CHAPTER 4
DESIGN METHODOLOGY AND DATA ANALYSIS

This chapter describes the underlying paradigms, methods of the research design, the interpretive practice and the process of data analysis adopted for this thesis. In the final sections I discuss the major themes emerging from the data and the validity of my research.

My Institution Focused Study (IFS) (Cogill, 2002) was the pilot study for this thesis. From this pilot I perceived that teachers' practice in their use of the interactive whiteboard varied considerably between teachers. In chapter one I have explained how using a semi-ethnographic approach, I decided upon the major research questions:

1. Do teachers change the way they teach during one year of interactive whiteboard use and if so how?
2. What are the factors that may influence whiteboard pedagogy?

I have also developed the research design of my thesis as a consequence of learning from the methodological experiences of my IFS and will refer to these in this chapter.

4.1 Underlying paradigms of the research design

Although my pilot study (Cogill, 2002) adopted a qualitative approach using interviews and classroom observations, for this thesis I have re-examined the underlying paradigms and my reasons for using a similar approach.

4.1.1 Qualitative versus quantitative methodology

The aim of my research was to seek illumination and understanding in teachers' use of the interactive whiteboard rather than, for example, determine data on the frequency of use of different whiteboard practices. Laws and McLeod (2004) suggest that while a quantitative research design identifies and isolates specific variables, a qualitative design focuses on a holistic view of what is being studied:

Quantitative design tends to control for bias so that facts are understood in an objective way, the qualitative approach strives to understand the perspective … looking to firsthand experience to provide meaningful data. (Laws and McLeod 2004, page 2)

I agree with Hoepfl (1997) that a quantitative enquiry cannot address either firsthand experience or the complex and dynamic quality of teaching and the behaviours of teachers as they occur in the contextual social world. Furthermore my pilot had provided only a snapshot of whiteboard activity with one interview and one observation per teacher and for this thesis I wished to address teachers' behaviour over a period of time. Apart from the epistemological reasons for choosing an interpretive rather than a positivist approach, there were further, practical reasons why an approach via questionnaire was felt to be inappropriate. It seemed unlikely that data of this nature could be gained through the impersonal nature of a questionnaire, since it required asking teachers about their pedagogical values and beliefs which are situated in a social world. In addition in 2002 not only was it becoming increasingly difficult to send questionnaires to schools owing to the data protection act but there was little prior research available on interactive whiteboards on which to base appropriate research questions. Consequently for both epistemological and pragmatic reasons I adopted a qualitative methodology using a case study approach to enable teachers' behaviours to be explored in detail and over a period of time.

4.1.2 Case study approach

Hitchcock and Hughes (1995) regard case study research as appropriate to a school setting 'because its principle rationale is to reproduce social action in its natural setting' (p323). They also consider that the facility of case studies to develop new theory or evaluate existing practice provides
a potentially significant contribution within the particular context of teaching. Stake (1995) suggests that it is the need to appreciate the uniqueness and complexity of a situation, of the embedding and interaction with contexts that creates circumstances appropriate to case study research. Yinn (1994) echoes this view:

You would use the case study method because you deliberately wanted to cover contextual conditions – believing that they might be highly pertinent to your phenomenon of study. (p13)

The issues that are important in studying cases are not straightforward but intrinsically linked to social, historical and personal environments. Hodkinson and Hodkinson (2001) propose both strengths and limitations of case study research as summarised in the table below.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>helps understanding of complex inter-relationships</td>
<td>easy to dismiss by those who do not like the messages that they contain</td>
</tr>
<tr>
<td>grounds data in ‘lived reality’</td>
<td>cannot answer a large number of relevant and appropriate research questions and does not lend itself to numerical representation</td>
</tr>
<tr>
<td>facilitates the exploration of the unexpected and unusual</td>
<td>the complexity examined is difficult to represent simply</td>
</tr>
<tr>
<td>enables research to focus on the significance of the idiosyncratic through the use multiple cases.</td>
<td>not generalisable in the conventional sense</td>
</tr>
<tr>
<td>helps show the processes involved in causal relationships</td>
<td>strongest when researcher expertise and intuition are maximised, but this raises doubts about ‘objectivity’</td>
</tr>
<tr>
<td>facilitates rich conceptual/theoretical development.</td>
<td>there is too much data for easy analysis and work is expensive if attempted on a large scale</td>
</tr>
</tbody>
</table>

Table 4.1: Strengths and limitations of case study research (Hodkinson and Hodkinson, 2001)

Some of the limitations cited are pragmatic in that they address the time and cost of case study research. Those concerning generalisation I will discuss in the next section. I was however especially interested in the research conducted by Hodkinson and Hodkinson (2001) which gave rise to the table above. The research tracked 12 trainees through interviews across a range of stakeholders over an 18 month period enabling the examination of complex interrelationships. The design adopted struck a chord since I consider it pertinent to my own research design.

My initial interest was to create a research structure to investigate any pedagogical change in teachers as a result of whiteboard intervention. Therefore, it was necessary to consider the social setting and the context in which teachers were working.

Teacher learning … involves the complex interrelationship between individual careers and dispositions to learning, the cultures of school and department, and the broader social, economic, political and above all, policy contexts in which teachers are currently working and have worked in the past. (Hodkinson and Hodkinson 2001, p8)

Later as my research progressed I decided to address the different experiences of two schools, so required the opportunity as Mason (2002) suggests, to consider data in different ways. A case study approach met both of these needs. As Stenhouse (1982), Hitchcock and Hughes (1995), Yinn (1994) and Hoepfl, 1997) point out, case studies facilitate rich, conceptual, theoretical development within the context of teacher learning.

4.1.3 Generalisation in case study research

Hodkinson and Hodkinson (2001) consider how case studies can provide more than just idiosyncratic understanding. They prefer not to use the term ‘generalisation’ but consider that cases may shed light on issues beyond the immediate context in which the research was undertaken. The researchers make three claims on how findings can illuminate other situations:

- Theory can be transposed beyond the original study. If case studies generate new thinking then new concepts may be relevant to other settings.
- Findings can ‘ring true’ in other settings. It is up to the reader to decide if the analysis presented is convincing, based on their own knowledge of other similar situations and of contexts to which such knowledge may be transferred.
- Case studies can provide ‘provisional truths’. If there has been little previous theorising in a field of study then evidence from a case study may provide initial provisional theory. As further research is conducted in the field these early provisional findings may become more accepted or refuted.

Since the research base on pedagogical practice and interactive whiteboards is still relatively immature owing to the ‘newness’ of the technology I consider that ‘initial provisional theory’ may still be significant. Presenting a convincing case for any conclusions I may draw from this research is a matter that I will need to seriously address if I am to convince others that the results I present are more than just a snapshot of whiteboard interaction.

4.2 Interweaving design aspects from the pilot study

Several major factors emerged from my pilot study (Cogill, 2002) which influenced the research design of my RBT. Despite the pilot’s limited methodology, a case study approach through interviews and observations had provided me with a wealth of data on which to explore relevant issues. However in order to gain prior knowledge of teachers’ views and pedagogical practices I needed to interview teachers with full-time whiteboard access in their classrooms before use. In addition, to detect any possible change in teachers’ behaviours it was necessary to conduct several interviews and observations with each teacher over a period of time to gain the depth of knowledge I required.

The interview with the head teacher that I undertook for the pilot had proved to be a particularly useful instrument to determine school policy re whiteboard adoption and the overall ethos of the school. Although access to helpful documentation from heads concerning school policy on interactive whiteboards in the pilot schools had not been forthcoming I decided to persist with this request. For the pilot I had also conducted interviews with children involved in the lesson observations but the data that stemmed from these interviews added little to my overall knowledge of each teacher’s practice. Added to which the task of requesting parental permission for up to 100 children was formidable. However my pilot had involved 2 schools which was enlightening so that when the opportunity arose for this study to undertake my research in a second school I considered it a bonus. As a result of these considerations I created the following research design for my RBT:

- Interviewing and observing a number of teachers who were all new to whiteboard use at the start of the year
- Interviews and observations at the start of the Autumn Term, during the Spring Term and at the end of the Summer Term, resulting in 33 teacher interviews and observations
- The pursuit of any possible school documentation available relating to whiteboard adoption
- Interviews with the head teachers of schools taking part at the beginning and end of the academic year during which my research was conducted
- The involvement of more than one school

A summary is given below:

<table>
<thead>
<tr>
<th></th>
<th>Autumn 2002</th>
<th>Spring 2003</th>
<th>Summer 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher interviews</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Classroom observations</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Head teacher interviews</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Request for documentation on whiteboard policy</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 4.2: Summary of research design

4.3 Implementation of the research design

I was initially looking for at least one school where all classrooms had an interactive whiteboard. At the time the research started in 2002, 28% of primary schools had access to an interactive whiteboard and the average number of units per schools was less than one (DfES 2003). This low penetration of access necessarily restricted the choice of schools for my research.

I already knew of one school, West with total whiteboard access. It was fortunate that 7 new teachers were starting at the school in September 2002 and were consequently new to whiteboard use. This number of new teachers may seem to be above average but to put this in context, West is a very large primary and at that time there was a desperate shortage of teachers in the UK. I had virtually given up any possibility of finding a second school fully equipped with whiteboards when I heard through a colleague of Nolan, which had been kitted out during the Summer of 2002. Since all teachers were inevitably new to whiteboard technology in Autumn 2002, these circumstances similarly met my brief.

4.3.1 The school contexts: West and Nolan

West Primary School is a large established primary school which had been re-housed in a new building 2 ½ years prior to my research. Each classroom has an Internet linked computer and a whiteboard. The school also has a computer suite. The head teacher at the time my research started was an ICT enthusiast. It was her enthusiasm for ICT and the move to a new building in 2000 that had brought about the establishment of an interactive whiteboard in every classroom.

Nolan Junior School is two form entry and children attend between the ages of 7 and 11 (Years 3 to 6). The school has an ICT suite which is centrally situated so that pupils can use computers throughout the day as long as the suite is not occupied by another class. There are also additional networked computers in all classrooms. The head of Nolan was similarly an ICT enthusiast and a technical expert.

4.3.2 The teacher contexts

Teachers from both schools taking part in the research were volunteers. I contacted the head teachers who sent a note to appropriate staff ie new whiteboard users to see if they were interested in taking part in the study.

Seven new teachers had joined West as my research started. The sample comprised teachers who had recently arrived from either Australia or New Zealand, reflecting the current recruitment crisis at that time. All teachers were experienced having taught for at least 3 years and their teaching commitments were distributed across several year groups as summarised in table 4.3.

At Nolan all staff were new or nearly new to the technology, depending on how much they had accessed the boards after installation at the end of the Summer Term. All teachers were experienced and had been teaching for at least 5 years. Of these, four had been teaching at Nolan for a considerable time and the 5th participant was new to the school and also from New Zealand.
All participants were new whiteboard practitioners with full-time access in their classrooms with no access to special whiteboard training as sometimes happened at that time through Education Action Zone initiatives. Teachers were using the boards in their own way within a natural environment with for the most part only school support. The distribution of teaching commitments across each school was as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Nolan teachers</th>
<th>West teachers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Year 2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Year 3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Year 4</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Year 5</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Year 6</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 4.3: Summary of teaching commitments by participants

4.3.3 Matters arising from the design implementation
Several matters arose in putting the research design into practice so that it was not exactly as I had planned.

- Teachers’ ‘newness’ to whiteboard use was in a different context in each school. At West the teachers were new to a school in which other staff were experienced whiteboard practitioners. At Nolan, teachers were largely already based in the school when whiteboard technology was introduced.
- The schools were not exactly matched, in so far as one was a primary and the other a junior school. In addition the catchment area of the two schools varied considerably.
- It was difficult to interview and observe teachers before they had used the whiteboard though many admitted during their Autumn Term interview that at this stage they were still on a very sharp learning curve. Classroom observations supported this view; teachers’ whiteboard practice in the Spring Term was more confident and sophisticated than that observed in the Autumn.
- Since several participants taking part in the study had come from abroad, there was some lack of curriculum familiarity by all participants at West and by one participant at Nolan. I hoped that this would not compromise my research since pedagogical skills are not considered especially culturally bound within the context of teaching in the UK and Australasia. The recent interchange of teachers and the adoption of teaching methods, such as the reading recovery scheme across the two cultures suggest that pedagogical methods and philosophies are felt to be reasonably concurrent. Any emerging issues were borne in mind and considered appropriately during the research and in the subsequent analysis.

I felt reasonably confident that 11 teachers would give a sufficient range of practice to determine some defining characteristics of teachers’ pedagogical knowledge and whiteboard practice across the year. A larger sample would have been desirable but since each teacher was interviewed and observed three times making a total of 33 interviews and 33 observations, I considered that a sample of this size would enable sufficient depth of each participant’s views to gain insight into any pedagogical change participants might experience.

4.3.4 Teachers’ participation
There was no loss of participants during the research so the sample of 11 teachers were all interviewed and observed each term. My final question, at the end of the Summer Term interview with each teacher, concerned how they had felt about taking part in the research. The response was almost unanimously positive with some teachers saying that they had enjoyed the experience and taking part had provoked them to consider more carefully their use of the whiteboard. There were no negative responses to this question.
4.4 Methods employed in the research design

The research design of this thesis employed interviews, classroom observations and examination of relevant documentation from the participating schools. In addition I kept a research diary.

4.4.1 Interviews
There were huge advantages in interviewing each teacher 3 times during the year. I had the opportunity to meet participants at the earliest stage in their adoption of the interactive whiteboard and doing so enabled detection of any change in teachers’ responses at different stages of whiteboard practice. I also had the opportunity to reflect on each interview and consider issues I might have missed or probe more deeply into initial responses at a later stage. By the third interview I had some idea of where teachers were placed on the pedagogical continuum so could question more deeply their knowledge and beliefs. I was also aware that there are dangers as well as advantages in the situation of ‘knowing’ since views of the interviewer may not be easily detached from the research investigation (Kvale 1996), (Silverman 1993), Hammersley (1992).

Tuckman (1972) cited in Cohen et al (2000) describes the research interview as:

> providing access to what is ‘inside a person’s head, [the interview] makes it possible to measure what a person knows (knowledge or information), what a person likes or dislikes (values and preferences) and what a person thinks (attitudes and beliefs)  

(p268)

Stake (1995) supports this view. He considers that the principle use of a case study is to obtain the descriptions and interpretations of others. Since no situation will ever be viewed in the same way by all, the interview is the major path through which to discern these multiple realities.

The interview style adopted was semi-structured as defined by Hitchcock and Hughes (1995). They consider that this style of interview enables the interviewer to probe and expand on meaning once the respondent has answered initial basic questions. The participants in my study were asked the same major questions but opportunity was available to explore responses so that each interviewee had a unique experience. The aim was to enable participants to tell their own stories even though I had in mind a list of issues that I wished to raise, a technique proposed by Stake (1995). At the start of the year teachers were sent a letter assuring them of confidentiality in any matters they might disclose.

The Autumn Term interviews (see Appendix 4.3 for an ‘aide memoire’ of all interview questions) were largely a ‘get to know you’ session to ascertain teachers’ existing pedagogical stance, their knowledge of ICT and attitudes to the whiteboard in the early stages of use. The Spring term questions probed more deeply into each teacher’s pedagogical approach through specific questions on how they might use the interactive whiteboard to teach one or two topics in literacy and numeracy and a third subject of their choice. The style of question adopted was: ‘How would you advise a student to use the whiteboard to introduce 2D shapes?’ as used by Williams et al (2000). Questions in the final term first picked up any outstanding issues pertaining to individual teacher’s previous data; second, a structured interview format was adopted to ascertain specific information on teachers’ whiteboard practice, for example, ‘How often do you do you use the Internet in class?’ The third aspect of the interview returned to a semi-structured approach to explore teachers’ experiences and views after one year of whiteboard use.

4.4.2 Issues related to interviewing techniques
A range of concerns regarding interviewing techniques are raised in the literature. I did not perceive any special difficulties while interviewing but give below the precautions I took to eliminate potential problems and explain how these were dealt with during the interview procedure.
Yinn (1994) points out that interviews should always be considered as verbal reports only, since they are subject to issues of bias and poor recall. A reasonable approach is to corroborate interview data with other sources of evidence. For this thesis I was able to corroborate data for each participant through the use of three interviews and three classroom observations. Prior to each interview I observed each teacher in the classroom. Such action is recommended by Zweig cited in Burgess (1993). Zweig advises that it is essential to observe someone before a detailed conversation can occur so that the interviewer has some knowledge and perception of how the participant may react to the interview.

Two issues arise concerning monitoring progress during an interview. First, Burgess (1993) considers that researchers need to be constantly aware of the direction, depth and detail of the interview so that the length and relevance is constantly monitored. Second, but just as important interviewers should reflect on content during the interview and respond to and ask participants to verify the interviewer’s interpretation and probe meaning more deeply. In doing so, tacit as well as explicit knowledge is gathered (Patterson, 1997). During the interviews I made every effort to follow the advice of Hitchcock and Hughes:

To sustain an objective approach to data collection that will reveal valid and reliable data …the semi-structured interview must be flexible unstructured and sensitive to the context of the interaction.  

Hitchcock and Hughes (1995) propose the need for rapport, empathy and understanding between interviewee and interviewer. Interviewers should develop and understand the context of the respondent especially if interviewer and interviewee are in an unequal relationship. Power may be an important contextual influence in the interview process and should not be minimised (Paterson, 1997). While interviewing I was not overtly aware of any power conflict. Though one participant seemed nervous at the start of the year and brought with her a set of written notes, she never referred to these and was totally relaxed in later meetings.

‘No matter what research stance is being taken, the success of an interview is influenced by the inter-personal skills of the interviewer.’ (Patterson 1997, p1). He considers that the skilled interviewer appears to be real, genuine and have respect, acceptance and trust for the respondent together with empathetic understanding. Clearly, without being observed and assessed myself during the interviewing process this is difficult to comment on. I did however have no loss from the sample of teachers over the course of one year. I also asked respondents how they felt about taking part in the research after the 3rd interview with positive response. Throughout the interviews I endeavoured to enact the role presented by Patterson (1997) so that the interview was one of mutual participation:

The interviewer and the respondent are actively creating meaning through the interview interaction. [So that] the respondent can be seen as a narrator of a diverse multifaceted and emerging resource, rather than the reporter of a series of facts or units of knowledge.  

Each interview lasted approximately half an hour and in practice less than 50% of the questions noted in Appendix 3.2 were asked directly. I aimed to reduce my role as interviewer to allow participants a free response so that answers arose naturally from teachers’ own discourse. Interviews were tape recorded and later transcribed but notes were made immediately after each interview to record first impressions prior to listening to the interviews themselves.

4.4.3 Classroom observations
The classroom observations of my pilot study (Cogill, 2002) had provided helpful information on teachers’ whiteboard use. Nevertheless, although I was fortunate to see some interesting practice I did not consider that random observations truly informed me of teachers’ classroom behaviour on a day-to-day basis. Stake (1995), referring to observations, makes two points that support this judgement:
It is not uncommon for case study researchers to make assertions on a relatively small
database, invoking the privilege and responsibility of interpretation. (p12)

Often it seems there is no story, that is, nothing relating much to the issues, nothing that
opens up the depth of the case. Some researchers find stories when others do not, enough
to be worrisome. How much are they making it up? (p60)

On the one hand much everyday classroom practice is fairly mundane and unexciting; on the other
hand as Cohen et al (2000) point out sometimes a single event may occur which sheds enormous
light on a situation. As a result I considered that though I definitely wished to observe teachers at
work my intention in doing so was as a secondary rather than a primary source of evidence. My
major reason for observing practice was to corroborate teachers’ responses to interview questions
statements on pedagogy do not always reflect their behaviour. I was keen to view teachers in action
to ascertain whether their statements about teaching and learning were in agreement with what
happened in the classroom. I regard classroom observation within the research design of this study
largely as a triangulation device. Although 33 observations were undertaken I consider they were
only a snapshot of classroom practice and not a rich source of data. Consequently I have appended
further consideration of observation theory and my subsequent practice as Appendix 4.4.

4.4.4 School documentation
I requested documentation from the heads of both schools on their reasons for purchasing
whiteboards and relevant school policy documents. No documentation was forthcoming from West.
Nolan did let me have a copy of the letter which was sent requesting seed funding from the DfES,
but this was a very brief note (one side of A4). The details added no information to my research that
was of value. Absence of such evidence may be significant in that it suggests that whiteboards were
introduced in both schools without a firm policy on how they would be used. Neither school had
recently had an OFSTED inspection so this potential source of evidence proved to be equally
fruitless.

4.4.5 Research diary notes
Throughout the research process diary notes were kept on each participant’s interview
and classroom observation and my perceptions of what might be emerging from the data at
particular points in time. These notes were especially important given the longitudinal nature of this
study; it was essential to consider what was emerging on an individual basis from each interview and
observation before any subsequent meetings. The diary notes contributed most especially to the
final interview with each participant, when it was necessary to consolidate my knowledge and to
ensure that there were no known deficiencies in any participant’s data. Second, it was essential to
reflect back and consider if there were important global issues across participants that I had either
omitted to investigate or which had not emerged from previous conversations. Third, when planning
the focus for the 2nd and 3rd interviews the diary notes contributed to the overall progress of the
research by helping me to keep track of the direction of the investigation. Through constant
reflection, the diary helped in the analysis of data. By referring back to notes made at the time of the
interviews and observations I was able to add to the theoretical memos I created at the analysis
stage to compare concepts while examining the data.

4.5 Ethical and confidentiality considerations
I was aware of the need to inform teachers prior to the start of the research and before each set of
interviews and observations so that the purpose of the research was clear and unambiguous.
Participants were notified that confidentiality and anonymity would be maintained. Transcripts of the
interview material were offered to all participants so that they had the opportunity to adjust their
comments. Since 37 transcripts were involved I did not send these automatically but wrote to all
participants offering copies for their own records.
I did not conduct this research in my own teaching environment but I was a Governor of West at the time of the research. Although my position helped me to gain initial access despite early concern I did not feel that this influenced the objectivity of the research. I had not met any of the participants beforehand and was careful to inform teachers that the interview responses were confidential and unrelated to the fact that I was a School Governor. The reality was that in my role as Governor during the research my contact with the school was attendance at three meetings held once a term after school. Issues concerning whiteboards were never raised at these meetings. I was not questioned by school management or the governing body about my interviews or observations which enabled me to maintain the code of confidentiality with both teachers and the head teacher without compromise.

### 4.6 The interpretative process

Once qualitative data has been collected, which for this study largely refers to transcribed interview responses, the problem that arises is how to use the data to develop conjectures, hypotheses, and ultimately knowledge that will contribute to the field of study. I adopted an approach based on Grounded Theory (Glaser and Strauss 1967), (Strauss and Corbin 1998), (Strauss 1987) which according to Thomas and James (2006, p3) offers a solution: ‘a set of procedures, and a means of generating theory’. Piantinida et al (2002) add detail to this basic definition:

The procedures of Grounded Theory provide interpretive researchers with a disciplined process, not simply for generating concepts but more importantly for coming to see possible plausible relationships among them. It is the researcher’s portrayal of these conceptual relationships that constitute the theory.

(p3)

Grounded Theory is a complex research practice in which data sampling, data analysis and the development of theory are not distinct and disjoint but closely interwoven so that different steps are repeated and re-iterated until it is possible to describe and explain emerging concepts and phenomena. The process is only completed when new data which might contribute to the theoretical perspective fails to emerge. The main elements of the theory noted by Strauss (1987) are:

1. The concept-indicator model which directs the conceptual coding from the empirical indicators. Initially there may be several concept- indictors which may change, develop or even merge as the analysis proceeds.
2. Data collection
3. Coding
4. Core categories
5. Theoretical saturation
6. Integration of the theory
7. Theoretical memos: tools to help define, keep track of ideas, and compare incidents to incidents and concepts to concepts
8. Theoretical sorting

(p23)

The analysis for this thesis was based on Grounded Theory rather than strictly adhering to the totally ‘disciplined process’. I initially used coding procedures to discover signposts which I felt were relevant to teachers’ own persona and their pedagogical practice. In doing so however other data inevitably emerged some of which led me to consider how teachers felt they learned to use the whiteboard and the positive or inhibiting factors related to their learning. It was both my interview observation notes and the coding process which led me to adopt a semi-ethnographical approach to this thesis in so far as I had not initially intended to pursue teachers’ own learning but was guided in this direction by the emerging data. In coding data from 33 interviews, several other themes similarly emerged, for example, implementation of the National Strategies but as explained below such data was only pursued in so far as I considered it relevant to this study.
Coding was initially adopted using line by line analysis to create micro codes. As far as possible at this stage in-vivo codes were sought, supported by theoretical memos to help ensure that the emerging micro codes were truly grounded in the data. Next, while constantly comparing incidents and concepts several macro codes started to emerge. The subsequent stage, with the help of the theoretical memos, involved constantly moving backwards and forwards from micro codes using an iterative process. Eventually the macro codes surfaced as saturation point was reached. Not all of these macro codes were necessarily pursued to develop emerging themes but care was taken at this stage to build in maximum variation within the macro codes so that all relevant supporting or non supporting properties, conditions, strategies and actions for each participant were included; also to ensure that if early micro codes overlapped then they were included in all the relevant macro codes or links created so that data would not be lost to support any emerging theory. The techniques used and diagrammatic representations of the micro codes macro codes and emerging themes are described fully in Appendix 4.5

4.6.1 The role of the researcher using Grounded Theory

Piantinida et al (2002) consider that the role of the researcher is one which challenges self-understanding by bringing tacit knowledge so that taken for granted assumptions, preconceptions and possibly misconceptions are recognised. Equally, Piantinida et al (2002) acknowledge that such knowledge, which may be idiosyncratic and individual does not necessarily lead to theory. To overcome this problem, they suggest that moving towards a theoretical perspective requires self-awareness of any idiosyncrasies and the need to bring conceptual understanding of the situational and individual experience. This process is helped by three forms of researcher reflection (Piantinida and Garman 1999), noted in Piantinida et al (2002):

- re-collective reflection to provide a careful, descriptive account of situational issues
- introspective reflection to provide insight into the meanings emerging from the situation
- conceptual reflection to connect individual meanings to the broader discourse.

These reflective procedures may help to clarify the concepts upon which theory is built. Consequently, proposed hypotheses arising from Grounded Theory are warranted by the coherence with which the researcher portrays the ground; the vitality of concepts that draw attention to significant aspects of the ground and the persuasiveness of the researcher to set out lines of reasoning about the relationship between concepts. As a result the usefulness of interpretive Grounded Theory ‘lies in the insights it can provide into self and others within discursive moments of practice’ (Piantinida et al 2002, p3).

4.6.2 Some Issues surrounding Grounded Theory

The issue of pre-knowledge in the discussion of the theory is contentious. The initial concept of the theory (Glaser and Strauss, 1967) assumed that a researcher entered the field to discover what was to be learnt without any preconceptions from previous theory. There is now a difference of opinion between Glaser (1992) and Strauss and Corbin (1990) as to whether a researcher should approach analysis using Grounded Theory with pre-conceived ideas. Glaser (1992) considers that studying the literature in advance gives rise to preconceptions which desensitise a researcher’s openness to new theory. He believes that literature should only be adopted at the analysis stage and treated alongside and only with equal importance as the rest of the data.

Strauss and Corbin (1998) on the other hand have moved away from such a free approach. They consider that ‘familiarity with relevant literature can enhance sensitivity to subtle nuances in data, just as it can block creativity.’ (p49). Furthermore, some knowledge of the literature may help to formulate pertinent interview questions, stimulate researcher analysis during the coding process and help create early categories in the first stages of analysis. Once the analysis is complete any emerging new theory may be compared to theory from the literature to validate or negate what already exists in the field.
For this thesis I used literature reviews on preconceived knowledge in the field to inform me of pedagogical theory. I consider that knowledge of this field helped rather than hindered both my research methods and analysis. Since I only decided to examine teachers’ learning part way through my analysis I was not familiar with the relevant literature while undertaking fieldwork. I deliberately did not systematically address the literature on interactive whiteboard technology at an early stage since I did not wish to be influenced by existing research. While there is a well established body of literature on pedagogy and teachers’ learning, little is situated in the context of interactive whiteboard pedagogy, the context of my investigation.

Other issues surround Grounded Theory. Thomas and James (2006) in a highly critical paper ‘challenge the continuing legitimacy of the theory and the lofty place its methods have come to hold in social and institutional analysis’ (p3). They argue that the notions embedded in ‘Theory’, ‘Ground’ and ‘Discovery’ ‘constrain and distort qualitative enquiry’ (p2). This is an interesting but complex paper and I will briefly summarise the arguments under their headings.

Relating to the term ‘theory’ the authors question why what has been ‘discovered’ may be termed ‘theory’, since people make interpretative acts frequently and unselfconsciously in every day life through finding links and discovering patterns but do not necessarily explain these as theory. There is also an assumption that qualitative enquiry through Grounded Theory can share elements or endpoints that are congruent with scientific enquiry. The authors propose that Grounded Theory is just an example of qualitative enquiry which has no more foundation for creating theory than other areas of qualitative research. In relation to the term ‘ground’ assuming there are no assumptions from previous research then the analysis process is highly dependent on the researcher’s interpretations. What reason is there to suppose that ‘what is in the researcher’s head’ is more reliable than prior relevant research since it is impossible for any researcher to totally dispassionately derive ‘theory’ from data as everyone must be influenced to some extent by their own disposition. The term ‘discovery’ assumes that there is always something innovative within the data that can be found to express as ‘theory’ but sometimes research may result in little that is new or of interest.

In summary, Thomas and James (2006) raise a major concern that if researchers become over-involved in using an almost mathematical system of coding and recoding within the process of Grounded theory then they may undermine the significance of interpretation, narrative and reflection that are open to all qualitative researchers. They do however acknowledge that the procedures of coding, fundamental to Grounded Theory provide helpful ways to create signposts in qualitative research. This is how I have adopted the theory and reflect that my analysis was based on Grounded Theory rather than following all the rigorous processes of its procedures.

4.7 Data analysis

In Appendix 4.5 I describe the methods I employed for evolving the micro codes and macro codes that emerged from my data. Also included in this Appendix is a quantitative analysis across macro codes relating to each teacher as I was interested to investigate at this stage whether there were any significant differences amongst participants. My reason for doing so was that I had initially hoped to assess pedagogical differences between the two schools by contrasting the pedagogical change emerging between pairs of teachers, one from each school. When however I ultimately interpreted my data on teachers’ learning (Chapter 6) I abandoned this idea. It became apparent that differences in emerging whiteboard practice between the schools largely concerned whole school differences rather than any individual teacher discrepancies. I will resume the story of my analysis, subsequent to Appendix 4.5, at the point of determining the major themes for interpreting the data.

4.7.1 Macro codes to main themes

The analyses of micro and macro codes described in Appendix 4.5 enabled me to determine the main themes. I encountered some difficulty since three sets of interviews were conducted over a period of time. Consequently the theme of change emerged as a thread running through all the data. Despite this I decided to also include ‘Change in whiteboard use’ as a stand alone theme since the
Autumn Term data largely referred to ‘Anticipating Change’ both to the whiteboard and a new environment, the Spring Term to ‘Progress in adapting’ to the whiteboard and the final interview in the Summer Term to ‘Activity’ following one year of whiteboard use.

At this stage of analysis having worked with the data in several ways I was confident to identify emerging themes. Table 4.4 shows the macro codes previously analysed for each term and how they were combined to form the major themes of this research project.

<table>
<thead>
<tr>
<th>Major Themes</th>
<th>Autumn macro code headings</th>
<th>Spring macro code headings</th>
<th>Summer macro code headings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in whiteboard use</td>
<td>Potential change</td>
<td>New experiences</td>
<td>Whiteboard use (Adapting to Change)</td>
</tr>
<tr>
<td>Personal Disposition</td>
<td>Confidence</td>
<td>Enjoyment potential</td>
<td>Confidence</td>
</tr>
<tr>
<td>External Contexts</td>
<td>Frustration/Issues</td>
<td>School/Gov policy</td>
<td>Frustration</td>
</tr>
<tr>
<td>Pedagogy</td>
<td>Children’s learning</td>
<td>Children’s learning</td>
<td>Children’s learning</td>
</tr>
<tr>
<td></td>
<td>Teaching</td>
<td>Teaching</td>
<td>Teaching</td>
</tr>
<tr>
<td></td>
<td>Resources</td>
<td>Resources</td>
<td>Resources</td>
</tr>
<tr>
<td>Teachers’ Learning</td>
<td>Teacher as learner</td>
<td>Teachers’ learning</td>
<td>Teachers’ learning</td>
</tr>
</tbody>
</table>

Table 4.4: Major themes emerging from the data

In addition to these emerging themes I envisaged that there might be some potential ‘wild card themes’ still to emerge when investigating the specific data from each teacher in more detail.

4.7.2 Validity of the data

One issue that immediately arose in relation to the validity of this data is that at West teachers were not only new to the school but they had also all recently arrived from Australia and New Zealand. Consequently they were not only new to the whiteboard experience but also new to the English education system. This situation had not been my choice but rather a coincidence owing to the acute shortage of teachers in the South-East at the time the research was undertaken. To help address this problem Paul who was in a similar position, but at Nolan was included in the initial analysis of pairs of teachers to enable at least some comparison across the schools.

A second issue concerned the reliability of the whiteboards available to participants. At Nolan this was not a problem. At West however it was an issue for two teachers, especially Janet. For reasons of validity, although she made interesting observations I was aware of the need to consider her testimonies carefully. A third issue might have arisen given that Nolan was a school with pupils from ages 7-11 and West had a school intake of children from aged 4-11. All the teacher participants apart from one teacher at West were teaching junior age children so I did not feel that this particular difference between the schools invalidated the data.

One assurance in the validity of the data was that in my opinion all teachers taking part in the research were confident, experienced, and able teachers regardless of their experience of the English system. For the most part they were also confident in using ICT although of course none of them had previously used a whiteboard.

4.7.3 Triangulation
The central means of triangulation of this data was tracking teachers over one year using interviews and observations across each of the three school terms. Time and again throughout the year teachers reiterated views that they had previously expressed regarding issues relating to teaching and children’s learning. The links between interviews and observations were less conclusive as is commonly the case. Teachers may frequently express a view about teaching which is not necessarily observed in practice. I became very aware of such a situation when undertaking the pilot study in which one teacher’s views just did not match her classroom practice. As a result I was aware of the necessity to consider and comment on discrepancies between interview data and observations when interpreting the data.

4.8 End of chapter summary and reflection

Interviews and observations were conducted with 11 teachers from two schools in the Autumn, Spring and Summer terms 2002-2003. No teacher participants were lost from the research sample during the year of fieldwork. Four interviews with the heads from each school were conducted as the fieldwork commenced and on completion. In the case of one participating school the head changed part way through the year leading to a potential lack of coherence in this aspect of the data. In all 37 interviews and 33 classroom observations were undertaken in two schools between September 2002 and July 2003; a summary of the research data is presented in Table 4.5.

Requests for documentation from the head teachers on school policy in relation to interactive whiteboard adoption and subsequent practice proved less fruitful. Only one document emerged despite several requests, and I regarded the content of this as insignificant to the analysis of data. A research diary was maintained throughout the fieldwork and analysis process to help reflect on emerging issues and to keep track of the direction in which the research was developing and progressing.

<table>
<thead>
<tr>
<th>School A: Nolan Junior</th>
<th>Autumn</th>
<th>Spring</th>
<th>Summer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher interviews</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Classroom observations</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Head teacher interviews</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Documentation collected</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>School B: West Primary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher interviews</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Classroom observations</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Head teacher interviews</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Documentation collected</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4.5: Research data gathered for this thesis

The process of using a Grounded Theory approach helped me to be objective, to focus and reflect on the data and consider the important emerging aspects. I found it stimulating and personally educative since I was enabled to acknowledge unexpected data, which participants might be of particular interest and discover that belonging to a different school might have contributed to each teacher’s development in whiteboard use. Equally I remained aware that more themes might yet arise and the unexpected surface as significant during further analysis of the data.

During my analysis I genuinely tried to eliminate any prior knowledge of theory or experiential knowledge on whiteboards. Nevertheless I personally had some familiarity with the whiteboard practice since I had both attended and spoken at conferences on interactive whiteboards and consequently carried with me a bank of pre-knowledge on aspects of its use for teaching and

learning. As Hammersley (1992), Silverman (1993), Kvale (1996) and Siedman (1998) suggest, interviews are social events so I acknowledge that the views of the interviewer can never be totally detached from the research investigation.