

CHAPTER 2 PEDAGOGY AND MODELS OF TEACHER KNOWLEDGE

When whiteboards were first introduced in 1998 my interest was roused through a conversation with a secondary mathematics teacher who commented: 'The whiteboard changes the way I teach'. At the same time I had read an observation that whilst an operating theatre would be unrecognisable from 100 years ago, a classroom might look almost identical. As a result I decided to explore the influence that interactive whiteboards might have. Technology creates some appearance of physical change but what matters are the potential effects the interactive whiteboard has on teachers teaching and children learning, often referred to as pedagogical practice.

This chapter explores how pedagogical practice is constructed from a theoretical perspective. Following a brief discussion on what is meant by pedagogy I investigate Shulman's (1987) framework of teacher knowledge. Next I offer a more complete picture of how teacher knowledge is built up using theories of pedagogy and models that already exist in the field. Finally I construct a model of influences on pedagogical practice based on previous literature as a theoretical foundation on which to underpin my analysis of a teacher's individual whiteboard pedagogy for this thesis. I intend to use the theory explored in this chapter to address the change in an individual teacher's change in pedagogical knowledge and practice as opposed to his or her learning within the whole school context.

2.1 What is pedagogy?

What constitutes pedagogy is complex and not easily defined. Even the definition of pedagogy appears to be somewhat obscure. Watkins and Mortimer (1999) define it as 'any conscious activity by one person designed to enhance the learning of another' (p3). Alexander (2003) has his own preferred definition which suggests that pedagogy requires discourse:

Pedagogy is the act of teaching together with its attendant discourse. It is what one needs to know, and the skills one needs to command in order to make and justify the many different kinds of decisions of which teaching is constituted. (p3)

Leach and Moon (1999) expand further on what may define pedagogy by describing a *Pedagogical Setting* as 'the practice that a teacher, together with a particular group of learners creates, enacts and experiences' (p267). In doing so they suggest that pedagogy is a joint activity in which the learner has an active role. This offers a different perspective from previous definitions offered and draws in the social interaction between teachers and learners. Many others: McNamara (1991), Brown and McIntyre (1993), Black and Wiliam (1998) Ireson et al (1999), Bruner (1999) and Loveless (2002) acknowledge that the variables which help in understanding teachers' pedagogy are complex and suggest there are many factors that affect practice. Teachers bring far more than just the latest government thinking on how they should teach into the classroom. Practice may be affected, for example by the school environment, a teacher's position in the school, previous teaching experience, teacher training and a teacher's own experience of learning. These are issues I will address later in Chapter 3 when I consider teachers' learning at whole school rather than individual level. Meanwhile, since there is a consensus from those working in the field that 'teacher knowledge' is fundamental to pedagogy I intend to make this my starting point.

2.2 Teacher knowledge

Shulman (1987) defines seven categories to provide a framework for teacher knowledge which are:

1. Content knowledge
2. General pedagogical knowledge eg classroom control, using group work
3. Pedagogical content knowledge
4. Curriculum knowledge

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5. Knowledge of learners and their characteristics
6. Knowledge of educational contexts eg schools and the wider community
7. Knowledge of educational ends purposes and values

Each of these 'knowledges' is worthy of lengthy debate. However, initially Pedagogical Knowledge (PK) Content Knowledge (CK), Pedagogical Content Knowledge (PCK) and Curriculum Knowledge are of most interest to me. These 'knowledges' form the building blocks of many of the theoretical models I will explore later but first I consider it important to comprehend how they are debated in the literature.

2.2.1 Pedagogical Knowledge (PK)

Although Shulman lists Content Knowledge (CK) first, I have chosen to discuss PK initially because I regard it as more fundamental to primary school teaching which spans several subjects.

Shulman (1987) regards general pedagogical knowledge as the broad principles and strategies of classroom management and organisation that appear to transcend subject matter. Brown and McIntyre (1993, p28) provide 10 qualities proposed by pupils that create good teaching and a further 4 proposed by teachers (p39):

- Creation of a relaxed and enjoyable atmosphere in the classroom
- Retention of control in the classroom
- Presentation of work in a way that interests and motivates
- Providing conditions so that pupils understand the work
- Making clear what pupils are to do and achieve
- Judging what can be expected of a pupil
- Helping pupils with difficulties
- Encouraging pupils to raise expectations of themselves
- Development of personal mature relationships with pupils
- Teachers' personal talents.
- Considering how planning interacts with the management of classes and lessons
- The management of lesson introductions
- Managing question and answer sessions.
- Building the confidence and trust of pupils

These qualities however which largely refer to general teaching activities and hence PK, appear to lack any reference to how children learn. Consequently I looked for more explicit views on pedagogy and children's learning to Bruner (1999). He considers that the way in which teachers adopt an understanding of children's minds is a prerequisite to any change in pedagogical practice. His view is that there are four dominant models of learners' minds that need to be understood: children as imitative learners, children as learning from didactic exposure, viewing children as thinkers and children as managers of their own knowledge

To link all these statements derived from both theory and empirical evidence more directly to classroom practice I have reclassified them in Table 2.1, under the headings of Teaching activity and Teachers' personal dispositions.

Teaching activity	Strategies and qualities of good teachers
Lesson planning and preparation	Making clear what pupils are to do and achieve
	Considering how planning interacts with the management of classes and lessons
	Managing lesson introductions
	Managing question and answer sessions.
Understanding children's learning	Viewing children as imitative learners
	Viewing children as learning from didactic exposure
	Viewing children as thinkers
	Viewing children as managers of their own knowledge
	Judging what can be expected of a pupil
	Helping pupils with difficulties
	Encouraging pupils to raise their expectations
Influencing motivation	Creating a relaxed and enjoyable atmosphere in the classroom
	Presenting work in a way that interests and motivates
	Providing conditions so that pupils understand the work
Classroom management	Retaining control in the classroom
Teachers' personal dispositions	
	Ability to develop personal mature relationships with pupils
	Personal talents
	Ability to build the confidence and trust of pupils

Table 2.1: Teaching activities, teachers' personal dispositions and qualities of good teachers

I consider those qualities noted in Table 2.1 which refer to Teaching activity as relevant to PK. Brant (2006) along with Turner-Bisset (2001) and Schon (1983) suggest that general pedagogic knowledge is often learned from practice. If this is the case then the intervention of using a whiteboard over just one year may have an insubstantial effect on teaching activity and PK.

2.2.2 Content Knowledge (CK)

Shulman (1987) defines CK as the knowledge teachers have of the subject matter they are teaching. This definition does not include, for example, knowledge of the curriculum which Shulman places in a distinct category.

McNamara (1991) suggests that knowledge of subject content is essential not only for teaching itself but also for the evaluation of text books, computer software and teaching aids. He also adds that teachers with strong CK may teach in a more interesting and dynamic way whilst those with little CK may shy away from the more difficult aspects of the subject, or approach their teaching in a didactic manner. In relation to using ICT, Cox et al (2003) support these views. They suggest that teachers need to possess relevant CK in order to make appropriate decisions when choosing software. In UK primary schools teachers teach across the whole range of subjects and implications for the teacher in this context are considerable. They need to continually add to their subject knowledge to keep up-to-date with changes in a subject area (Nicholson and Duckett, 1997).

There is a range of views on how teaching experience affects CK. Leach and Moon (1999) consider that CK is changed by teaching practice and in particular, by the resources that may be used in teaching. Prestage and Perks (2000) on the other hand argue that CK is only changed if teachers reflect on their teaching beyond a consideration of simple classroom events. Teachers need to consider their own understanding of the subject if practice is to affect CK. Thus the important aspect

in changing CK appears to be how a teacher internally reflects on a teaching experience rather than just the experience itself.

Both Leach and Moon (1999) and McNamara (1991) express concern about the lack of research into whether teachers who are confident in their CK bring particular attributes to their pedagogical practice. In primary schools relevant research has been undertaken with teachers into what makes effective teachers of literacy and mathematics. Medwell et al (1998) found that effective teachers of literacy had extensive knowledge about the subject. Askew et al (1997), writing about effective teachers of mathematics found that they had knowledge of the conceptual understandings within and between areas of the curriculum. This did not necessarily correlate with high qualifications in mathematics but effective teachers were much more likely to have undertaken mathematics-specific professional development over an extended period. The results of these two studies may not be necessarily contradictory. It is perhaps real understanding of the relevant content knowledge that is the key factor.

McNamara (1991), Ireson et al (1999), Alexander (2003) and Hay McBer (2002) all agree that teachers' CK is important. Shulman (1987) suggests that CK is a significant aspect of teaching since it affects planning, task setting, questioning, explaining, giving feedback and assessment. My particular interest however is not to consider what may affect teachers' knowledge in any specific subject since I am researching within a primary school context reflecting a broad range of content. What I wish to explore more deeply is the relationship between CK and Shulman's categories: PK and PCK.

2.2.3 Pedagogical Content Knowledge (PCK)

Shulman defines pedagogical content knowledge as the knowledge of how to teach within a particular subject area. It enables teachers to ease the learning for students through use of clear explanations, appropriate analogies and presenting learning in interesting, motivating and even entertaining ways.

Pedagogical content knowledge identifies the distinctive bodies of knowledge for teaching. It represents the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction. (Shulman, 1987, p 4)

Alexander (1992), Macnamara (1991), Brown and MacIntyre (1993) agree that PK, the knowledge of how to teach, is intrinsically linked to CK. There is however much debate as to what these links are and how PCK is formed. Duggen-Hass et al (2000) consider that the ability to teach science requires more than just an understanding of CK and PK. It also requires an understanding of what happens at their intersection. McNamara (1991) similarly suggests that it is not the case that CK is simply added to PK but that a teacher reflecting on classroom practice may create his or her own PCK.

The potential of teachers themselves to create their own PCK raises further debate on the relationship between the experiential knowledge and the theoretical knowledge of teachers. Stinnett (1968) suggests that while education has developed a great body of PCK too little has resulted from careful, thorough research. Too great a proportion of the literature on education is based on opinion, beliefs and slogans. Schon (1983) suggests that '... in much of the spontaneous behaviour of skilled practice we reveal a kind of knowing which does not stem from a prior intellectual operation' (p51).

Carlgrén (1996) points out that that this 'kind of knowing' or tacit knowledge alone is not necessarily a good thing, since tacit stupidity exists as well as tacit wisdom. There is need for other ways of perceiving theory and practice, while theory is about saying, practice is about doing and theory and practice represent two different ways of knowing. Bromme (1995), states that it is important for teachers to differentiate in their own minds between 'wisdom of practice' (Shulman 1997) which may

be subjective and the wider body of knowledge which exists. Goodson and Hargreaves (1996) suggest that teachers derive their skills from mediation between experience and theory. So the issue of solely theoretical knowledge requirements to define teachers' PCK is disputed, with a consensus view supported by Schon (1983), Goodson and Hargreaves (1996), Watkins and Mortimer (1999) and Brown and McIntyre (1993) that a mix of theory and practice provides greater professionalism. This is a position I share.

Within the context of this thesis on interactive whiteboards in the primary school, I consider there are however elements of CK across a spectrum of subject areas that require specific subject knowledge from teachers and which are separate from PCK. This specific knowledge relates to the use of the new range of software resources that teachers will necessarily employ as they adopt the whiteboard. Without the appropriate prior CK teachers will not be in a position to make the appropriate choice of such new resources; additionally, use of new resources may also potentially affect teachers existing CK. Despite the complex interaction between PK, CK and PCK I consider that in using the interactive whiteboard, teachers require more than just 'the knowledge of how to teach within a particular subject' they also require appropriate CK: knowledge and understanding of the subject matter so that they can employ and reflect on the use of new software resources in a satisfactory way. Consequently I regard it as important to consider CK in the context thesis as an independent entity in its own right rather than subsume CK altogether under the heading of PCK.

2.2.4 Curriculum Knowledge

Curriculum knowledge is knowledge of what should be taught to a particular group of pupils. It requires understanding of children's learning potential, national syllabuses, school planning documents and year group plans. In addition any examination or testing syllabuses must be taken into account and any local or contextual requirements considered.

Over the past twenty years what may contribute to curriculum knowledge has changed considerably in the UK. There has been the introduction of National Curricula and Primary and Secondary National Strategies. The latter not only define what is to be taught but also set out or at least advise on how teachers should teach. This has not surprisingly raised considerable debate (Helsby 1999; Gerwitz 2000; Watson 2001; Brown 2003) but one which is too wide to embark on within this discussion.

The arguments made earlier on PK, CK and PCK suggest that teacher knowledge may be influenced through change in their experiences. In order to examine the affecting factors of such change in more detail I will next explore some theoretical models of teacher knowledge.

2.3 Models of Teacher knowledge

There already exists a range of established models and theories relating to teachers' professional and pedagogical knowledge and skills. My purpose in presenting these is to provide a conceptual base to explore the pedagogy of the teachers in my study. While Shulman (1987) suggests different types of pedagogical knowledge he does not reflect in detail on the interrelationship between them or influences that may affect teachers' pedagogy (Banks et al, 1999). In addressing a range of models I intend to investigate the similarities and differences between them so that I can form a new model on which to base the analysis of my results for this thesis. The models I will examine in this review are those of Banks et al (1999), Prestage and Perks (1999), Nicholson (1996), alongside pedagogical frameworks from Alexander (1994) and Cox et al (2003).

2.3.1 Model proposed by Banks et al (Fig 2.1a)

Banks et al (1999) suggest that teachers' knowledge is derived from their *Subject knowledge*, *Pedagogical knowledge* and *School knowledge*. They use different terms from those of Shulman in their model in order to emphasise the different meanings they ascribe to each 'knowledge'.

Subject knowledge is analogous to Shulman's Content Knowledge (CK). *School knowledge* is not defined by Banks et al (1999) as knowledge of the school context but as 'an analytical category' in its own right subsuming the Curriculum Knowledge of Shulman and PCK. *School knowledge* is related to the way CK is taught in schools and includes understanding the processes necessary to transform knowledge for a pupil audience. In agreement with Macnamara (1991), Banks et al consider that *School knowledge* is not just the intersection between Shulman's CK and PK. It involves not only an understanding of school curricula in a subject but also what happens at the intersection of these two knowledges which involves teachers in creating their own PCK. Verret (1975) cited in Banks et al (1999) proposes that such learning is non-linear and that *School knowledge* is under constant interpretation and reinterpretation at a range of levels. Pedagogical knowledge in the Banks et al model is equally considered to be constantly changing and closely integrated with CK and PCK.

At the heart of this model lies *Personal constructs*. Banks et al (1999) define this as a teacher's 'complex amalgam of past knowledge, experiences of learning, a personal view of what constitutes good teaching and belief in the purposes of the subject.' Teachers' *personal constructs* are formed as a result of their experiences and they underpin a teachers' professional knowledge. Such constructs are continuously reassessed during a teacher's career (Banks et al 1999). Rather than address *Personal constructs* at this stage I intend to examine them in detail in Chapter 3 on 'Teachers' learning'.

In summary the model proposed by Banks et al is comprised of PK, CK, PCK and Curriculum Knowledge which are linked to teachers' values, beliefs and experiences. This model may appear at first glance to be similar to the framework presented by Shulman (1986). A major difference however cited by Banks et al with which I agree is the dynamic nature of teacher knowledge. Shulman views teacher knowledge as fixed and external rather than knowledge which is constantly changing through a teacher's own learning. I will use the Venn diagram representation of 'Shulman's knowledges' proposed by Banks et al as a starting point for my work in progress in presenting a pedagogical model. Until I have further information the preliminary model I present in Fig 2.1b proposes that PK, CK and Curriculum Knowledge are entities in their own right and that PCK remains integrated within PK and CK.

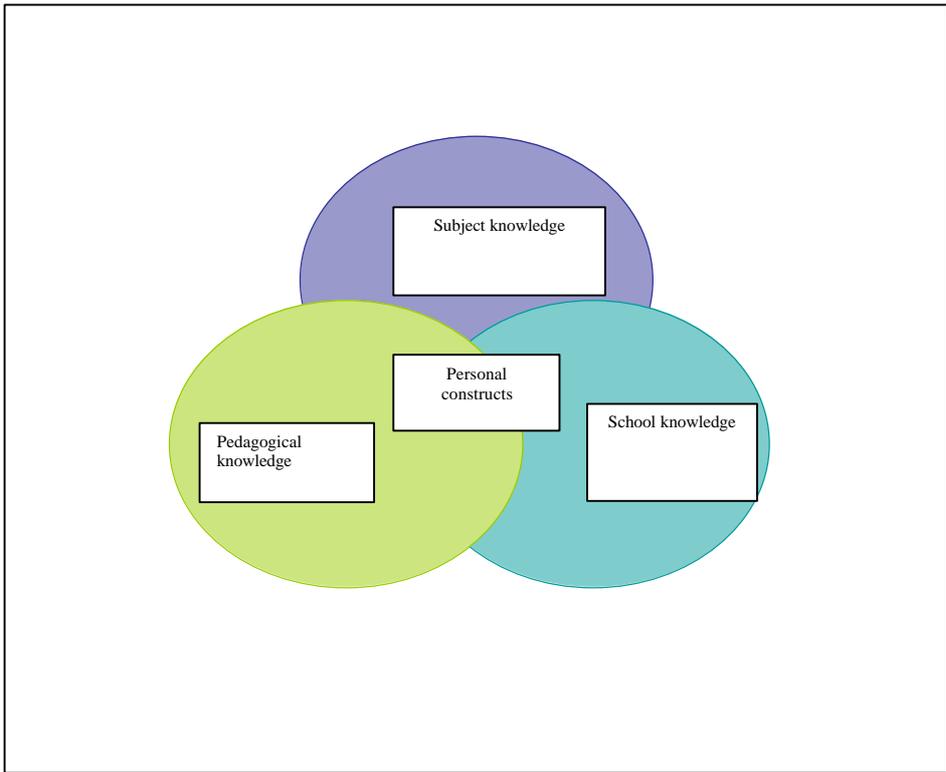


Fig 2.1a: Teachers' professional knowledge (Banks et al 1999, p94)

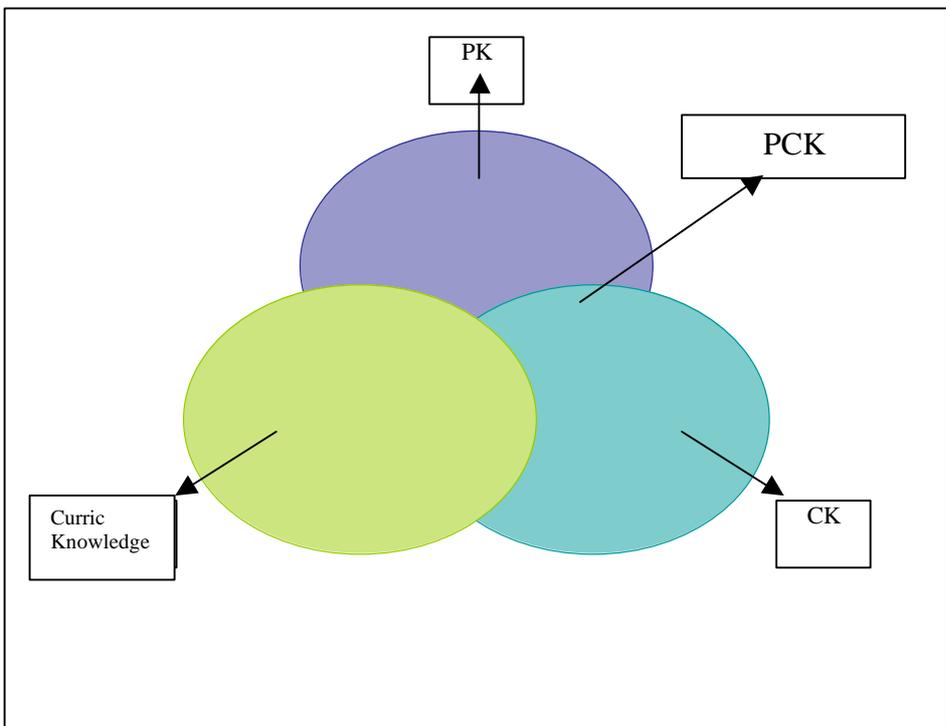


Fig 2.1b: My model of pedagogy: work in progress arising from Banks et al (1999)

2.3.2 Model proposed by Prestage and Perks (Fig 2.2a)

Prestage and Perks (2000) in a paper which considers the knowledge required in teaching mathematics, provide a different model. They suggest that classroom events, professional traditions, practical wisdom and learner knowledge, make up the factors which may affect teacher knowledge. Within this context teacher knowledge is analogous to Shulman's PCK. The model sets the teacher as the focus of attention, since learner knowledge relates not only to CK but also to the way teachers' themselves were taught as learners. Similarly other terms in the diagram *Practical wisdom* and *Professional traditions* concern a teacher's beliefs and values and his or her own experiences of teaching.

Classroom events, a term not specifically noted in the Banks et al (1999) model are what happens in the classroom or could be defined as teachers' actual practice resulting from their *Professional traditions*, *Learner knowledge* and *Practical wisdom*. The model shares common ground with Banks et al in that both propose that PCK is constantly changing as a result of teaching experiences. The Prestage and Perks model (Fig 2.2a) is shown as a tetrahedron where the struts represent the reflective/analytic process. Teacher knowledge or PCK arises from teachers' reflection on elements based at each apex of the model and *Classroom events*.

This model concentrates on PCK. I consider the elements pertaining to teachers' personal constructs that result in PCK are background factors which are constantly affecting not only PCK but also PK, CK and Curriculum Knowledge. Consequently, teaching experiences and teachers' beliefs lie on a metaphorical plane beneath; constantly influencing both these four knowledges and classroom events as illustrated by further revision of my model (Fig 2.2b).

NOTE: Any changes from a previous working model are highlighted in yellow from figures 2.1b to 2.5b.

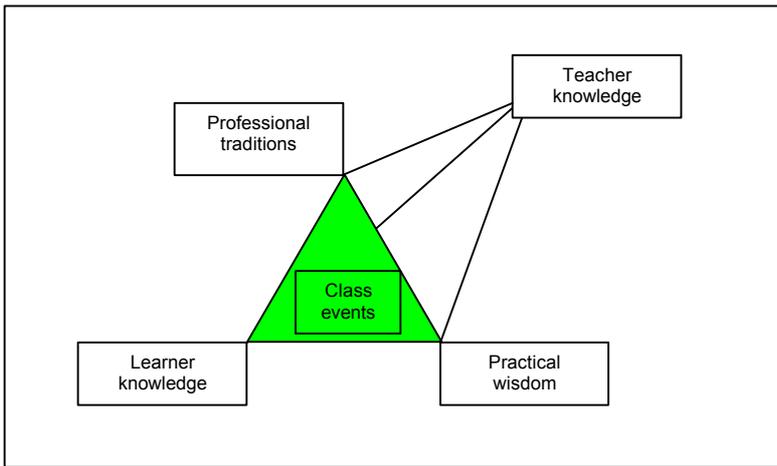


Fig 2.2a: Model describing subject knowledge (Prestage and Perks 2000, p3)

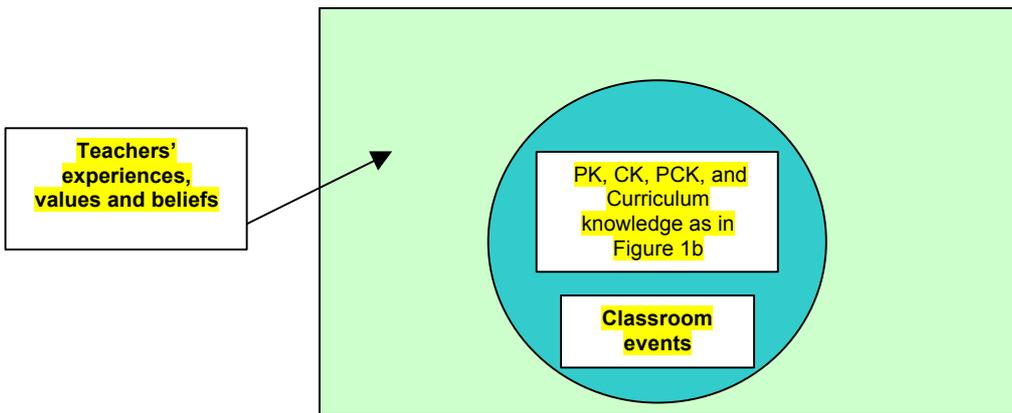


Fig 2.2b: My model of pedagogy: work in progress arising from Prestage and Perks (2000)

2.3.3 Model proposed by Nicholson (Fig 2.3a)

In contrast to both Banks et al and Prestage and Perks, Nicholson (1996) suggests that teacher knowledge comprising PK, CK and Curriculum knowledge can be formally acquired. I do not agree since I consider that these knowledges are affected by practice but what is of interest in her model is the accumulated experiential knowledge of teachers which she describes as *Personal practical knowledge*. This is developed in a social context in which educational practices occur. The model proposes that teachers are influenced by personal beliefs and theories throughout their life and career as well as the professional context in which they work. Nicholson also suggests that professional context ie the activities that take place in classrooms and schools are influenced by the educational system and society at large rather than just Classroom events as proposed by Prestage and Perks.

The Nicholson model supports that of Banks et al (1999) and Prestage and Perks in endorsing the effects of personal beliefs and experiences as highly influencing factors in teachers' lives. The model however suggests that there are further elements: the school, community and society which have a significant part to play in the way teachers' teach which I will refer to in future by *Educational context*, as presented in my third revised model Fig 2.3b.

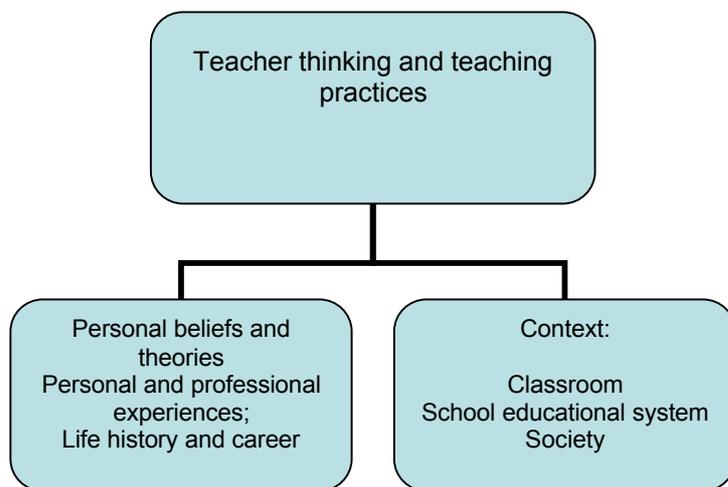


Fig 2.3a: Conceptualisation of research on teacher thinking and teaching (Nicholson, 1996 p4)

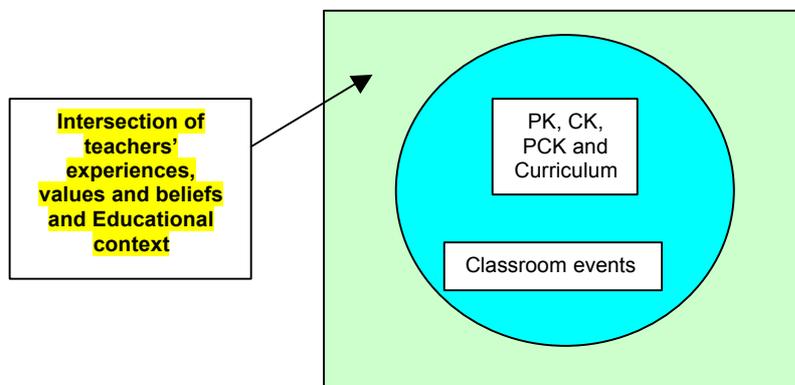


Fig 2.3b: My model of pedagogy: work in progress arising from Nicholson (1996)

2.3.4 Framework proposed by Alexander (Fig 2.4a)

So far I have not examined *Classroom events* in any detail and I now turn to Alexander (1994) for further insight. He proposes a conceptual framework for analysing and exploring classroom practice which relates to the elements of teacher knowledge previously discussed. The framework separates pedagogical aspects into two main dimensions *Observable practice* and *Ideas beliefs and values*.

Alexander (1994), states that the categories are by no means discrete and each aspect of practice is affected by some or all of the components given under *Ideas values and beliefs*. This is a view shared by previous models given and one which I endorse. Of particular interest however from Alexander's Framework is the dimension of 'Observable practice' which concerns the day-to-day practices that teachers may adopt ie 'the act of teaching together with its attendant discourse' Alexander (2003). This draws in classroom management, lesson preparation, use of resources, assessment of learning and knowledge of learners which may not only be affected by teachers' beliefs and values and context of teaching but also their PK, CK, PCK and Curriculum Knowledge. Observable practice subsumes teachers' tacit knowledge. Classroom practice is a complex amalgam of actions resulting from both recognised and tacit knowledge that teachers themselves may not realise they possess or are easily able to express. In agreement with Alexander I consider that Observable practice is at the heart or intersection of all these knowledge and social effects on teachers as illustrated in Fig 2.4b.

OBSERVABLE PRACTICE		
	CONTENT	whole curriculum subjects/areas
	CONTEXT	physical, interpersonal classroom, resources, participants
	PEDAGOGY	teaching methods and pupil organisation
	MANAGEMENT	planning, operation, assessment of learning, assessment of teaching
IDEAS VALUES BELIEFS		
	CHILDREN	development, needs, learning
	SOCIETY	needs of society needs of individual
	KNOWLEDGE	children's ways of knowing, culturally evolved ways of knowing

Fig 2.4a: Educational practice a conceptual framework (Alexander 1991, p84)

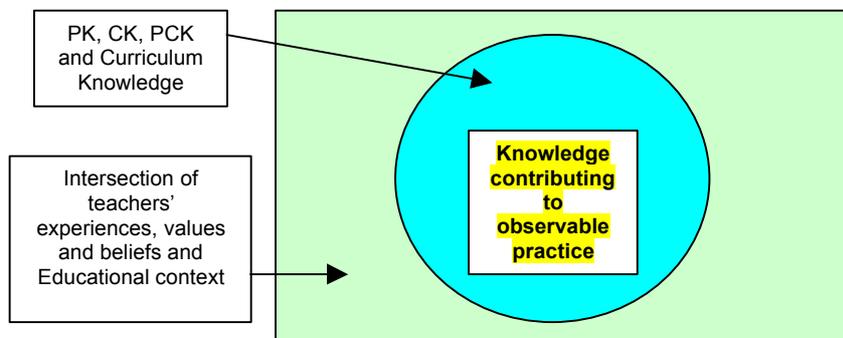


Fig 2.4b: My model of pedagogy: work in progress arising from Alexander (1994)

2.3.5 Framework proposed by Cox et al (Fig 2.5a)

Since I am addressing the use of interactive whiteboards for my research the final framework I wish to consider relates pedagogy to the use of ICT. Cox et al (2003) use an earlier model from Laurillard et al (2000) and evidence from case studies in schools to present a pedagogical framework drawing in the affordances of ICT. Kennewell (2001) defines affordances as the potential for action which may enable pupils to achieve a goal. The issue of affordances may be significant in creating a satisfactory model for influences on whiteboard pedagogy.

My earlier 'work in progress models' (Figs 2.1b-2.4b) have included elements from the left hand side of the Cox et al framework (Fig 2.5a). There are however differences: the Cox et al framework suggests linearity between teacher knowledge, their beliefs, values, experiences and classroom practice while my working model (Fig 2.4b) arising from other knowledge models proposes that all these elements are fused in complex ways. I consider this latter position best represents the real situation. Elements from the right hand side of the Cox et al framework on pupils' beliefs and behaviours I will not pursue since I do not intend to examine factors relating directly to pupils for my thesis.

The green shaded area in Fig 2.5a presents the actions of affordances, in this case due to the influence of ICT, suggesting that it is the affordances that stimulate change in pedagogy. I support this view and also regard the Cox et al Framework as relevant to other pedagogical interventions. In relation however to the model I am presenting for pedagogy I consider that my corresponding 'green area' of Fig 2.5a lies in a different dimension to the white. Influenced by Prestage and Perks (1999) I regard the relevant white area of Fig 2.5a as representing the base of a pyramid and the green area the result of affordances which stimulate pedagogical change. This change lies in a different plane at the vertex of the pyramid. Fig 2.5b presents my final work in progress model prior to presenting the complete theoretical version for the analysis of my results.

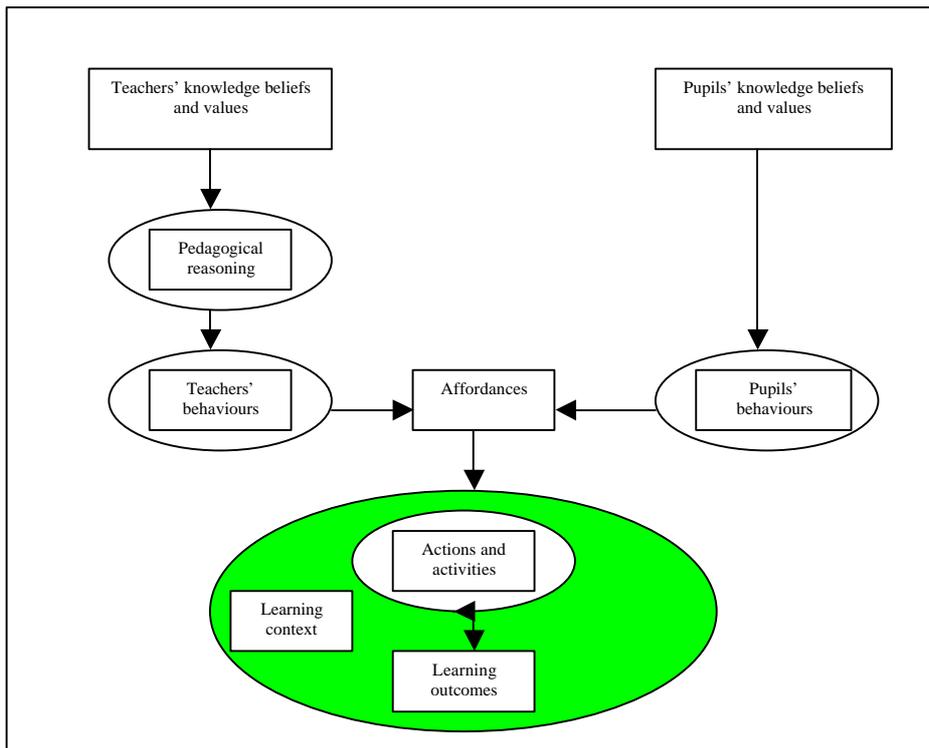


Fig 2.5a: Overview of emerging framework: ICT and pedagogy (Cox et al 2003, p28)

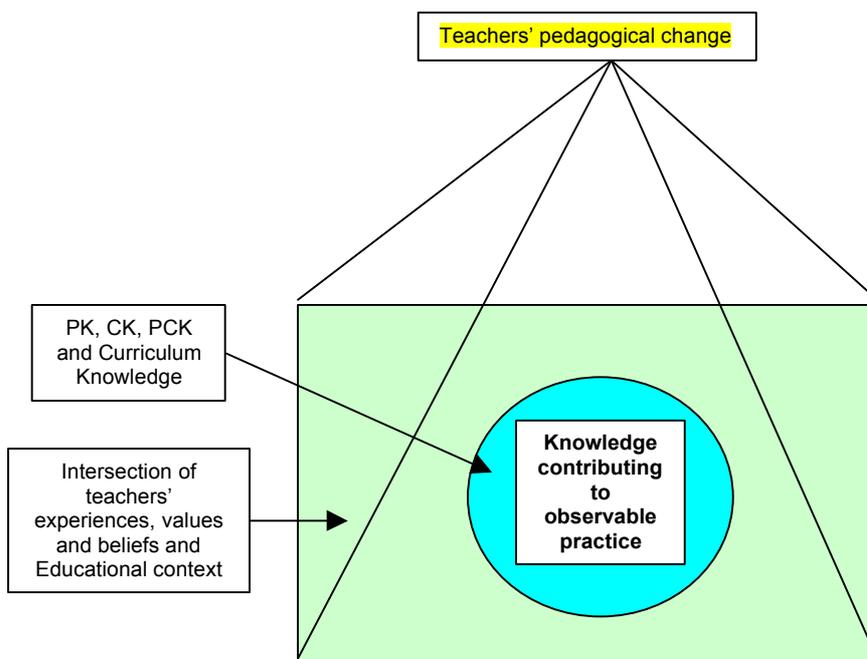


Fig 2.5b: My model of pedagogy: work in progress arising from Cox et al (2003)

2.4 Construction of a model of pedagogical change for analysis of influences on whiteboard pedagogy

In reflecting on the models discussed so far I feel it is pertinent to return to Shulman's categories which provided an initial framework for teacher knowledge. According to the models discussed, Shulman's Framework (1986) neglects to take into account any consideration of practice which is adopted through teaching experience. To exemplify the situation Ritchie (1998) explains such actions.

'My *theory of action* for setting the scene (in the classroom) was not acquired from reading or even observations of more experienced teachers but developed through my experiences and later successful application of these ideas on several occasions.... This amalgam of ideas crossed several of Shulman's knowledge bases.' (p2)

Thus taking into account all the factors considered from established models I propose a revised model for influences on pedagogical change arising from the following elements:

1. PK which includes knowledge of learners (Shulman 1986)
2. CK (Shulman 1986)
3. PCK (Shulman 1986)
4. Curriculum Knowledge including educational goals and purposes (Shulman 1986)
5. A Venn diagram representation of PK, CK, PCK and Curriculum Knowledge (Banks et al, 1999)
6. Teachers' values, beliefs and experiences (Prestage and Perks 2000)
7. Contexts pertaining to pupils, the classroom, school, community or Educational Context (Nicholson, 1996)
8. Observable practice (Alexander, 1994)
9. Change in pedagogy enabled by the affordance of an intervention (Cox et al 2003)

I have not as yet discussed all these factors which contribute to pedagogy in detail. Teachers' values beliefs and experiences and Educational Context (points 5 and 6) I will address in Chapter 3 on 'How teachers learn' in the whole school context. The final elements: 'Observable practice' and 'Change in pedagogy' I hope to address as the result of my empirical evidence from teachers subsequent to interactive whiteboard intervention.

I have re-presented the 'work in action' (Figs 2.1b-2.5b) on my revised model sequentially in Appendix 2.1 so that its construction may be more easily observed. The culmination of these and the final model that I intend to use for my analysis of influences on whiteboard pedagogy is presented in Fig 2.6 (plan view) and 2.7 (3D view).

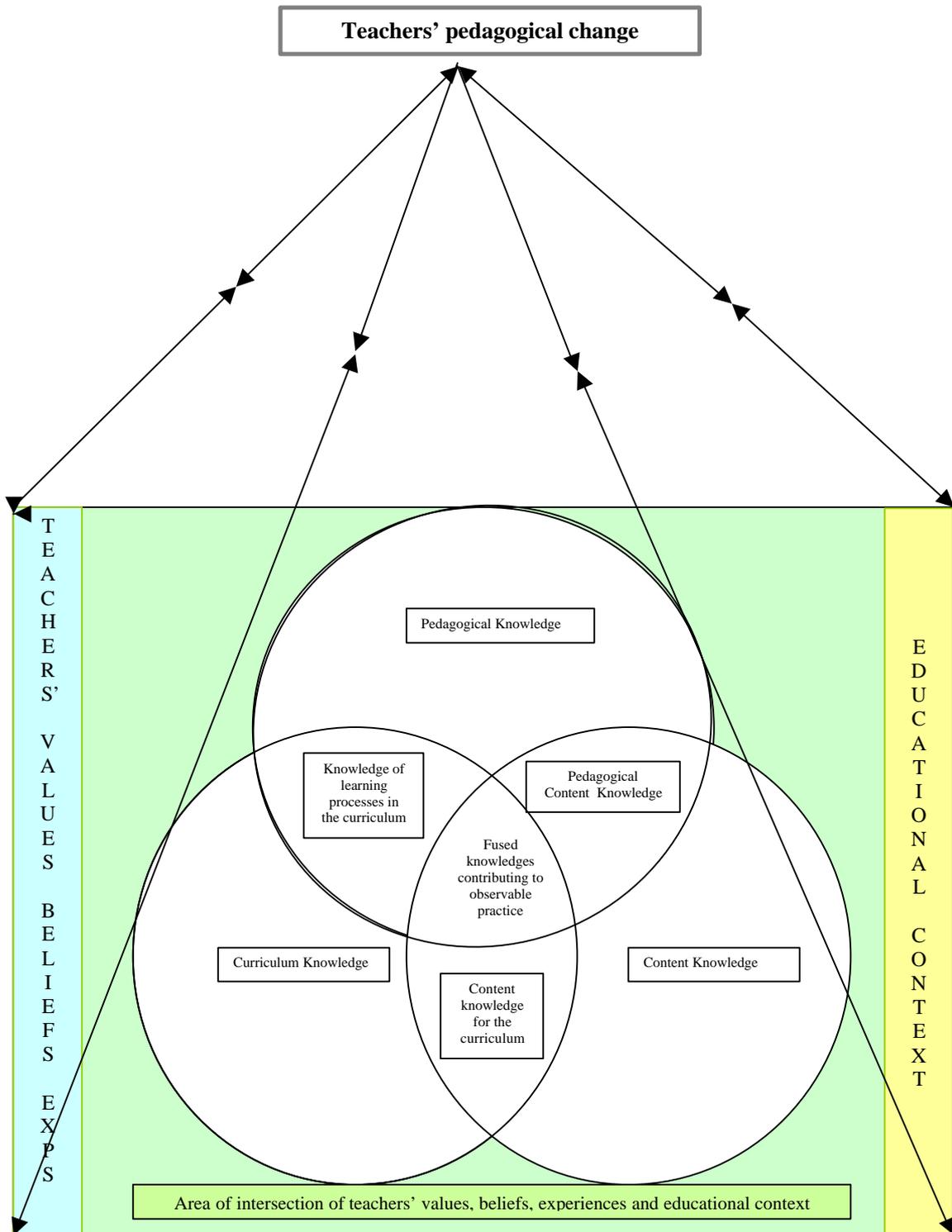


Fig 2.6: Theoretical model for teachers' pedagogical change

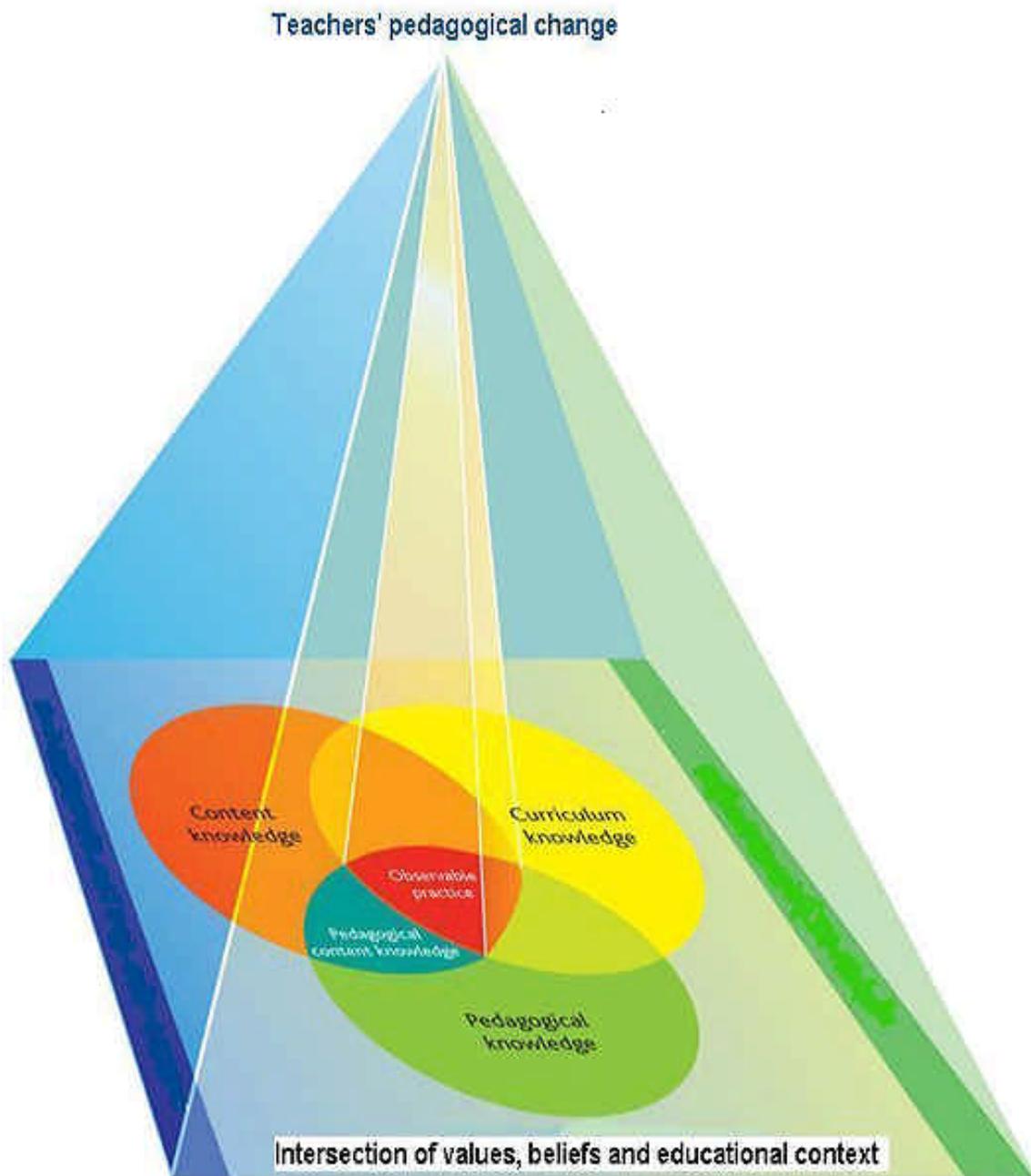


Fig 2.7: 3D view of 'Theoretical model for teachers' pedagogical change'

2.4.1 Model adopted to analyse change in pedagogy

The model (Figs 2.6/2.7) aims to demonstrate both the changing nature of teacher knowledge and the relationship between a teacher's beliefs, values and experiences and educational context. CK, PK, PCK, Curriculum Knowledge and Observable practice are all based within the intersection of a teacher's beliefs, values and experiences and their educational context. The purpose of this aspect of the representation is to illustrate that a teacher's knowledge is influenced by all of these dynamics.

At the vertex of the pyramid, formed by connecting the four corners of the base, lies 'Teachers' pedagogical change'. The purpose of using a 3D model is to suggest that there is a constant two-way flow between the base elements: teacher knowledge, teachers' beliefs, educational context and the vertex element: pedagogical change. Through this representation of the two-way process the model is also intended to suggest that a teacher's knowledge is dynamic in that it is constantly changing and responding to new events. Figure 2.6 is the theoretical model of teacher knowledge and influences on pedagogical change that I intend to employ to underpin my analysis of each individual teacher's interactive whiteboard pedagogy across one year of use.

Before moving on however further consideration is required of the use of the term 'whiteboard pedagogy'. In section 2.1 I have presented several definitions of general pedagogy so that 'whiteboard pedagogy' might be construed over simplistically as the way a teacher teaches in the classroom with the interactive whiteboard. Though simply stated the process is more complex. Drawing on the definition of pedagogy earlier given by Alexander (2003) I consider 'whiteboard pedagogy' as the act of teaching with the interactive whiteboard through employing appropriate teaching skills and the necessary technological skills to foster children's learning through the use of appropriate teaching methods, resources and questioning techniques. This definition necessarily draws in issues relating to a teacher's knowledge and in particular his or her PK, CK and PCK in using the whiteboard, thus encompassing both pedagogical knowledge and practice. Consequently in subsequent use of the term 'whiteboard pedagogy' distinction will be made where appropriate between 'whiteboard pedagogical knowledge' and 'whiteboard pedagogical practice' if the general term 'whiteboard pedagogy' is ambiguous.