... They're quite intrigued by how it (the technology) works as well and they can't quite work it out.'

She feels that the board has changed the way she teaches:

I think it can affect my lessons in so far as I might go off at a tangent and be able to use it for something, whereas I wouldn't do that in the past.

However she was quite clear that it's a case of 'Does the whiteboard fit in with my lesson?' rather than 'What am I going to use the board for today?'

The lesson I observed was a practical lesson which started with children listening to a piece of music. Using her own graphic design she displayed a short score for a similar piece on the whiteboard which the children played in groups using 5 types of instruments. Later each group composed variations on the original theme which were subsequently performed to the whole class. Angie explained that this was the first time they had used this notation and that in later lessons they would write their own compositions on the board to share performances with the class. The groups worked hard at their performances and the children enjoyed the lesson.

Mary: Year 5 teacher

Mary is the ICT co-ordinator at Devon School and is confident in her use of ICT.

I think why I can teach ICT and why I'm quite adept at teaching it is because I have an open mind and I try things, I just have a go, I've got quite an enquiring mind so I go 'Ooh I'll have a play with that' and I get into it that way ... so my training is more play, but hopefully if someone said to me 'Oh can you do that' so yes 'I'll have a go fine'.

She does not often have classroom access to a whiteboard and uses it chiefly for ICT and whiteboard staff training. She has been teaching at Devon for the past 18 months and 7 years altogether. Like Angie she has been using the whiteboard for the last 12 months though infrequently. Despite this Mary was interested to talk about its potential and issues for training. She was responsible for calibrating the board when it first arrived and described it as 'a really smooth feeling when you first run the pen across the board.'

It was quite exciting because it was something new, and it was like 'Ooh does this work? How can I use it? How would it be useful?' Not necessarily apprehension though, because it's quite solid. ... Calibrating was fun as well because you have to stand without getting in the shadow ... so yes it was kind of hilarious at the same time.

I asked her if she thought that other teachers had felt the same way. She responded:

They were a bit concerned about the pen, instead of a mouse. Other than that maybe they were a bit apprehensive because of the new technology and they were wondering how they were going to even use it in the classroom, or be asked to use it in the classroom. ... just something new, you know and how to move and adapt to it.

I was also interested to know what skills she felt are required for whiteboard use:

I think basic skills in being able to use a desktop computer and being able to click between different windows. ... knowing how to connect it up is actually the first thing. ... I think also having some initiative and some ideas on how to use it and having a go is probably enough because it seems to me that from just playing, the playing that I've done, it can be used in so many ways.

She is enthusiastic about children using the board themselves:

I think a big plus is children being able to be in front of the board and actually physically being able to move things, sometimes the actual connection between the mouse and the back of the computer, some kids don't have the full connection that you start clicking and moving objects; that's for younger kids. For older kids I think it's probably a very powerful tool and in a different medium from what they're used to.

She spoke of the potential to blend resources when teaching with a whiteboard. If she is using it for training she feels it makes her communicate a lot more clearly as the board feels very direct. She feels that similar circumstances apply when using it with children:

I think you have to step back off the control and let the kids get the pen and do all the rest of it. I think you become more of a facilitator. 'So have a go at that. Try that, Well what's that done?' ... They (children) can actually go and point to things and ask questions and say 'Well how did you get there, and how's that been done?' You really get a lot more out of the kids in terms of in depth questioning and the answers you get back.

Mary also noted the sensory stimulation aspects relating to whiteboard use:

They've got sound and visuals and a lot of the time if you're using it interactively they (children) will be able to do physical things with it as well, like touch and move things. So I think it's harnessing the three systems that we know. It makes meaning you know, 'Is it 90% rather than 50%?' ... so the kids are more enthused ... and it's so big and everyone can see it and read the writing easily.

The lesson I observed Mary teaching was for PSHE with a child-centred focus. It was a small Year 5 class of about 15 children (as some were out on a trip) and they were working in groups of five on PSHE projects. There were three computers available, with one linked to the whiteboard. The children were preparing presentations chosen by each group on Fox hunting, Animal research and Save the whale. In previous lessons they had collected information from the Internet, downloaded images, scanned in images from books and prepared on paper the presentations that they were going to give to the class. Some of these activities were on-going in the lesson I observed.

The group using the whiteboard at this session were putting the information they wished to convey onto PowerPoint with 'for and against' arguments on Fox hunting. They were investigating fonts, text sizes and colours for both the foreground and

background of their slides. This was a collaborative process. Each child in the group had chosen a text colour for their name but as the names appeared on the whiteboard it became apparent that some text colours did not show up well against the background. Discussion and experimentation ensued so that each was satisfied with the outcome.

Mary's role was as a facilitator; with one group she was discussing the images: whether or not they were appropriate (some were quite gruesome) and the appropriate places in the presentation to display them; with another group she was helping them to consider the brevity of language required for a PowerPoint slide; the group using the whiteboard she largely left alone as they were busy experimenting themselves with the text for the presentation.

The next stage for the groups, in the following lessons, was to rehearse their presentation with the whiteboard since each member was going to speak about their research and finally each group would present to the whole class.

I have to admit that though attempting to be an objective observer, the lesson did leave me feeling that I would have loved to have had access to these resources when I was at primary school.

Jane: Year 2 teacher

Jane has taught Year 2 at Devon School for several years. She uses the whiteboard once a week and had requested to be timetabled so that she could have access with her class. At the time of my visit she had been using the board on this basis for about 4 months. Her use of the whiteboard is chiefly for worksheets which she produces herself. Though she would like to use the board interactively rather than as a projector, she finds it difficult to get sufficient access to practise and become familiar with this aspect.

I haven't worked out yet how to work it out where you write with the Activ studio. ... There must be a way of doing it but I've just got to practise more with it. ... At the moment I'm still learning really, about it, how to work the thing myself technically.

She feels that using the board interactively would be the real benefit of using it in class. Using it as a projector she finds difficult 'because I have the computer at the side, it's very difficult to see round because you're always trying to work with the computer, so it would be better with the Activ board up'.

I asked her how children felt about the board, she replied:

Well they enjoy using the board but it's visual they can see it easily and they do enjoy using the pen. But to be honest I would say most of them like using the board because it's different and because they haven't got to actually do any work, while I'm using the board. It's oral they like oral, anything oral. ... And even writing the things on the board it's quite, you know, it's a treat.

I also asked her how the board affected children's attention span to which she responded:

They probably do pay more attention because well I suppose they're used to watching a television screen, that it's a bit like that and it's different. How it would be if it was always there ... I don't know, you would probably have to then

use lots more activity on the screen to keep their attention. It's like anything if you make it interesting and exciting then children will focus for longer but maths is very difficult (laughing) to make interesting and exciting all the time.

Jane feels she is quite computer literate so could do 'lots of things' with children on the board. The way she would like to use the technology is:

To produce worksheets on Publisher or PowerPoint where you go in, you know and you can bring things in and highlight them and learn how to do the links where they disappear and come back. But it takes such a long time to do that, so I just tend to make up a worksheet that will be useful for us in maths.

On the morning I observed Jane's lesson a laptop and projector had been set up but from our earlier conversation I gathered that this was not usually the case. She had commented several times during our conversation that the children tended to become impatient while she was setting the system up. Jane was using the whiteboard as a projection system and stood by the computer which on this occasion was on a stand to one side of the board.

The lesson was on numeracy and about doubling. There were 13 children and they first of all sat on the floor then got chairs to sit on. Jane introduced the lesson and then 10 questions appeared one by one and children gave the doubles each time as verbal answers. After each question the screen was scrolled down to reveal whether or not answers were correct through further illustrations of the doubling process. The questions involved numbers, clipart such as 3 stars, 2 coins, 4 ten pence pieces and finally several coins: 1p, 2p and 2p coins together on one screen. During the process Jane asked the children how they had worked out their answers and if one method was easier than another. This part of the lesson lasted for 25 mins.

The children then returned to their own classroom where they worked individually with much help from the teacher on practical doubling with coins. Following the lesson Jane explained how useful she found the board:

It's easier to put it on the whiteboard than to show them money because you lose half of them (the children) if you're trying to show a 2p and 1p in your hand ... and you've got to check all the time that you've got the right money.

Anne: Year 4 teacher

Anne has been teaching for several years and has used the whiteboard in her classroom for the past couple of years. She appeared somewhat unsure about her confidence and competence in ICT though feels that this is improving.

I wouldn't say that I'm particularly good at using the computer. It was a matter of me really working hard at it. It doesn't really come easy to me. ... Before the whiteboards we had very basic computers but these were so much more of everything. ... We did occasionally, we got together with some of my team mates ... and we helped each other out, demonstrating things that we could you know, help, share with.

Later in our discussion she said that she uses Publisher, Word, PowerPoint and the Internet but added:

There are still lots, I mean as you can imagine still lots of things happening in the ICT world that I haven't come across yet, but it (whiteboard) has certainly increased my confidence in using ICT as a teacher. It's certainly increased my ability ... my confidence 100 fold really. I mean I've actually been teaching the Intel course (for training teachers in basic ICT skills) as well.

Anne's early use of the whiteboard she describes as:

Terrified. Yeah absolutely. ... but the children were great, I mean they know so much more. ... if someone comes in, they're actually helping the supply teachers. ... I can imagine how off-putting it is for people who perhaps come in for supply who have not got very much computer knowledge. ... It (whiteboard) makes everything a lot easier now, it certainly does. When we first had it I used it for the very basic things, just writing on, but now you know you just build up so much more confidence as time goes by. As with all things, the more you practise, the more you get better at it.

She spoke of her use of the board

To demonstrate ... the range really, except PE ... I use it for the Internet ... for demonstration purposes, for children coming up and writing on the board, virtually anything ... Just another way of presenting work in a nice visual manner really. Sometimes it's just a matter of writing on the board. You don't always have to have it all singing all dancing just, you know, straight forward.

She feels that the board helps her teach in several ways: to provide images, for presentation, 'for downloading information and searching things further, ... you've got a bigger picture, more detail on the board'. However she suggested some reticence in that using the board too much 'could lose impetus I think.'

I don't normally use the board for Numeracy at all ... so I think it (PowerPoint) should have better effect because I don't normally use it all the time ... but you'll use it to help them, to help demonstrate, introduce a subject. ... I like using it particularly with shape, it's brilliant for bringing up 2D and 3D shapes' ... you've got them there, accessible rather than drawing.

Anne doesn't feel it has changed the way she teaches: 'I've always liked to sort of take a pride in myself in presenting my work nicely on the board (blackboard). I've always had children coming up to the board. ... I still questioned children.'

The lesson I observed was a three part Numeracy lesson with the 'main teaching' section on multiplication. After the mental/oral starter (in which the children described 4 ways of finding the answer to $24 \div 6$) the whiteboard was used for multiplication by partitioning. At this point Anne asked children who could not see the board to move from their tables and chairs and sit on the floor at the front. Two or three children responded.

The aims of the lesson were displayed and she asked children about different words for multiplication, again they gave several answers. She then put some text up on the screen so that they could check their suggestions and read them aloud.

Several partitioning examples were then demonstrated by first asking the children how they would partition and then checking against previously written results. Children read the results aloud from the board each time.

When it came to doing the first multiplication Anne first of all asked for suggestions to 15×3 ; there were 3 alternative suggestions. She then demonstrated how to multiply by partitioning by bringing up a previously typed-in solution. Each time a question was produced the board made a tinkling sound. After 10 minutes of similar examples, the work for groups 1 to 3 was displayed on the whiteboard whilst she helped a group of lower ability children by going through further examples on a flip chart. The children then worked on task on the questions given and there was a pleasant working buzz in the classroom.

About 5 minutes before the end of the lesson Anne went through a couple of examples on the flip chart and then displayed the lesson summary on the board which the children read together. She asked how many children had understood the method and explained that they would be doing more examples the same way tomorrow if did not yet feel confident. The teacher and the children had all worked hard throughout the lesson.

Anne explained after the lesson that sometimes she might have children up using the board 'but because the PowerPoint was up there and I knew I wanted to carry on with it, I couldn't allow that, so I used the flip chart instead. It had taken her two hours to prepare the PowerPoint so she couldn't do this everyday;

and I haven't done this ... for quite a long time and again they don't go 'Wow!' It's just accepted that it's just another way of teaching and, you know, it's a completely different way to how I sometimes do it.

4.4 Commentary on interviews and observations

This is a small study with only brief encounters through two interviews and one observation with the participants. Nevertheless I felt that the each teacher reflected a different experience and a different view of whiteboard use in the classroom.

Carole uses the full potential of the whiteboard and in doing so is able to let the children direct the learning in the classroom. She is an enthusiast but tempers this with careful thought on how it can be employed to provide a child-centred focus and used to foster children's learning.

You do have to make sure you've found the right resources. ... I mean if you're a good teacher you're gonna sort out resources you're gonna look through them. ... 'cos children at the end of the day need to show what they've learnt from it.

Angie uses the board largely for its functionality in helping her to teach music. Although she has access every day, since she teaches a practical subject she uses the board only two or three times a week.

I don't think 'What am I going to do on the whiteboard today and how does that fit in with my lesson?' It's more a case of 'How does the whiteboard fit in with my lesson?'

Although for the most part Angie likes to direct what is happening in the classroom she did note that in using the board she now sometimes 'goes off at a tangent' which she never used to.

Mary is also a whiteboard enthusiast. She has the skills and confidence to use the technology but is restricted in being able to experiment with it in the classroom through lack of access. She presented interesting views on the ways in which the 'physical and tangible' aspects of the whiteboard may contribute to learning and expressed enthusiasm for children themselves using the board which was reflected in the lesson I observed.

Jane only has the opportunity to use the board once a week and currently lacks the confidence to use the board other than as a projector. She is at a much earlier stage of development in adopting the technology than the other participants and almost seemed surprised that children could learn when using the board as opposed to enjoying themselves.

In the lesson observed, Anne's use of the board was efficient but seemed without risk. She did not, for example, want children to write on the board as she had her PowerPoint presentation on screen. She is an experienced whiteboard user who may perhaps takes less frequent advantage of the potential the technology may offer.

I think you could do (overdo use of the board). ... I don't normally do it for numeracy at all, but it's very odd occasions that I would and I don't use PowerPoint very often anyway, so I think it should have better effect because I don't normally use it than if I used it all the time.

I was surprised to find that teachers' reflections on whiteboard use from their interviews largely reflected their classroom practice as I had possibly expected otherwise. Earlier research studies from Askew et al (1997) and Moseley et al (1999) report the phenomenon of teachers differing descriptions of the way they teach, from their actual practice as observed by researchers.

This research has not delved as deeply as these earlier reports nor has it covered such a wide range of pedagogical skills. I felt however that in this study, teachers' descriptions of their whiteboard use largely reflected their practice, which I have tried to illustrate briefly through the juxtaposition of interview and observation data given above.

To aid identification in later discussions a summary of each teachers' use is given below.

School	Teacher	Class observed	Whiteboard use	Length of use
Devon	Jane	Y 2: Numeracy	Once per week	4 months
Devon	Mary	Y 5: PSHE	Infrequently but ICT experienced	1 year
Devon	Angie	Y 6: Music	2/3 times per week	1 year
Wessex	Carole	Y 3: Literacy	Every day	1½ years
Wessex	Anne	Y 4: Numeracy	Every day	2½ years

CHAPTER 5

Analysis

In this chapter I will relate the research findings across respondents to the two major research questions:

- What is happening in the whiteboard classroom?
- What is the pedagogical approach of teachers using an interactive whiteboard?

In doing so some insight into the subsidiary research questions relating to the use of ICT may also emerge.

5.1 What is happening in the whiteboard classroom?

The question above is too broad to attempt to answer as it stands, so analysis in this section has been categorised into three parts:

- Whole class engagements and interactions
- Collaboration and discussion in the whiteboard classroom
- Could the lessons have happened without the whiteboard?

The analysis in will draw on both interview and observation data.

Whole class engagement and interactions

Although there was plenty of engagement with children in the lessons observed, only Carole's lesson emerged as creating whole class engagement through the whiteboard. There was a constant 'to-ing and fro-ing' of ideas between Carole, the board and the children. Then she would move the lesson forward as children grasped concepts. In other observations (though Mary's lesson was somewhat different), I felt the board helped to capture children's attention but consider this different from the teacher-child involvement and interaction of Carole's lesson.

The interviews brought out several differences as to how the participants regard children's thinking skills and interaction in the classroom. Mary was particularly interested in children themselves interacting with the board:

I have remote learning on my computer in the suite but I think sometimes the actual 'interactiveness' of me sitting at my screen is not as lively as the kids being able to touch the board, manipulate things. ... If you use it (whiteboard) in the right way I think children get involved with it a lot more. I think you have to step back from the control and let the kids have a go.

Angie commented that 'Whenever I switch it on they're always really interested straight away ...it's visual it's exciting'. For Carole, using the whiteboard required not only less effort in attracting children's attention but also the potential to engage with children's learning at a higher level.

You haven't got all of that interrupting and trying to explain to say, 'Oh Jordan what did I just say' to make sure they're watching and listening and it's not that glazed out cadet look you get.... They're just glued the whole time and they do get a lot more from it.

Everyone (the general public) thinks teaching is based on interacting with children but now I use other skills that fine tune and develop that interaction. I spend time actually working on how to facilitate that learning.

For numeracy she describes how

There's a lot more of right 'There's a problem' and giving them a few minutes to think about it and actually being able to drag and drop shapes and see how they work. ... You try and see it (interaction) in their eyes but then I suppose I always did.

For Jane and Anne interactivity involved children answering quiz/test questions sometimes from Internet sites. Anne felt that she largely used the whiteboard 'as I would a (black)board'

If you have some work up then children can come up and use it, but generally I tend to use it for demonstration purposes if I'm introducing something on the board. ... I may have a cloze procedure exercise where children can say what the words are; sometimes they come up and write the words on the board.

Jane associates children engaging with the whiteboard as them not really working:

I did go into the internet once and there was an interactive quiz and they had to answer questions but again it was oral and it was very visual and they enjoyed answering but you know it was quite informative for them. ... They can watch and haven't got to do anything practical with it. Most of them like using the board because it's different and because they haven't got to actually do any work.

Collaboration and discussion in the whiteboard classroom

In all lessons observed the whiteboard display instigated some discussion between the teacher and children. Only in Carole's lesson however did I feel that the resources themselves created the potential for considering more than one position, drawing opinions from the entire group and reaching agreement before acting (Wegerif et al 1998, see section 2.2). She used the board examples to draw in suggestions from the children, to consider a range of rhyming words and took her cue for the final choice of words from the enthusiasm and sometimes laughter of the children.

Both Anne and Carole felt that they had always questioned children a lot before having access to a whiteboard, though Carole added:

There is a difference ... you can be a lot more specific, 'cos your resources have multiplied. ... I think children are a lot more specific as well.'

Mary echoed these sentiments:

I think it makes you communicate a lot clearer. ... so it brings out a lot more questions and they'll try and extend their knowledge 'cos the first part is clear. ... You get a lot a lot more out of the kids in terms of in-depth questioning and answers you get back.

Although not directly related to whiteboard use, three of the lessons observed moved the responsibility for learning to children and required collaborative work: Mary's lesson on PSHE, Carole's lesson on literacy and Angie's lesson on music. It was expected

that children in groups would perform to the rest of the class and there was discussion between them (with appropriate teacher intervention) on how to carry out the task.

Could the lessons have happened without a whiteboard?

First of all it is necessary to distinguish between the use of a whiteboard and use of a projector. It has been argued (Wood 2001) that there is little difference apart from cost. As I observed use of the board, the difference lies in the closeness of a teacher to the resource being used and her involvement with the class, which is of great importance in a primary school setting.

When a teacher controls the computer software from the board, the large, attractive, easy to read display is in the teachers' hands and she can use her personality and dynamism (as particularly observed in Carole's lesson when she marched up and down to the 'Grand Old Duke of York') alongside the materials to attract attention to and to mark features. Smith H (2001) and Wood (2001) support this view when they describe how the whiteboard enables the teacher to feel more in touch both physically and metaphorically when using ICT in the classroom (see section 2.4).

With the teacher separated from the display as in the use of a projector a remoteness to teaching may be added which is not necessarily present when using a conventional blackboard. The remoteness was perhaps apparent in Jane's lesson in which coins were displayed for doubling; it was more difficult for her to identify the coins for children to name as she couldn't point them out so easily, it was similarly difficult to check remotely that doubling had taken place and then to check the total by counting. Whether this accounted for the fact that children were more fidgety than in other observations is difficult to say without more knowledge of the class. One of the comments she made was that she hoped to use the Activ board in the future as that was where the real potential of the whiteboard lies.

Undoubtedly the lessons could have happened without a whiteboard, though in my view not so successfully. First, at a practical level, it appears to help overcome several time consuming elements associated with teaching. Without it, information would need to have been supplied to children via a teacher writing on a blackboard, a flip chart or on worksheets. As noted by Angie and Carole, the time saved in scribing on a blackboard allows considerably more time for teaching. While scribing could be done in advance using a flip chart or an OHT, text size, and the amount of easily read material that can be displayed on one page or transparency is restrictive for children of this age. The use of individually printed worksheets to put across concepts or to investigate sources of evidence for this age group was noted as a particular problem that the whiteboard overcame, both in terms of finding resources and for whole class discussions. My observation was that the pace of lessons was certainly livelier and more direct than if waiting for teachers to write on a blackboard. Most importantly teachers were free to give more thought to actually teaching.

The teachers especially noted the size, colour, potential for images and sound as added value in using a whiteboard. All respondents felt the board motivated children and held their attention. The facility to display a large number of pages and to keep some in reserve if children had grasped the concept was noted by Carole and Jane described the facility to ease her teaching through large images as in her use of coins. In Anne's lesson the board was used to save scribing time and so that children could read together important information from the board. Angie had a specific purpose for its use ie musical notation and Mary was using the board with a child-centred focus for children's own presentations.

5.2 What is the pedagogical approach of teachers' using an interactive whiteboard?

I will first of all address what may be considered effective teaching practice in the primary school and relate this to the research findings. Second, I will consider whether any change in teachers' pedagogy may have occurred as a result of using the whiteboard.

Effective teaching practice in the primary school

In section 2.2 under 'Pedagogy in primary ICT practice', I referred to the effective teaching behaviours identified by Moseley et al (1999).

1. Placing the lesson in the perspective of a past or future lesson
2. Checking for prior learning relevant to the task at the start of the lesson
3. Using a variety of illustrations, demonstrations and visual aids to explain and clarify
4. Using attention gaining devices
5. Incorporating pupils' ideas in aspects of the instruction
6. Providing direction and control of pupils' work through structuring, questioning and probing
7. Gradually shifting some of the responsibility for learning to pupils themselves through encouraging independent thinking, problem solving and collaborative work.

Within the lessons observed all teachers demonstrated points one and two, although no-one used the interactive whiteboard to display children's previous work. In subsequent lessons it was going to be used for these purposes by Carole, Angie and Mary and in each case the next lesson would prove difficult without the technology. Points 3 and 4 were satisfied directly through use of the sound and text and images on the large whiteboard screen.

I felt only one of my observations of whiteboard use illustrated points 5 to 7: incorporating children's ideas and enabling them to share the learning. As discussed earlier in Section 5.1, Carole's lesson on literacy provided the direction for children's work but children were able to input their own ideas and contribute to the final outcome.

How is the board affecting teachers' pedagogy?

For both Mary and Jane access was so limited that I felt it was not possible to assess change in their pedagogy as a consequence of using the whiteboard.

Angie and Carole were both adapting resources to meet their own particular teaching needs. Angie valued the whiteboard particularly for the new music resources she can access and the flexibility.

I think it can affect my lessons in so much as I might go off at a tangent and be able to use it for something, whereas I wouldn't in the past.

Anne and Carole with full-time access were using the board to structure their teaching. In Anne's case I feel from her comments on using the board for demonstration and her use of Powerpoint 'only occasionally' may suggest that the structuring procedures she uses with the board are not dissimilar to those a teacher might use with a blackboard.

I asked Carole if she felt the whiteboard had changed her teaching, she replied:

I do feel more competent now.... It has made it better but I was a good teacher before the board as well, but I think that it's not that I'm a better teacher but I feel more professional, I have more skills.

In her use of the board she is constantly on the lookout for interesting resources.

They're just part of my day and I, you know I couldn't function without them, and if I can't think of how to do something quickly then James (a colleague) or somebody in one of the other rooms will just say, and we're forever ... finding sites and James will come through and say I've found this site and that actually cuts down preparation time as well.

She is also using the resource as a cognitive tool. She described changing children's perceptions and using software for problem solving. She explained how prior to using the board she would spend a lot of time making work cards but now

I'm a lot more efficient as well. I don't spend time doing all that, I spend time actually working on how to facilitate that learning.

5.3 Some early conclusions from the analysis

This analysis of just ten interviews and five observations helps to provide some answers to the two major research questions. The participants were all using the interactive whiteboard in different ways and had different views and interests in its potential. Although data of this nature can never be exhaustive I feel it presents a range of activities to describe 'What is happening in the whiteboard classroom?' which largely reflects each teacher's pedagogical stance. The participants' attitudes towards pedagogy varied considerably especially in their need to direct classroom events versus handing part of this responsibility over to the children themselves.

Teachers did not in general feel that use of the whiteboard had really changed their classroom practice (Question 2c). Both Mary and Jane's use of the board was too infrequent to assess change but I felt that for both Carole and Angie, even though the board may not necessarily be changing their practice it was enabling them to teach with greater flexibility.

Answers to the secondary research questions are less tangible though I feel that I was fortunate to observe a lesson in which the whiteboard did create the focus for whole class engagement (Question 1b).

Many of the secondary issues relate to teachers' use of ICT and I intend to consider these in more detail in the next chapter. I will use the findings of this chapter to compare the pedagogical skills and attitudes outlined here with those pertaining to the use of ICT from the earlier research outlined in Chapter 2.

CHAPTER 6 Is there a relationship between good whiteboards users and good users of ICT?

As I analysed the data I became interested in a further question, which reflects the methodology employed by this research: that theory may emerge during the analysis rather than be necessarily predetermined (Lincoln and Guba 1985). This new question is:

‘What are the similarities and differences between good users of ICT (as defined by established research in chapter 2 of this report), and what may be considered good whiteboard use as suggested by my short study.’

At first glance a positive relationship seems likely but the data does not yet fully support this. The problem that arises (Hage and Meeker 1993) may be related to whether there is a third causal effect: that of the effective enthusiastic teacher. One who is a great learner themselves, who really strives to get learning across to children and who almost leaps on new resources as a way of engaging, motivating and enthusing children to learn.

I will examine the evidence on what is considered to be good use of ICT and relate this to the data I found on whiteboard use.

6.1 Does using the whiteboard enable the integration of ICT into the curriculum?

The issues to be discussed in this section refer to the secondary research question of this study (1b). It is difficult to address, since to use a whiteboard does demand some ICT skills. Mary, one of the participants in my study suggested that the necessary skills are: knowing how to connect the whiteboard to the computer and projector, being familiar with linking between windows and having some initiative and ideas on how to use the board with children. I consider that the first two skills are not related to the integration of ICT into the curriculum. They may indicate some use of ICT via the whiteboard but this is not what is recognised in the ICT research field as ‘real integration’. The third skill, that of a teacher using initiative and having ideas on the potential of the technology for teaching and learning is very pertinent to the discussion.

Within the context of ‘real integration’ I will juxtaposition the evidence on use of ICT from established research with the findings from my study to consider the issues surrounding teachers use of ICT, the links to existing teaching strategies and finally teachers use of software in relation to use of the whiteboard.

Teachers’ use of ICT

In some instances the very nature of whiteboard use ie with a whole class may refute issues from previous research concerning teachers’ use of ICT.

Handy and Aitken (1986), Crawford (1999), Cox et al (1999), Eraut (1991), and Russell and Bradley (1997) cite the following as issues in teachers use of ICT (see section 2.1).

1. reduction in control over learning and monitoring progress
2. different classroom organisation
3. less autonomy; just implementing other ideas
4. difficulty of access
5. lack of proficiency in use of ICT

6. change in working habits
7. change of relationship from transmitter of knowledge to enabler of learning
8. pupils' questioning of received knowledge may undermine the traditional authoritarian role of the teacher.

Though difficult to confirm as the context was not always given, this list appears to relate to pupils' individual use of a computer, rather than use in a whole class context. I suggest that the first three factors may be redundant in the context of whole class teaching with a whiteboard. Of course teachers may choose to reduce their control of learning if using a whiteboard but none of the respondents suggested that this was a threat. Equally they felt in control of the software as it was prepared and presented by them.

Research by Veen (1995) showed that teachers best adopt new media if they can use it in accordance with their existing beliefs and practices. I found evidence to suggest that whiteboard use supports this view. Assuming they have had sufficient access teachers were able to gradually employ the new technology in a way that matched their existing practice, with quite hard work but relative ease.

The next three issues in the list: difficulty of access, lack of proficiency in using ICT and change in working habits may be equally relevant when teaching with a whiteboard particularly in the early days of use. These aspects featured in my discussions with respondents when they spoke of 'starting out' with the whiteboard. Jane and Mary noted difficulty of access, Anne spoke of her initial lack of proficiency in ICT which had now increased enormously and Carole described how she was in school at 7.00am each morning to prepare her resources.

The final two statements concerning the enabling of learning are the ones that really interest me. I feel however that with reference to my research questions they have greater relevance to pedagogical practice rather than the integration of ICT and will return to them in section 5.2 under '*Teachers as enablers of learning*'.

Links to existing teaching strategies

Watson (1993), Somekh (2000) and Hinostroza and Mellor (2000) state that good users of ICT employ it to support existing teaching strategies. The use of ICT is integrated into children's learning as opposed to being used as an add-on or an extra.

Within the very limited number of lessons observed, I felt that all participants did integrate their use of the whiteboard into their teaching strategies. This is not to suggest that the board is necessarily always being used to integrate ICT into teaching strategies, nor that it is necessarily always being used to its maximum potential as a teaching tool. I do not have sufficient evidence to assess this issue in a more general way.

Angie does not use the board all the time but when she does it is to integrate software within her teaching strategies for music. As she stated explicitly, she considers how the whiteboard can help her teaching, not vice-versa. The whiteboard I suggest has helped her to integrate ICT into her teaching, though through limited software applications.

The issues for Anne and Carole are somewhat different. They are both using the whiteboard full-time across all subjects and the demands to integrate ICT and use the board to its full potential every lesson are unrealistic. However I feel that Carole is close to attaining this goal. She described how she enjoyed looking for resources on the Internet and didn't notice how long this took. She was adapting traditional

resources such as prefix cards to a whiteboard format. Her enthusiasm in searching for materials to excite children and arouse their interest came across many times when I interviewed her.

Use of software

OFSTED (2002) reports two weaknesses in the teaching of ICT: lack of clarity of purpose and the use of glossy computer graphics with no real learning aims. Neither arose as an issue during my observations though in an earlier pilot study the problem of children being more interested in the flying graphics rather than the topic being taught had arisen. Consequently I asked respondents about this. Anne felt that extensive graphics could be over-used and Angie that she used graphics to only suit her needs. Carole wanted to 'bring everything more alive' but with the reservation that the resource had to be appropriate and that it was always necessary to ensure that children are learning. In the lesson I observed she did not feel obliged to use all the resources she had prepared. It is my view that participants were more than aware of the need for clarity of purpose in their whiteboard use and sensible about over-use of the resource which nevertheless did vary with their views on teaching.

Watson (1993) and Cook and Finlayson (1999) speak of good users of ICT experimenting with software, understanding clearly its application and of innovative use through adapting it for their own purposes. All participants to a greater or lesser extent were using software resources to suit their own environment. Angie spoke of adapting resources for music, Anne and Jane of using Internet resources such as quizzes, intended for individual learning in a whole class context and Carole spoke of cutting and pasting existing software and of creating software resources that had traditionally been available using cards and blue tack.

Only Mary mentioned the lack of ready-made software available for whiteboard use. The teachers involved in this research appeared to be content in creating their own resources and adapting others to be appropriate to the context of whole class teaching. It would be a pity if the creation of software resources for the whiteboard resulted in pushing teaching towards being 'directive, routine and lacking in imagination', as noted in the NGfL Pathfinders (2001) report with reference to some current use of ICT.

On the evidence I collected, I feel that while some of the participants in this study were integrating ICT into the curriculum in their use of the whiteboard, others were not. Certainly difficulty of access was an issue just as it has traditionally been an issue in the use of ICT. Lack of proficiency in using ICT may also be a factor. Anne spoke of spending 2 hours to prepare the PowerPoint for the lesson I observed and added not surprisingly that she 'could not do this every day'. Angie was integrating ICT resources into her music lessons but for quite specific purposes.

6.2 Pedagogical practice in ICT and whiteboard use

There is a great deal of existing research on the pedagogical skills required for good practice in using ICT (see section 2.2). I will use evidence from this research to compare and contrast some of these skills with those that arose from the use of the interactive whiteboards in my study.

Use of scaffolding

Scaffolding is noted as a feature of good practice in the use of ICT by Selinger (2001), Somekh (2000), Smith H (1999) and Cook and Finlayson (1999). Selinger (2001) describes the teachers role as one in which she is, 'supporting and scaffolding learners

to assimilate new information, to turn it into knowledge and understanding within a nurturing and supportive environment' (page 91).

Unlike the use of ICT for individual learning, the whiteboard is usually controlled by the teacher for use with a whole class. In my observations, the reason for use was to assist the teacher in providing an initial structure to set up the learning situation. This is very similar to the way a teacher might employ a conventional blackboard to explain what the lesson is about, and to instigate learning of new knowledge. In whole class situations teachers usually initiate the learning and guide this process at least in the early stages. OFSTED (2002) endorses the use of presentation software and a large display to present information to pupils as a focus for discussion

'In many very good lessons, ICT is used as a tool for demonstration, exposition or instruction. This contributes to improvements in learning.' (page 15)

The related issue that arises with individual learning using ICT is that children may be set a task to do on the computer with no introduction as to how it fits in with their prior learning or the learning in hand (Hinostroza and Mellor 2000). Consequently I feel that the issue of scaffolding differs in the two contexts and that scaffolding at least in the form of lesson structure may be expected to feature more generally in whiteboard use. Within the lessons observed it was employed this way and there was also some extension to what Cook and Finlayson (1999) describe as:

'Task structuring: the teacher organises the task so that learners with this support are able to operate in the Zone of Proximal Development when, without this help, the task would be too much for them.' (page 98)

In using a whiteboard with the whole class there is less potential to guide each child through the learning process than may be possible if children are working individually at a computer. Despite the fact that Glover (2001) and Wood (2001), (see section 2.4), describe the potential of the whiteboard facility to respond to individual children's needs I did not experience this phenomenon in my observations.

Similarly I did not observe 'over-structure' (Smith 2001), ie a tendency for the teacher to dominate the 'whiteboard lesson'. OFSTED (2002) indicates that primary teachers find it easier to use ICT in class when a projector or screen is available but how far this involves children-teacher interactions or changes the authoritarian role of a teacher is not mentioned.

Assuming a teacher is reasonably skilful in her use of the whiteboard, on the basis of this small study I believe that the technology may make it easier for teachers to provide a structure for whole class lessons. Planning may be undertaken in advance and the flip chart facility of the board makes it easier to move the learning forward and provides the possibility of returning to earlier work at any stage. The issue of more extensive interaction and classroom discussion is discussed in the next section.

Intervention, discussion and collaboration

OFSTED (2001), Loveless and Taylor (2000), Smith H (1999), Wegerif et al (1998), Mercer and Fisher (1997) and Watson (1993) all cite the importance of intervention, discussion and collaboration in the use of ICT. Smith H (1999) suggests that the success of any approach to investigative learning with ICT depends on

'presenting challenges and opportunities for children, the quality of the teacher's insight into learners' interactions, and the ability to intervene appropriately.' (page 11)

I endorse this statement. Although expressed as relating to the use of ICT I feel it could equally apply to a teacher using a whiteboard or to teaching in general.

Dawes et al (2000) write:

'Technology can provide new opportunities but the essential skill of communication lies in knowing how to reach a shared understanding. This knowledge can empower so that children are able to make the most of opportunities for communication.' (page 62)

Though discussion occurred in all the lessons I observed, I felt that only Carole was using the whiteboard for higher order discussion and as a collaborative tool between herself and the children. She created the possibility to consider more than one position, drew opinions from the entire group and reached agreement before changing the rhymes (Wegerif et al 1998, cited in section 2.2).

Perhaps disappointingly I did not in general find evidence to support the view that the whiteboard enables higher order discussion and collaborative work. I did however observe one example in Carole's lesson of how it may provide such opportunities.

Use of ICT and the whiteboard as cognitive tools

Somekh (2000) proposes that ICT has the potential to be used as a cognitive tool, though this is not a frequent occurrence. Cook and Finlayson (1999) regard cognitive skills as strategic thinking and logical reasoning which are applied to problem analysis, problem solving and evaluation of the problem analysis.

I felt that both Mary and Carole were using the board as a cognitive tool for children in the lessons I observed. They were both developing children's thinking skills through providing problems which were given to the children to consider and to solve. Carole noted the use of software for altering children's perceptions, persuading them to consider another's point of view and 'seeing how shapes work'. Mary's views on children's use of the board, ie 'giving it over to them' reflects the potential of the whiteboard as a cognitive tool.

Teachers as enablers of learning

Both Mary and Carole spoke of the whiteboard as empowering them to become more a facilitator of learning than a teacher. Other participants did not acknowledge this process, though Angie touched on it as she described how she sometimes now when using the whiteboard goes off at a tangent which she never used to.

Andrews (1999) referring to the use of ICT, states that many teachers appear to be unable to reconcile their professional beliefs, concerning the value of teacher-pupil interactions. With the introduction of another medium, the computer via the whiteboard may impart knowledge to children and consequently create a possible threat to the teacher's traditional role. Somekh and Davis (1991), Eraut (1991) and Handy and Aitken (1986) suggest that this phenomenon is highly dependent on a teacher's individual constructs on loss of control and threats to knowledge base.

I do not have enough evidence within this short study to know if use of the whiteboard enables teachers to share the learning. Through observations and discussion I felt that Mary and Carole were both able to do this. Both were confident teachers in so far as they were able to say why they were good teachers and did not feel threatened in any way. In Mary's case her use of the whiteboard had been so infrequent that the

whiteboard could not realistically have been an influencing factor. Carole said that she used to be a good teacher before the whiteboard but now she was better. Angie's point, stated implicitly, about her now going off at a tangent was perhaps the most telling and it may suggest some change in her becoming more an 'enabler of learning' through the whiteboard.

There are interesting links between what is considered good use of ICT from established research and what I discerned on whiteboard use during this study. Some of the issues that arose when teachers first use the whiteboard are not dissimilar to the issues cited by established research on teachers' use of ICT. However, there are some differences: the fact that teachers are able to adopt the interactive whiteboard largely in accordance with their existing practice appears to ease the process of change for teachers as this new technology is introduced.

I found some incidence of teachers integrating ICT into their whiteboard teaching but felt this was dependent on each teacher's pedagogical stance rather than access to the new technology affecting their pedagogy. The participants themselves supported this view and stated that using the whiteboard had not changed their practice.

Teachers were employing the board effectively to provide the initial lesson structure but further scaffolding to meet individual needs did not occur. In general the board was not being used to instigate higher order discussion and collaborative work, though I did observe one example of such whole class engagement.

CHAPTER 7 Conclusions

This small study of 5 pre observation interviews, 5 post observation interviews and 5 classroom observations has led me to have a wider understanding of how teachers are using an interactive whiteboard in the primary classroom and of the pedagogical skills that may enhance learning through this new technology. Nevertheless many issues remain outstanding. While I feel that the study has provided some answers to the two major research questions, several areas of the secondary enquiry remain open. During the process of analysis, I also became interested in how good use of ICT as defined by existing research is relevant to what I may consider to be good whiteboard use. Consequently I have categorised the conclusion into four sections:

- Conclusions to the two major research questions
- Conclusions to the secondary research sections
- The relationship between good use of ICT and good whiteboard use
- Areas for further investigation

7.1 The major research questions

The two major research questions of the study are:

1. What is happening in the whiteboard classroom?
2. What is the pedagogical approach of teachers using an interactive whiteboard?

In order to answer these questions fully, more extensive research is required but the study provides some early indications. Teachers were enthusiastic about the interactive whiteboard as a new tool for teaching. Their statements suggested that it is being used (by those who have daily access) across most areas of the curriculum and with many software applications including the Internet and CD ROMs. When used with a whole class, there were several common factors within the teaching practice I observed. Participants were using the board to:

- provide an initial structure for their teaching
- save time scribing
- provide a large display that children could see and read easily
- demonstrate skills for children
- attract and retain children's attention
- provide images or text that children could not easily have had access to in other ways

In addition all teachers spoke of using the whiteboard for:

- quizzes or tests within the whole class environment
- increased class participation by children writing their solutions on the board.

There was also more extensive use of the board by one or more participants in the study to:

- provide images that could later be adjusted by children to display their own work
- save work so that the teacher and class could access their joint contributions at a later stage
- provide a tool for children to create their own multimedia screens for class presentations
- enable collaborative work between the teacher and the class

- use ICT or a traditional resource after having adapted it to suit particular needs
- foster independent thinking skills in children and improve their cognitive skills

The teachers in this study were all using the interactive whiteboard in different ways and had different views and interests in its potential. Although data of this nature can never be exhaustive I feel it presents a range of activities to describe 'What is happening in the whiteboard classroom?' The participants' pedagogical approach to using the interactive whiteboard varied considerably and I felt this largely reflected each teacher's pedagogical stance, especially in their need to direct classroom events versus handing part of this responsibility over to children themselves. The board was particularly valued by all respondents because it helped to hold children's attention and saved time scribing in class or handing out pieces of paper. As one teacher commented; she now has more time to teach.

7.2 The secondary research questions

The secondary research questions which pertain to the use of ICT (1a, 1b and 2b) will be addressed in section 7.3. The remaining questions concern whole class engagements (1a), change in teachers' classroom practice (2a) and the effects on teachers' professional lives (2c).

It does not appear that the interactive whiteboard is being used to instigate higher order discussion and collaborative work in a whole class context, though I did observe one example of such engagement which is described in sections 4.3 and 5.1.

The participants themselves did not feel that the whiteboard had changed their classroom practice. I felt that teachers were largely using it according to their pedagogical beliefs and constructs as suggested by their interview responses. Without knowledge of their teaching practice prior to their whiteboard experience I do not yet have sufficient evidence to know whether their existing pedagogy may have been affected by adoption of this new technology.

I did gather some information on the effects the whiteboard may have on the participants' professional lives with regard to training and lesson planning issues. This varied between the two institutions in the study since in one there is a central computerised filing system for lesson plans and classroom activities. I considered that this is an area which could form a major study in itself, so took the decision not to respond to this question in just a superficial way within this investigation.

7.3 The relationship between good use of ICT and whiteboard use

There may be an interesting relationship between what is considered good use of ICT from established research and what emerged from my own perceptions on good whiteboard use. I believe a whiteboard may obviate some of the demands and difficulties that teachers find in integrating ICT into classroom practice:

- The fact that teachers are able to adopt the interactive whiteboard largely in accordance with their existing practice appears to ease the process of change for teachers as this new technology is introduced.
- Teachers are more in control of the learning in the whole class situation. They are using the whiteboard and any software according to their own needs, rather than implementing others' ideas as might be the case when children are learning individually at a computer.

None of the participants who had sufficient access noted a loss of control of the learning process when using the whiteboard. Even though some reported their very first use as intimidating, they also reported that they could initially use the whiteboard in a way that did not change their teaching habits and gradually allowed them build up confidence. At least one participant was able to hand more control of the learning over to the children while using the board.

Other issues arising from my investigation appear to remain similar to the demands in using ICT cited by prior research:

- difficulty of access and lack of proficiency in ICT
- change in working habits
- ensuring that resources are appropriate to the learning requirements
- the threat that pupils' questioning of received knowledge may undermine the teacher
- initiating higher order discussion between teacher and pupils and use of the whiteboard as a collaborative tool
- use of the whiteboard as a cognitive tool

The whiteboard may enable some but not all teachers to integrate ICT more easily into the curriculum. I suspect that the underlying difference between teachers in integrating ICT rests with the teachers' existing ICT skills and pedagogical skills and constructs. Since I was unable to work with the participants before they used the whiteboard, I do not yet have the evidence to support this or fully understand what these constructs may be.

7.4 Areas for further investigation

This short study has addressed some issues relating to interactive whiteboards: how they may be used in the primary school and how they may affect teachers and teaching. In the course of my research I was faced with several difficulties: some were caused by the fact that I had no prior knowledge of the teachers' behaviour before they had access to a whiteboard in the classroom; others were caused by the lack of depth of the study. Only a limited number of interviews and observations were possible with the participants and the small sample of teachers further limited the scope of the study.

In a future investigation, as well as the original major research questions which I do not feel have yet been fully answered, I would like to pursue in greater detail:

- the relationship between teachers use of ICT before their access to the whiteboard and their subsequent whiteboard practice
- whether continued use of the whiteboard affects the teacher's integration of ICT into the curriculum
- the effects a whiteboard may have on the teacher's pedagogical approach in the long term
- the training that may be considered appropriate for whiteboard use

In order to carry out this further research I hope to track a number of experienced teachers who are new to the interactive whiteboard over a period of time.

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