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**Sociocultural understandings of technology-
mediated educational practices:
Improvable objects and meaning-making trajectories
in the ICT-literate classroom**

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BSc (Hons)

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requirements of the degree of Doctor of Philosophy**

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Abstract

Informed by sociocultural theory, this thesis addresses the gap between the view that teaching-and-learning should be an extended, integrated experience, and the limited research available on how classroom technologies can support this (Glover, et al., 2007). The research explores a new programme using technologies (including interactive whiteboards: IWBs) together with dance/movement and more traditional classroom activities to support teaching-and-learning. Data are presented from eight consecutive history lessons on the Great Fire of London with a Year 2 class (6-7 years), together with four interviews, two Video-Stimulated Reflective Dialogue sessions and a focus group. Findings are based on sociocultural discourse analysis (Mercer, 2004), multimodal analysis (Jewitt, 2009; Kress & van Leeuwen, 2001) and thematic analysis (Braun & Clarke, 2006) of these data.

With implications for both theory and practice, analysis shows how the IWB was used in innovative ways to offer structure and flexibility across lessons. Evidence is also provided of how exploring the topic through dance/movement, images and other activities could support pupils in building *conceptual understanding*. This then served as a context to develop *verbally-expressed understanding*. Analysis indicates, however, that confusion could arise in the different ways concepts were referred to through this integrated approach. Based on these findings, Wells' (1999) concept of the 'improvable object' is extended to illustrate how flexible use of IWB slides and talk around them, and how exploring and re-versioning concepts across activities, brings new dimensions to the knowledge-construction process.

Furthermore, the importance of addressing meaning making as an interactional achievement became evident, through extension of Baldry and Thibault's (2006) 'meaning-making trajectory'. Analysing teacher and pupil perspectives offers valuable insights, regarding how the teacher used and improvised from his lesson plan to acknowledge pupils' interpretations, and support ongoing

meaning making. These contributions represent important understandings of knowledge construction in contemporary, technology-mediated classrooms.

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Publications arising from this work

Twiner, A. (2010). Interactive whiteboards and the discourses of transformation, affordance, orchestration and participation. In Thomas, M. & Cutrim Schmid, E. (Eds.), *Interactive whiteboards for education: Theory, research and practice* (pp. 37-52). New York: Information Science

Reference.

Twiner, A., Coffin, C., Littleton, K., & Whitelock, D. (2010). Multimodality, orchestration and participation in the context of classroom use of the interactive whiteboard: A discussion. *Technology, Pedagogy and Education, 19*(2), 211-223.

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Chapter 1

Introduction

1.1 General introduction

This thesis attends to an important gap in research: between the sociocultural principle of knowledge construction as a discursive, mediated and cumulative process, mindful of recent attention to the temporality of teaching-and-learning (e.g. Mercer, 2008), but limited research on how classroom technologies can be used to support cumulative, co-constructed learning experiences (Glover, et al., 2007). The research presented here in addressing this gap builds on interest generated through my involvement in previous research adopting a sociocultural framework to explore the use of interactive whiteboards (IWBs) across consecutive lessons on the same subject (Mercer, 2007). The research questions and findings from Mercer's project gave me an insight into the sociocultural theoretical framework and field of application, supported by my substantial reading in the field, and book chapter written on the shifting ways that IWBs in education are referred to in research (Twiner, 2010). This led me to frame my current research interests around how knowledge construction is supported over time through participation in lesson activities and orchestration of resources, within real-life classroom events. In a context where excitement and novelty about new tools was threatening to drive a focus on technology, it was important to strengthen the focus on pedagogy, and on how technological tools could be employed to support the teaching-and-learning process. To address these issues, I collected data from three primary schools developing a new programme to use technologies and dance/movement alongside more traditional resources within consecutive lessons on the same subject.

In my research I maintained the sociocultural view of talk as the central tool in communication, and my intention was also to observe how talk was used in drawing salience to and orchestrating the use of other tools. Thus I attended to the multimodality of communication in conjunction with

my broader sociocultural framework. Specifically I was keen to extend Wells' (1999) notion of 'improvable objects' in considering how resources are used and re-used over time, in facilitating and instantiating the joint construction of knowledge. Firstly I addressed this in the context of IWB use in teaching-and-learning, and so it is appropriate now to outline some issues regarding this tool.

A technological tool which is now reportedly available in 70% of UK classrooms (Futuresource Consulting, 2011), the IWB offers to users a large screen connected to a computer, on which resources can be displayed and interacted with through use of either pens or fingers via a touch-sensitive interface. Resources can be planned and saved prior to use (such as in presentation files), modified in use, and saved or deleted after use. I stress however that I was not aiming to focus on the technology in itself, but instead to observe how it was used as one tool amongst many. I was particularly concerned to address the orchestration and alignment of talk, digital technologies such as the IWB and other meaning-making resources. Such a research focus was pertinent as the tool was becoming more commonplace in classrooms, but was still relatively new to many teachers. Through this research focus I was able to contribute to the debate regarding how new *technological tools* are appropriated within, and potentially transform, existing teaching-and-learning practices, and to also offer an extension of *conceptual research tools* – in this case the improvable object – to address these emerging practices.

I therefore intended to address how teachers used and improvised from their lesson plans across their use of tools, as they attended daily to the challenge of how best to resource their pupils' learning experiences. Not wishing to focus solely on the teachers however, and in alignment with the sociocultural view of knowledge as co-constructed, I aimed to observe also how pupils were given and responded to opportunities to interact with and around such lesson resources. In a climate where pupils' participation in their learning is being strongly advocated (e.g. Rose, 2009; Solomon & Black, 2008), and new technologies that potentially have the capacity to be used to

support this endeavour are being incorporated into teaching-and-learning environments, there is both pedagogic and technological timeliness to this research agenda.

Within this view of teaching-and-learning experiences as participatory and co-constructed, it was also important to address the interactional and temporal nature of knowledge construction. In designing my research therefore I was keen to extend Baldry and Thibault's (2006) concept of 'meaning-making trajectories' in this frame. Specifically I wanted to move from Baldry and Thibault's focus on the individual navigating webpages, to a focus on pupils together with their teacher raising and negotiating views in making meaning through classroom interaction. This necessitated the adoption of a temporal analysis from both teacher and pupil perspectives, as I aimed to address the process by which pupils made meaning, and their responses to the tasks set out for them, over a continuous series of topic lessons.

Having established the background to my research, I now outline the context in which I collected my data to address the identified issues.

1.2 Context of data collection

I was fortunate to be able to conduct my research within the context of the development of a new teaching-and-learning programme. The programme was led by a contemporary dance organisation, and encouraged use of potentially interactive technologies and dance/movement in conjunction with more traditional educational activities, including talk, to support cross-curricular learning. The technologies included an IWB as well as a small number of Sony PSP handheld devices with attached cameras to allow capture as well as viewing of images and video in lessons. The use of dance/movement was intended to offer an alternative means, through physical exploration and representation, of resourcing subject concepts. Regular class teachers were paired with a dance specialist to support them in incorporating dance/movement activities within their subject teaching for a specific topic. This real-life educational context offered me scope to

observe and record series of consecutive topic lessons, and through this to consider and analyse the data around the theoretical concepts I was keen to explore and develop. It also provided a potentially interesting multimodal angle through the explicit incorporation of dance/movement activity to support subject learning.

In order to take full advantage of the data collection context involving one class in each of three primary schools, two of which included a substantial proportion of pupils speaking English as an Additional Language (EAL), I adopted a case study method to collect/conduct:

- observations and video-recordings of eight weeks of topic lessons, usually with two lessons per week, from three classes in different primary schools;
- semi-structured interviews with teachers and dance specialists before and after the series of lessons;
- video-stimulated reflective dialogue sessions (VSRD) with teachers and dance specialists around some video footage of their lessons, after the series of lessons;
- focus groups with a small group of pupils from each class, after the series of lessons.

For my thesis, in order to offer a detailed and comprehensive analysis around the theoretical concepts identified, I present an in-depth analysis of a single case – of a four week, eight lesson history topic on the Great Fire of London with a Year 2 class (pupils aged 6-7 years). I selected this topic as I was able to record all the eight lessons planned initially by the teacher (some lessons were omitted in the other two classes, due to teacher illness or other school events), and as they made substantial and integrated use of talk, digital technologies and dance/movement activities in resourcing the subject. I framed my analyses around the research questions explicated below.

1.3 Research questions

Mindful of my theoretical framework and data collection context, I proposed an overarching research question:

How is knowledge building pursued and orchestrated as a temporal and cumulative process, by teachers and pupils, through their use of talk, digital technologies and other meaning-making resources?

In framing this question I emphasise the focus on ‘knowledge building’ as a process, rather than ‘knowledge’ as a product. Thus my analysis needed to adopt a temporal approach to address this process. I elaborate further on this distinction as it has been explored within a sociocultural framework in chapter 2. This research question also incorporates a distinction between ‘knowledge building’ and ‘learning’: where knowledge building is one aspect of the larger goal of learning; and equally, where learning aligned with teaching constitutes the social and cultural practice framed to support the knowledge-building process (Ferguson, 2009). Within this is also a need to distinguish between ‘teaching-and-learning practices’ – the actual activities and experiences within classrooms – and the broader imperatives and challenges within ‘education’ (Mercer, 2004). In this sense, attempts by practitioners to address educational challenges can be considered in terms of how they resource the teaching-and-learning activities with their pupils.

From the above overarching research question I explored two more specific research questions, to address the key issues in more detail. My analysis chapters are organised around these two questions:

How are talk, digital technologies and other meaning-making resources utilised to resource and make visible meaning-making trajectories within and across lessons, and to scaffold the development of improvable objects as progressive and historical representations of developing understanding?

How do instances of, and allowance for, improvisation and reciprocity in teaching-and-learning experiences influence the negotiation of meaning-making trajectories?

I now outline how I structured my thesis to answer these questions.

1.4 Structure of the thesis

In the following chapter (chapter 2) I present my literature review, exploring in more detail the assumptions of the sociocultural framework I adopted, and how they relate to the context of my data collection. I discuss the theoretical concepts I particularly developed in my work: of the improvable object and the meaning-making trajectory.

In chapter 3 I outline the methods of data collection I employed in my research: in using lesson observations, interviews, VSRD sessions and focus groups to present a case study. I describe some of the challenges to reliability, validity and generalisation that have been levelled at use of such methods, and how I responded to these challenges.

Chapter 4 is where I discuss the methods of sociocultural discourse analysis (SCDA: Mercer, 2004) and multimodal analysis (Jewitt, 2009; Kress & van Leeuwen, 2001) that I adopted and adapted to analyse the lesson data. I also describe how I employed thematic analysis (Braun & Clarke, 2006) to address the interview data (referring to the pre- and post-interviews, VSRD sessions and focus groups). I outline how I generated findings related to data gathered from multiple sources, and across the different methods of analysis. I identify and address issues regarding potential challenges to reliability and validity.

Analysis of my data is presented in chapters 5, 6 and 7. Chapters 5 and 6 address the first research question:

How are talk, digital technologies and other meaning-making resources utilised to resource and make visible meaning-making trajectories within and across lessons, and to scaffold the development of improvable objects as progressive and historical representations of developing understanding?

In chapter 5 I use both qualitative and quantitative SCDA to address the promotion and appropriation of discourse relevant to the history subject and topic, and use of the IWB framed through an extension of Wells' concept of the improvable object. In chapter 6 I incorporate multimodal analysis to explore further the notion of the improvable object, in resourcing knowledge building within and across modes and over time around the historical concepts of concern. This combination of analytic method enables analysis at different levels of detail and temporal range. Through these analyses of the lesson data, and through alignment with findings from my thematic analysis of the interview data, I offer a rich picture of how a variety of resources and modes can be used and re-used to pedagogic effect, as improvable objects, and how the teacher and dance specialist used the available resources to address the challenges inherent in supporting learning.

The analysis presented in chapter 7 addresses the second research question:

How do instances of, and allowance for, improvisation and reciprocity in teaching-and-learning experiences influence the negotiation of meaning-making trajectories?

In this final analysis chapter I use SCDA to present a re-working of the notion of a meaning-making trajectory, offering a more interactive view of meaning. I explore the issue of the important role of the teacher and peers in planning and constructing teaching-and-learning experiences that are meaningful to all participants. Again I use findings from my thematic analysis of the interview data to substantiate and resource understanding of my claims.

In chapter 8 I bring together the findings from the three analysis chapters, to present a picture of how the temporal and cumulative knowledge-building process can be orchestrated and made visible through attention to practitioners' and pupils' progressive use of talk, digital technologies and other meaning-making resources. I show how these are pertinent concerns for practitioners and researchers, particularly within technology-mediated, and often multilingual contemporary primary school classrooms – such as was the context of my data collection. I highlight the original

contributions proposed, in the context of the theoretical framework set out in my literature review. I also offer reflections on my methodology, suggest potential implications of my findings for practice and identify important issues for further research.

Chapter 2

Literature review

2.1 Introduction

In this chapter I identify some key areas of concern, interest and gaps around the application of sociocultural theory to the use of tools to support teaching-and-learning, and how I address and extend them through my work. To open the review I outline the key tenets of a sociocultural approach, incorporating the traditional sociocultural notion of the 'tool' within the frame of the mediational toolkit, and in the context of a view of the mediated and discursive nature of human knowledge. I use this to address the role of teacher and pupil talk, and the different types and functions of talk as observed in the classroom. Building on this, I present a discussion of the terms 'knowledge', 'meaning' and 'understanding' within a sociocultural framework, and how this influences an approach to the research context. In considering the issues of knowledge construction and meaning making, I justify why a temporal analysis is a particularly pertinent but relatively recent research concern, focusing on the notion of trajectory and the 'meaning-making trajectory' in particular. Following this I address use and re-use of learning objects over time in the cumulative construction of knowledge as an interactional accomplishment. I particularly address the notion of the 'improvable object' within this. Building on a consideration of learning objects, I draw attention to the use of technological tools in teaching-and-learning experiences, particularly of the IWB alongside other classroom resources, as orchestrated by the teacher, and as vehicles for encouraging meaningful pupil participation. With this alignment of tools in mind, I outline how I incorporate a multimodal approach to my analysis, whilst maintaining a view of talk as the central mode in communicative interaction. In the final literature section I consider the use of subject discourses, and the importance of providing opportunities for pupils to appropriate these contextualised forms of discourse.

After reviewing the existing literature I offer a consolidated piece on how I particularly adopt and extend the concepts of 'improvable objects' and 'meaning-making trajectories' as applied to my data, emphasising the need to focus on contextualised user appropriation of tools, through the adoption of a socioculturally-framed, multimodal analysis. I begin this review of the literature by outlining the sociocultural perspective in which I locate my work.

2.2 A sociocultural perspective on teaching-and-learning

In this section I outline some key concepts within a sociocultural framework of learning and development. Specifically I highlight the mediated nature of human knowledge, and how this notion of external but contextualised influence supports a view of all knowledge as constructed. This reinforces the sociocultural approach emphasis on the important role of others in viewing learning as a dialogic relationship between teacher, pupils and the resources and environments in which learning experiences occur. I introduce the importance of talk in this section, but focus on it more explicitly within section 2.3. I begin this discussion with a consideration of the mediated nature of knowledge.

2.2.1 The mediated nature of human knowledge

One of the underlying features of a sociocultural approach is the role of the social and cultural environment in resourcing the development of the individual. Wertsch and Tulviste (1992) propose that analysis of the individual must take place and be contextualised within the social and cultural environments in which the individual develops and experiences the world. Development is said to appear on two levels, or planes: firstly on the social level, the intermental, and secondly on the psychological level, the intramental (Vygotsky, 1962). This interaction between the two planes is called internalisation. In a wider sense of development therefore, it follows that knowledge and meaning are seen as co-constructed and negotiated through dialogue and interaction between people, on the intermental level. Thus knowledge is considered as a social

construction, re-constructed in each interactive use, rather than a collection of objective facts to be learnt. I return to this issue in more detail in section 2.4.

Within a sociocultural view of human knowledge as mediated, it is important to pay attention to the nature of this mediation. This is predominantly referred to through the use of 'tools'. Tools (physical objects) are described by Vygotsky (1962) as 'technical tools', and signs (such as language, images) are referred to as 'psychological tools' (or 'cultural tools'). Within Vygotsky's work more emphasis and value is placed on signs, or psychological tools, in the mediation of human activity. This is in keeping with a view held by many researchers adopting a sociocultural framework (e.g. Alexander, 2008a; Mercer, 2004), of talk as at the centre of meaning making and as the primary mediational means for knowledge construction.

Many researchers have outlined the role of mediating artefacts (e.g. Wertsch, Tulviste & Hagstrom, 1993) in sociocultural theory. Researchers have however been keen to reiterate the need to view any mediational means as a situated and interactional device, which could be employed in different ways by different users and on different occasions (e.g. Wertsch & Tulviste, 1992). Thus only through action are tools given meaning and inspire meaning-making activity.

A sociocultural approach assumes that use of tools potentially supports, but through their use changes, the nature of the meaning-making activity or effort. Vygotsky (1962) suggests that the specific uses of such tools are key to how a process is enacted, and the resultant and ongoing learning and/or development – tools do not simply support something that would happen anyway, but significantly alter this process by how they are used. Such mediational means are considered to be 'the products of sociocultural evolution and are appropriated by groups or individuals as they carry out mental functioning' (Wertsch & Tulviste, 1992, p. 552). A key term here is 'appropriated', which implies that tools are not simply used 'out of the box' so to speak, whereby use of an item is constant across subsequent uses and users, but that tools are

interpreted by users in terms of how they fit within their current understanding and need (Maybin, 2006).

The emphasis in researching tool use therefore is on the developmental process and appropriation of tools, over the product of development. Such an approach aims to consider how understanding is negotiated (identifying the significance of action rather than passive reception), through the use of tools, rather than addressing any specific tool or any specific object of knowledge in isolation. This identifies a need and a tendency in sociocultural research for a developmental analysis (such as of the nature of human development: Wertsch & Tulviste, 1992), or more recently a temporal analysis (addressing conceptual development over consecutive or related interactions: Mercer, 2008), rather than focusing on a static end product as a sign of achievement. Thus gaining an understanding of the processes of how such tools are used to mediate communication of new and developing understandings is as important as any understandings developed. The role of others in mediating understandings is also a key element of the sociocultural approach, as I now discuss.

2.2.2 The role of others and the Zone of Proximal Development (ZPD)

Considering interaction on the intermental plane, the social, dialogic and co-constructive nature of learning is seen as being at the heart of a sociocultural approach. In this regard, arguably one of the most widely-reported concepts introduced by Vygotsky is the Zone of Proximal Development (ZPD) (Vygotsky, 1962). The ZPD defines the difference between what can be achieved in isolation, and that which can be achieved with the assistance of a more-knowledgeable other. In this Vygotsky suggests we can achieve more when our efforts are supported and guided to understanding or task completion (though this did not imply merely being told the answers). This does not suggest that the individual cannot achieve on their own, but that they can achieve more by being actively involved with the concepts and with others in exploring new understandings.

Introduced as a concept focusing on interaction, as opposed to Piaget's (1970, 1980) focus on the capacity of the individual, 'the ZPD is not an attribute of an individual child, it is an attribute of the event (in that the ZPD entered by any child on any occasion is created through interaction in a particular task with a particular teacher)' (Mercer, 1997, p. 18). Thus again we see the notion of learning as something interactionally accomplished, and of change across interactions.

The notion of the ZPD is complemented and developed by Wood, Bruner and Ross's (1976) concept of 'scaffolding'. Scaffolding focuses on pairing a more and a less-knowledgeable person, in stretching the novice's learning potential. Initially applied in the context of one-to-one interaction, Cazden (1979) suggests that scaffolding could also be relevant in the classroom environment, usually with one teacher to many pupils. The notion of scaffolding follows the sociocultural view where human, physical and cultural aspects are part of the learning environment, and 'scaffolding' and 'fading' can support collaborative knowledge building and learner autonomy (Wood, 1998) by providing and withdrawing support as appropriate to learning need.

In terms of sources of information or interaction partners, the growing availability and scope of technologies as technical tools in learning environments led Säljö (1999) to comment, regarding pupils using ICT: 'In such a process, where arguments can be gathered from many sources, the authority of the teacher as the most knowledgeable conversation partner will be challenged.' (p. 144). This challenges the traditional view of a ZPD as involving a more-knowledgeable teacher and novice learner. Clearly when using computers, pupils have to do most of the construction of their knowledge, but have a vast array of sources of potential expertise on which to draw. Therefore pupils are in control of their learning, and can align their use of the tool and information accessed through it to their needs and interests. This is certainly not to say that the ZPD is no longer a useful concept, or that teachers will be replaced by computers. It does however emphasise that the relationship between all people and tools involved in teaching-and-learning experiences may

be more complex. For instance in situations where a teacher utilises a whole-class technology such as the IWB, now commonplace in UK classrooms (Futuresource Consulting, 2011), they can draw on information displayed on the screen within their orientation to the class and topic, thus offering two potential sources of 'more-knowledgeable other' on which the pupils can draw (the teacher him/herself, and the displayed information).

The concept of the ZPD has been further developed by Mercer (2000) who proposes the notion of an 'Intermental Developmental Zone' (IDZ), to recognise that knowledge building and shared understanding are dynamic concepts. In contrast to the ZPD's focus on individual development through adult support, the IDZ orients predominantly to the use of dialogue between teacher and learner/s, in representing a mutually-maintained dialogic space, in continually negotiating where a pupil most needs support. The IDZ can therefore be influenced by contributions from both teacher and pupil/s, rather than just by the teacher, as well as the history of past experiences and expectations of future activities and interactions. Through this concept, Mercer re-contextualises the initial one-to-one interactional focus of the ZPD and scaffolding, within the whole class and often one-to-many context. Thus it is suggested through the IDZ that both or all participants in dialogue can bring new information or suggestions that support construction of shared and common knowledge, rather than the more-knowledgeable other controlling the interaction (as might be interpreted through use of the ZPD concept). Such a view reinforces the sociocultural emphasis that learning is a process of co-construction between all participants in interaction, rather than transmission of 'facts' from one to another/many.

Within this process of co-construction, talk is considered the primary communicative tool in the sociocultural tradition, and so it is appropriate to address this now in more detail.

2.3 The importance of talk within a sociocultural conceptualisation of education: A

psychological tool

As already identified, from a sociocultural perspective talk is considered the most important 'tool' in human communication. Therefore the use of talk in the co-construction of knowledge is a significant area of research. In this section I outline the sociocultural framework behind this stated importance, and illustrate some of the research tools employed to address use of talk in learning.

Drawing on sources cited in this review, my interpretation of some key terms can be stated as:

- Talk – physical production of spoken words
- Language – cultural means of human communication (not just oral/written, e.g. body language)
- Discourse – use of language within a discipline
- Dialogue – interanimation of ideas, and critical engagement with and interrogation of alternative perspectives through talk.

Within this frame talk is a constituent part of dialogue, but how talk is used in interaction determines whether or not it can be construed as dialogue: where there is dialogue there is talk, but where there is talk there is not necessarily dialogue.

To offer some background on this framework, Barnes claims that 'Vygotsky (1962) was one of the first psychologists to acknowledge the role of talk in organising our understanding of the world' (Barnes, 2008, p. 9). With this claim he suggests that in analysis we cannot just look at the words used, but 'the meanings and purposes that they represent. We learn to participate not only in activities but also in the meanings which inform them' (p. 9). Thus any activity, including talk, is informed by and responsive to an individual's interpretation of the social and cultural contexts in which it takes place. This is particularly pertinent in the context of face-to-face classroom-based talk, and where talk is used to create opportunities for dialogue through which knowledge can be

co-constructed in interaction. Thus talk can be used in building understanding, but it can also be used in exploring and using error as 'stepping-stones to understanding' (Alexander, 2008a, p. 20).

For instance, a text prepared by the Department for Education and Employment (1999) offering advice to teachers on how to use talk in class, states:

Of course, things don't always work out the way you intend. Discussion can be scuppered in many ways. Sometimes a child provides an unexpected – even bizarre answer and throws you off key... Worst of all, perhaps, are the occasions when a pupil comes up with a fully-fledged answer that pre-empts all your carefully laid plans. (p. 4)

Re-framed within a sociocultural framework, and as Merry and Moyles (2003) argue, instances of a child offering 'an unexpected – even bizarre answer' or a 'fully-fledged answer' would be considered to offer valuable opportunities for opening up dialogue by inviting pupils' contributions or considering alternative opinions. In this view, the pupils along with the teacher construct and appropriate knowledge together, rather than a teacher assuming they have all the answers and the responsibility to transfer these answers to their pupils. This identifies the crucial role of teacher and pupil talk within a sociocultural framework, as the dominant means by which knowledge and meaning are co-constructed and negotiated.

From this I now consider some of the identified types of classroom talk, as described in the literature, and the different roles they can play in offering pupils opportunities to construct knowledge.

2.3.1 Types of talk: IRF

A traditional view of classroom talk is predominantly encapsulated by the whole-class teaching scenario, and a pattern of 'Initiation, Response, Feedback' (IRF) (Sinclair & Coulthard, 1975). In this view the teacher is largely in control of the subject matter, evaluating responses as 'correct' or 'incorrect'. Pupil input tends to be short, invited by the teacher, and restricted to a direct

answer to the question or statement just made by the teacher. This illustrates a type of pupil talk referred to by Barnes (2008) as 'presentational talk' used to 'display' knowledge. In this instantiation, there is little opportunity for genuine 'construction' of knowledge. Over the years, this teaching practice has largely been criticised for its teacher-driven approach. Hardman (2008) for instance states that IRF usually occurs at a fast pace and 'predictable sequence of recitation... student responses are evaluated and commented on by the teacher who has the right to determine what is relevant within her pedagogic agenda' (p. 139). Despite criticisms however, and in view of the fact that Hardman made his comments in 2008 (over 30 years after Sinclair & Coulthard first reported the IRF pattern), the use of IRF appears remarkably embedded in teaching-and-learning practices. Alexander (2000) argues that although IRF appears to be used globally, it is used in different ways, and this is perhaps crucial to any consideration, and a re-framing, of its potential value.

Barnes (2008) places the IRF technique in a different and more positive light arguing that 'More recent commentators have insisted that IRF teaching is essential, and have shown how it can lead to developed discussion and not merely a recapitulation of authoritative material (Wells, 1993; Cazden, 2001; Alexander, 2004)' (p. 13). Wegerif, Mercer and Rojas-Drummond (1999) for instance refer to the 'spiral IRF', where a teacher built upon and chained together pupils' responses (R moves) to invite further responses, in a more progressive and less teacher-driven frame. Equally, a notion of IDRF (Wegerif & Scrimshaw, 1997), with the addition of 'Discussion' into the IRF pattern, indicates a shift in how this strategy could be employed to allow the same ultimate goal of shared understanding around a prompted concept or concern, but with more pupil input into the final agreed knowledge. Thus again we see that it is *how* the tool – classroom talk in the form of IRF – is used, rather than simply use of the tool, that influences the engagement with and resultant knowledge constructed through its use.

Similar to the notion of discussion within an IDRF pattern, an extension of the IRF technique, or a technique in its own right, is the idea of 'uptake' (Nystrand, et al., 1997). Uptake refers to how someone responds to and 'takes up' a prior contribution. As Nystrand, et al. explain, 'the teacher ratified the importance of a student's response and allowed it to modify or affect the course of the discussion in some way, weaving it into the fabric of an unfolding exchange' (p. 145). Whilst use of IRF therefore frequently relates to a teacher having a set of objectives or 'facts' to cover and often uncover from pupils, uptake allows for flexibility and deviation from the plan, by acknowledging and following up pupils' contributions, even if this occurs after the 'correct' responses have been collected and identified. Words such as 'modify', 'affect', 'discussion', 'weaving' and 'unfolding' in Nystrand, et al.'s statement outline that this strategy can be a flexible technique that is not pre-defined in the teacher's 'agenda', and thus applicable to a sociocultural view of knowledge as mediated and constructed rather than fixed.

2.3.2 Types of talk: Dialogic teaching

Following this trend of responding to pupils' contributions, there is a move in the literature toward promotion of 'dialogic teaching'. The origins of dialogic teaching are largely attributed to the work of Alexander, Mercer and Scott, as I review here. In the fourth edition of his 'Towards dialogic teaching' book, Alexander (2008a) claims that dialogue in the school context can be considered as 'achieving common understanding through structured, cumulative questioning and discussion which guide and prompt, reduce choices, minimise risk and error, and expedite "handover" of concepts and principles' (p. 30). To show some complementarity between authors, Alexander draws on 'Mercer's use of "interthinking" to convey the idea that talk in learning is not one-way linear "communication" but a reciprocal process in which ideas are bounced back and forth and on that basis take children's thinking forward' (pp. 23-24) – citing Mercer (2000). It is this 'interthinking' which allows people to work on an idea together, literally pooling their thoughts, in negotiating shared understanding through talk. Thus pupil and teacher participation

through talk is central to this approach. In defining the ideals of dialogic teaching, Alexander proposes that:

It is the qualities of extension and cumulation which transform classroom talk from the familiar closed question/answer/feedback routine into purposeful and productive dialogue where questions, answers and feedback progressively build into coherent and expanding chains of enquiry and understanding. (p. 26)

Thus we can see from this that Alexander implicitly refers to a traditional view of the IRF model, in also identifying the distinction between talk and dialogue. The critical notion for Alexander in making teaching dialogic is that pupils' responses are extended and cumulative: building on previous activities and experiences, and not closed off once a correct answer is found, or re-directed if a 'wrong' answer is given. Therefore Alexander emphasises the importance in dialogic teaching of the role of the teacher in using pupils' contributions to further draw on and extend their understanding – where all are active participants in constructing and negotiating knowledge.

In this pursuit, the pillars of dialogic teaching are outlined by Alexander as where teaching-and-learning activities are 'collective... reciprocal... supportive... cumulative... purposeful' (p. 28). He highlights that dialogic teaching: 'demands that we [teachers] have a secure conceptual map of a lesson's subject-matter, and that we give children greater freedom to explore the territory which that map covers' (p. 31). We can see in this the orchestrating role of the teacher in scaffolding activities, resources and discussions for pupils to engage in, and also in pupils and teachers working with lesson resources in ways that draw on and develop the 'common knowledge' (Edwards & Mercer, 1987) held amongst the participants. Thus dialogic teaching involves efforts to encourage all to bring meaning to (by linking to other experiences) and take meaning from learning encounters, by teacher and pupils who are active participants in supporting their own and others' learning.

Alongside a general aim that learning should be cumulative, through integration of concepts, an alternative notion of 'cumulative talk' is problematised by Mercer and Littleton (2007). Drawing on Mercer (1995) and Barnes and Todd (1995), Mercer and Littleton describe 'cumulative talk' as where participants in interaction build on or agree with each other's contributions, with little attempt to justify or query views. This is contrasted with 'exploratory talk', which Mercer and Littleton (2007) define as where:

partners engage critically but constructively with each other's ideas. Statements and suggestions are offered for joint consideration. These may be challenged and counter-challenged, but challenges are justified and alternative hypotheses are offered. Partners all actively participate, and opinions are sought and considered before decisions are jointly made... in exploratory talk knowledge is made more publicly accountable and reasoning is more visible in the talk. (pp. 58-59)

Thus a general aim that learning should be cumulative, as resourced by the teacher, can be aligned with attempts to make particularly pupil talk with their peers more exploratory. By the definitions above, *exploratory talk* (engaging with alternative ideas) is deemed more educationally productive than *cumulative talk* (agreeing with ideas), in efforts to support *cumulative learning experiences* (through integration of concepts). Mercer and Dawes (2008) relate exploratory talk to the IDRF pattern (referred to above), whereby 'In exploratory talk... a speaker "thinks aloud", taking the risk that others can hear, and comment on, partly-formed ideas' (p. 65). They suggest this is 'brave' for pupils to participate in, and requires pupils trusting each other not to criticise contributions. Barnes (2008) suggests that exploratory talk requires pupils to feel comfortable with trying out ideas, free from fear of criticism or contradiction. If pupils do not feel at personal risk they can take the intellectual risks involved in opening up their thinking to others in dialogue. This further goes against a traditional view of learning as the receiving of pre-given facts, and represents the sociocultural emphasis on knowledge as constructed.

Furberg (2010) argues that finding 'evidence' of such 'exploratory' talk does not necessarily mean students have understood a subject concept. However, the ability to observe how pupils construct understandings through their talk and interactions with objects and ideas may help to explore the nature and source of misunderstandings, which may in turn be more valuable than simply being able to produce a 'correct' answer. This would potentially be an important use of the uptake strategy and of exploratory talk in itself, to explore alternative understandings. This identifies a key concept in a sociocultural approach that knowledge is not stable, and also an educational challenge that pupils do not necessarily link concepts that are related but have been taught or covered at different times (Alexander, 2008a; Crook, 1999). It is important therefore to be mindful of the distinction regarding the goal that learning be supported as a cumulative endeavour, as the progressive construction of knowledge and meaning (revisited in section 2.5.1), and types of talk such as those identified as exploratory or cumulative.

In considering how teachers offer opportunities for pupil participation in classroom dialogue, other researchers employ the notion of a 'dialogic approach' as part of a broader concern with a teacher's 'communicative approach', which Scott (2008) defines as 'how a teacher will work with students to develop ideas in the classroom' (p. 20). Thus 'dialogic' is one form of communicative approach that can be aligned and contrasted with others, as I outline in the following section, as appropriate to the changing teaching-and-learning activities and needs.

2.3.3 Types of talk: Communicative approaches

The concept of communicative approach has been introduced by Mortimer and Scott (2003) to address the different ways in which teachers use their own and their pupils' talk in class, and how this relates to notions of transmission or co-construction of knowledge. Thus it offers an important tool for observing use of talk in this process, and how teachers frame activities to invite or inhibit pupil contribution. Mortimer and Scott propose two continua of dialogic-authoritative,

and interactive-non-interactive, which gives rise to four communicative approaches indicated in the table below.

Table 2.1: Communicative approaches (Mortimer & Scott, 2003)

	INTERACTIVE	NON-INTERACTIVE
DIALOGIC	Interactive: dialogic	Non-interactive: dialogic
AUTHORITATIVE	Interactive: authoritative	Non-interactive: authoritative

Building on this framework, Scott (2008) describes how '*Interactive* communication is defined as allowing for the verbal participation of both teacher and students and *non-interactive* teaching involves only the teacher... In a *dialogic* communicative approach the teacher asks students for their points of view' (author's italic, p. 20). Scott highlights the importance of the 'interanimation' of ideas within a dialogic approach, where different ideas are offered, challenged and justified, which can be aligned with the raising and negotiation of views within exploratory talk. In contrast, an authoritative approach refers to when the teacher presents one view or version of events. If pupil comments are requested (in an interactive, authoritative point of the lesson), they are only acknowledged or accepted if they support the same version as that presented by the dominant view. While an authoritative approach could therefore be viewed in a negative light, Scott refers to his and his colleagues' previous work in that 'authoritative talk acts as a seed for dialogic exchanges and conversely dialogic talk prompts the need for authoritative intervention (Scott, et al., 2006)' (p. 33).

Analysing talk from a sociocultural perspective requires consideration of the artefacts that mediate and influence attention. Equally, considering use of any technical tool involves a complementary consideration of talk that occurs around it, as well as any other physical objects

resourcing or influencing the nature of activity. In this light such activity can perhaps be more appropriately addressed by the notion of a 'mediational toolkit' (drawing on Wertsch, 1991) rather than thinking of different tools of talk, object, and so on separately. Meanings constructed through interaction with any combination of tools may differ from time and place, and in terms of with whom experiences are shared. This identifies the tension between intended and instantiated interactions with resources – the 'bizarre answer(s)' – and meanings constructed through interaction with resources, as well as the discursive nature of human knowledge and meaning making. On this basis, having outlined the discursive and mediated nature of knowledge co-construction, I now consider how the concepts of 'knowledge', 'meaning' and 'understanding' are employed within a sociocultural approach.

2.4 Knowledge, meaning and understanding, and the negotiation of meaning-making trajectories

Within this section I offer definitions for how the terms 'knowledge', 'meaning' and 'understanding' have been conceptualised within a sociocultural framework, and the role of talk in constructing and negotiating knowledge and meaning over time.

Mercer (1997) for instance positions sociocultural research as an alternative to the influential Piagetian approach, which addresses development, or *accretion* of knowledge, but without acknowledgement of the role of talk in *construction* of knowledge. As with the cognitive approach, the Piagetian approach largely ignores the concept of 'meaning', focusing instead on a staged theory of development and mastery of skills, without necessarily engaging in *how* such skills were achieved.

From this it is appropriate to consider the statement by Wells (1999) arguing for a shift in focus from the noun, or product, to the verb, and process, stating that: 'rather than with knowledge, our main concern should be with "knowing" and "coming to know"' (p. xvi). Through this Wells

draws upon the notion of 'progressive discourse' (Bereiter, 1994), whereby knowledge as a cumulative concept and a means to refer to and develop what is known can be considered as negotiable, constructed and contextualised (Kress, 2003; Lemke, 1990).

Wells (1999) represents the process of 'coming to know' in the sense of a cycle, drawing on personal experience and available information, toward knowledge-building activity that is used to develop understanding. He defines 'understanding' here as 'knowing that is oriented to action of personal and social significance and to the continual enriching of the framework within which future experience will be interpreted' (p. 85). Thus individuals must interact with ideas and with others to construct knowledge, and form understandings in the context of their past and present experiences. With this in mind a similar point is made by Säljö (1999), in that 'learning is in the co-ordination between language and experience' (p. 159), whereby language is the primary tool with which to make meaning out of classroom experiences.

Within this is a need to acknowledge the potential for difference between meanings *intended* by teachers and those *interpreted or instantiated* by pupils, in the whole-class nature of much classroom activity:

Teachers teach classes but pupils learn as individuals, each constructing slightly different versions of the meanings made available during the interchanges shared by the whole class and the teacher. Both the shared construction and the individual struggle to reinterpret are essential (Barnes, 2008, p. 10)

Barnes here identifies the importance of how new concepts are worked with in class, in terms of this 'shared construction' and 'individual struggle to reinterpret' material, and how both are likely to influence the other and often in different ways for different pupils. The sociocultural approach thereby incorporates recognition of the context of talk, and also talk as a context for the construction of knowledge (e.g. Rogoff, 1990). Thus having addressed the use of talk in general, I now address how research has explored its use in supporting knowledge construction.

2.4.1 Talk and knowledge construction

The label of discourse as a 'social mode of thinking' (Mercer, 1997) reinforces the concepts and relationship between intermental and intramental activity, in constructing and reconstructing knowledge and meaning. The idea of knowledge construction as a communicative and social act further indicates how knowledge or coming to know can take different routes, and have different outcomes dependent on the situation and conditions in which interaction occurs, as well as any other psychological or technical tools mediating negotiation of meaning:

Knowledge is not merely stored in our minds, it circulates between us when we communicate with each other in concrete activities. Even more importantly, to a significant extent it is created in such interactions when we convert our experiences and reflections into language and make them public. (Säljö, 1999, p. 150)

Thus talk in classrooms, and particularly pupil talk, offers a potentially valuable window onto the process of knowledge construction.

The relationship between spoken language and the creation of concrete tools, in particular written language, identifies how the form of a mediational device can greatly impact on how knowledge is constructed and presented. Construction of such a device, for instance a book, can offer new mediational means for others to interact with in negotiating their own meanings. Thus the written word opens access to a wider audience through text distribution. However, whilst a book can be said to have some dialogic quality, in being addressed to a reader and mindful of the targeted audience, by being written down it shifts from being a discursive version of events which can be queried and built upon in interaction, to a concrete tool whose author cannot defend or rectify their argument. Thus any knowledge constructed through use of such mediational means will depend on how these technical tools are reinstated in use.

Considering the complexity of meaning making, Furberg (2010) highlights how 'meaning is dialogically constituted in specific practices, and meaning making involves complex interactions

between people, resources, and the organisation of the setting' (p. 9). This is one point where a sociocultural approach deviates from a cognitive approach, whereby:

Conceptual constructions are not seen as residing inside individuals as abstract copies of an outside reality... Rather, concepts form parts of discourses and have meaning through their insertion into systematic modes of construing and manipulating the world in social practices. Reference is established by means of the integration of words and concepts into situated practices that include a particular way of using language. (Säljö, 1996, p. 9)

Throughout these statements we see how the notion of meaning, and specifically *meaning making*, is intertwined with the discursive nature of knowledge construction in the sociocultural view, and how knowledge construction is perceived as an interactional accomplishment through interactions with present other people and prior experiences. Both Furberg (2010) and Maybin (2006) reiterate the point that contributions are always a response to what has gone before, and in anticipation of future contributions, drawing on the work of Bakhtin (1981). Thus current actions and interactions become resources and tools for future interactions, to be reinstated as required or as deemed appropriate.

In considering how someone responds in verbal interactions, Solomon and Black (2008) highlight the difference in the nature of classroom talk when a teacher 'replies', rather than 'assesses' a pupil's comment:

It is the dialogic quality of... interactions – questioning to invite surmise and the reorganisation of ideas, and (most importantly) collaborative discussion which picks up what is said and extends, modifies or even challenges it – that enables genuine construction of knowledge. (p. 75)

It is worth noting that participation in talk in itself does not make the talk dialogic. However there is a collaborative element in the *inviting* of contributions. Where each contribution is equally valued within ongoing discussion there can be scope for a more distributed view of the knowledge constructed in any given learning experience.

This ties in with a conceptualisation of any subject-specific activity, verbal or otherwise, being appropriated in use, rather than acquired through observation. In explaining this view, Furberg (2010) proposes that ‘scientific concepts only contain what can be seen as “meaning potentials”, implying that their potential meaning must be negotiated and made sense of by participants in social interaction (Lemke, 1990; Linell, 1998; Rommetveit, 1985; 1992)’ (p. 8). I argue that this statement is not restricted to the subject of science, and through such negotiation we are necessarily led to consider the sociocultural commitment to the importance of talk, in making meaning out of multiple potential meanings that may be present and brought into interaction.

Regarding the making of meaning, there is general consensus particularly in the multimodality literature that ‘meaning’ is something created by the receiver, reader or viewer, or constructed or negotiated in interaction, rather than something made by the author or speaker (Kress, 2000). I address the multimodality literature within section 2.8 below, but in the sense that all communication can be considered multimodal (Gillen, et al., 2007; Johnson & Kress, 2003), this view is particularly relevant where meaning is regarded as constructed in interaction. Säljö (1996) for instance references the work of Bruner in this regard, who as ‘one of the founding fathers of the cognitive revolution, in his book *Acts of Meaning* (1990) gives an interesting account of why it was so difficult to accommodate notions of learning and development within the framework of cognitivism’ (author’s italic, p. 4). Säljö outlines how a focus on ‘meaning’ was not well-received within the dominant computational analogy of the cognitive paradigm, because ‘computers do not construct meaning or other cultural significations’ (p. 4). Within this approach, focus was on ‘processing’ of ‘information’ rather than ‘construction’ of ‘meaning’ (Säljö, 1996). In adopting the latter view and thinking about meaning as something that is made and re-made, I now turn to one of the key concepts that I extend in my work: the meaning-making trajectory.

2.4.2 Meaning-making trajectories

In researching the meaning-making process, Hennessy (2011) states that ‘there is no simplistic

input-output mechanism for learning through dialogue. Moreover, “cumulative” and “progressive” do not imply a straightforward linear trajectory of learning (Twiner, et al., 2010) nor a common final product’ (p. 481). Therefore to consider knowledge as constructed, and meaning as made, it is appropriate to view how individual pupils may negotiate and make meanings, and how these may at times be at odds with those intended by the teacher.

Baldry and Thibault (2006) offer an approach to researching meaning and meaning making in terms of a ‘meaning-making trajectory’, within a consideration of multimodal communication and a framework for multimodal transcription. Within this framework the analysis of meaning as constructed and as an ongoing process is focal to their endeavours. The notion of a ‘meaning-making trajectory’ as coined by Baldry and Thibault refers to individuals working through webpages, and how website users are drawn to, select and move through the various links and pages available to them. The authors state that:

a meaning-making trajectory... refers to the *progressive integration* over time of the semiotic resources that are encountered as the website user progresses from one linked object, one text... to another. A trajectory may last mere seconds or minutes or it may occur over much longer periods of time, as well as being picked up and resumed across separate occasions. (authors’ italic, p. 116)

A practical implication of this notion as outlined by the authors is that ‘a trajectory is also a *textual record* or a *trace* of the progressive integration over time of the meaning-making resources that the website user encounters’ (authors’ italic, p. 116). Therefore a user’s journey through the various resources can be logged within such a programmed but yet user-selected environment as the World Wide Web. The trajectory that users follow through texts is the ‘*entextualisation of the web user’s meaning-making activity*’ (p. 116). In this sense the users create their own coherent text that is meaningful to their needs and understanding, based on the resources available to them and as they work through, return to, or miss out certain features.

In linking the previous section's focus on the use of talk in knowledge construction with the above concept of trajectory, the issue of pupil participation is raised as important in Rasmussen's (2005) 'participation trajectory'. She states that the concept of the participation trajectory could be used as a tool to plot children's topic learning and involvement as a course of development across a series of topic lessons. In reflecting on this concept, Mercer (2008) argues for a consideration not just of pupils' 'participation trajectory', but to extend this to their 'dialogic trajectory'. This incorporates the notion of talk as focal to development of learning over time, whereby teachers are 'responsible for the temporal cohesion of the educational experience of their students' (Mercer, 2008, p. 56).

Furberg (2010) offers a developed and widened conceptual device of participation and dialogic trajectories, in her focus on 'interaction trajectories'. She states that the interaction trajectory 'expands a moment-to-moment analysis of learning and takes into account how *continuity* and *change* are constructed in interaction (Krange, 2007; Mercer, 2000; Rasmussen, 2005)' (author's italic, Furberg & Ludvigsen, 2008, p. 1782). Furberg refers to interaction trajectories by assessing people's 'orientations' and changes in orientation. In doing so she includes both 'on task' and 'off task' talk and activity, to take account of what is important and made relevant by the pupils, and thus what is informing or capturing their orientation.

Furberg (2010) qualifies this focus on continuity and change through the interaction trajectory claiming:

The emphasis on changes is closely related to the assumption that meaning making activities are taking place through moment-to-moment interactions, but also across longer stretches of time. A focus on what is termed students' "*interaction trajectories*" makes it possible to study how students' orientations change over time. (author's italic, p. 22)

Thus in this we see the notion of knowledge as constructed over time and through interaction, and therefore always open to revision and reconstruction. Any dialogue or dialogic trajectory (identified by Mercer) would be considered one part of the interaction trajectory.

Within the notion of trajectory and progression over time as addressed here is the concept of temporality, and I now outline how attention to temporality is pertinent within sociocultural research.

2.5 Temporality as a key concern in sociocultural research

Continuing the thread of how learning is structured over time, in this section I outline different ways in which the temporality of learning experiences is addressed in the literature, particularly through the concepts of continuity and cumulation. Within this frame the temporal dimension of teaching-and-learning is being increasingly acknowledged, in considering how shared understanding unfolds over time. It is a well-documented educational challenge, as Alexander (2008a) reports, that pupils do not necessarily make connections between lessons and learning experiences for themselves. Bridging these gaps can be a difficult task for teachers. Addressing notions of temporality and cumulation in the development of understanding therefore, such as through re-use of a resource in consecutive lessons, is important in supporting consolidation of learning about unfamiliar material (Scott, 2008).

To de-construct these concerns, Roth, Tobin and Ritchie (2008) offer a definition of 'time' as 'the dimension in which practice irreversibly unfolds' (p. 118). They define 'temporality' as 'the structure of time, including its rhythm, tempo, and its directionality' (p. 118). Thus within the classroom context we can think of temporality as a certain way of viewing time: by how lesson tasks and activities are sequenced, through the planned content and changes in rhythm and tempo of knowledge construction; and in how directionality can be invoked in terms of time which always moves in one direction, but where teachers and learners can invoke alternative

directionality in references to previous activities, and in anticipating future activities. We can see the crucial role of classroom talk where links are made between otherwise isolated tasks and activities. To use two metaphors, the activities can provide the 'anchors' (Schwartz, et al., 1999) for learning concepts – to offer a conceptual or tangible starting point on which to build further understanding – while teachers can orientate discussion around and between activities as the 'bridge' (Rogoff, 1990) linking these together and drawing salience to important points of connection, whereby learning becomes a cumulative, as well as an extended experience. It is therefore important to identify the distinction but complementarity between continuity and cumulation in learning experiences.

2.5.1 Continuity and cumulation

As already identified, from a sociocultural perspective the cumulative quality of teaching-and-learning experiences is a crucial goal. In this frame, Mercer emphasises the importance of existing and evolving knowledge, in stating 'The continuous, cumulative, contextualization of events and the creation of a "common knowledge" through discourse are therefore the very essence of education as a cultural and psychological process' (Mercer, 1997, p. 13). Thus in this view all interactions have a historical and a dynamic aspect, both of which invoke temporality. Such common knowledge is continually refined as interaction continues, as new information is discussed, and links to previously held, often implicit knowledge are realised and made explicit. It is through this establishment and realisation of what is and is not common knowledge, constructed afresh for each new interactive encounter, that successful communication and knowledge construction can ensue.

A decade after his statement cited above, Mercer (2008) claims that in observing teaching-and-learning in classrooms, we need to go beyond the content of the contained lesson: 'From a student's perspective, school work should ideally have a cohesive, cumulative quality in which specific activities and their goals can be seen to form part of a greater whole, as part of a

purposeful educational journey' (p. 34). This is one of the tenets of dialogic teaching as highlighted in section 2.3.2 above, in that teaching-and-learning experiences be not just extended but cumulative, to encourage pupils to link related concepts, and find relevance and meaningful interpretation of the issue at stake. He states 'the teacher uses talk to provide a cumulative, continuing, contextual frame to enable students' involvement with the new knowledge they are encountering' (p. 37). Within this Mercer infers the notion of timescales, whereby the teacher's talk contextualises new information within familiar, already-learned concepts; referencing shared or common activities in the past to facilitate pupils' participation in the present.

Whilst continuity and cumulation are often referred to together, both being important educational goals, it is necessary to distinguish between the two terms and to identify what a cumulative experience adds to learning that continuity alone cannot. Continuity emphasises the adding or linking to previous experiences, events or resources. Cumulation emphasises the progressive integration and evolution of ideas and experiences – in a multiplicative rather than additive frame. For instance, a pupil who can connect different concepts learned during the course of a topic and identify the relationship between the concepts would be said to be adopting a cumulative approach. Alternatively, where one or many pupils offer short answers to a teacher's quick-fire recap questions this would be regarded as continuous.

In also recognising this educational challenge, Gee and Green (1998) emphasise the notion of 'connection building' as 'making assumptions about how the past and future of an interaction, verbally and nonverbally, are connected to the present moment and to each other' (p. 139). We see in this the complexity and importance of a temporal view of knowledge construction, through discursive interaction as well as interaction with technical tools, where the knowledge at stake is subject to review, and subject to representation and re-presentation in different modal forms. Thus how to resource cumulative connection building is an important concern.

2.5.2 Resourcing education as a continuous and cumulative experience

In considering how to support a cumulative learning experience, the statement made by Roy (2005) illustrates the challenge, and suggests an area in need of research:

all too often education is seen as the communication and accretion of finished ideas and rarely as the cultivation of sensitivity to transition and continuous change. We tend to approach learning as composition over time – that is, as an event in the frame of extensionality only. (p. 452)

This contrasts starkly with a sociocultural aim that learning should be a cumulative experience, and suggests that pupils are not being supported to integrate their learning experiences. Barnes (2008) also suggests there is a tendency in classrooms for pupils to be asked to produce ‘finished’ products, or answers they feel are ‘right’, with little time devoted to exploratory talk or writing in learning new concepts. This view, whilst representing a temporal notion of learning as built over time, demonstrates an authoritative:non-interactive form of teacher instruction. Within this the teacher proposes the ‘right’ version of events or understanding, without acknowledging alternative perspectives. Mortimer and Scott identify that this communicative approach can be appropriate at certain times, when used alongside the other three approaches that teachers can utilise at different points for different purposes (see section 2.3.3).

In efforts to resource a cumulative learning experience, frequently teachers make use of artefacts and resources, both physical and those mediated by technology, in conjunction with their use of talk. Such artefacts can be employed over time as ‘improvable objects’ (Wells, 1999), as physical or virtual resources that enter the class timeline by being introduced, annotated, and/or revised (‘improved’), and can be re-presented at a later point. They act as knowledge artefacts worked on by collaborating participants, and offer a progressive and historical representation of developing understanding. With the rapid increase of technologies in the contemporary classroom, display technologies such as the IWB can be used as a site for the projection and development of an

improvable object, to facilitate exploration and cumulation of pupils' conceptual knowledge around a tangible, manipulable representation (Littleton, Twiner & Gillen, 2010).

Though there are exceptions (e.g. Hennessy, 2011; Littleton, et al., 2010), Glover, et al., (2007) asserted that, regarding temporality in teaching-and-learning and the IWB, 'there has, however, been little attempt to explore sequentiality in concept development and the ways in which the IWB can foster responses to a range of learning processes' (p. 6). This is therefore an area in need of further research, to view how the IWB is and can be used to facilitate a cumulative, co-constructed learning experience, through active participation in shaping the physical and virtual tools in the classroom, and in dialogue around represented concepts. This makes the use of IWBs an important area of study. I explore the concept of learning objects in more detail in the next section and use of IWBs in teaching-and-learning in section 2.7, but we are given a glimpse here of how the IWB as a technological tool can be used to support the creation of improvable objects, in the construction of knowledge over time.

2.6 The role and orchestration of learning objects

In this section I continue discussion of the 'improvable object' as identified above, by outlining the nature and use of learning objects, followed by a discussion of the orchestration of such tools to support a cumulative learning experience. In general terms, and to emphasise the place of learning objects within a sociocultural perspective of learning as mediated, Wertsch (1991) identifies the role of mediating artefacts in sociocultural theory in that:

any tendency to focus exclusively on the action, the person(s), or the mediational means in isolation is misleading... mediational means are inherently related to action... Only by being part of action do mediational means come into being and play their role. They have no magical power in and of themselves. (p. 119)

Thus analysis of learning objects must take account of the context of their use – any object can be a learning object if used with that purpose. The converse is also true, that an object can only be

considered a learning object when its affordances are interpreted and acted upon as such.

Therefore the construction of knowledge through engagement with and interpretation of learning objects is crucial to this process of learning with objects.

In judging what is relevant to an interaction, and a view of the 'long conversation of learning' (Maybin, 2006; Mercer, 2000), Green, Yeager and Castanheira (2008) propose that 'any idea has a history' (p. 120), in trying to plot this history and progression as a 'historical web of ideas' (p. 126). In this frame they describe dialogue as an opportunity to explore understandings, 'not as a finished text but as a work in progress' (p. 123). Here dialogue can be considered as an object, as can the idea being interpreted and re-interpreted across the history of its use. I now consider the issue of how such objects are used over time, focusing particularly on the notion of an 'improvable object' (Wells, 1999).

2.6.1 The learning object as an improvable object

Wells (1999) raises the relevance of the term 'progressive discourse', and the 'improvable object' as a means to work on current knowledge or knowledge objects, to expand, revise and open up propositions for criticism. He argues that writing can offer an advantage over or alongside the temporary nature of spoken language, in that 'it can be reviewed, rethought and revised through a different form of dialogue, in which the text under construction plays a central role' (p. 115).

This refers to something being written at the time, but Wells also argues for the case where an already-written text can be used as a resource in current discussion, as a permanent and shared resource on which to draw: 'Both for readers and writers, then, the text can function as the "improvable object" that provides the focus for progressive discourse and simultaneously embodies the progress made' (p. 115).

Säljö (1999) offers a similar argument stating that 'When writing, in some form, entered the scene, the mode in which humans used their limited cognitive capacities changed. Writing can

preserve and make permanent messages in a manner that talk does not (Ong, 1982)' (p. 146).

Thus the combination of speech and writing provides a powerful tool for knowledge construction, as an improvable object to illustrate any progression of discourse.

Continuing this line of thinking around the use of written texts, Wells (1999) argues that:

the individualistic nature of both production and reception [of writing], coupled with the great variation among students in speed and fluency, mean that sustained written text can only serve occasionally as the "improvable object"... it is the material permanence of the form in which the semiotic artefact is embodied that enables it to support the recursive reflection and revision that is so important a characteristic of knowledge building. (p. 116)

In this sense, and in comparing an IWB-mediated and a non-IWB resource, as well as offering the potential for permanence of an idea an IWB can also be used to support a 'temporary exploration of ideas, in a form of semi-permanence, until its purpose has been served and any changes can be discarded' (Twiner, et al., 2010, p. 215). Haldane's (2007) reference to the IWB as a stable medium (drawing on Kozma, 1994), relative to talk as unstable, is a useful notion in considering how orchestration across communicative modes and media can resource fruitful exploration and refinement of thinking, in temporary and more permanent form.

More recently Wells (2009) again refers to the use of an improvable object, in that it:

provides a purpose as well as a focus for the attempt to achieve understanding. This object can take many forms, ranging from a functioning model to a work of art (e.g. a drawing, a story or poem, a musical performance) and from a scientific explanation to a geometric proof, a map or a diagram. Such an object is likely to be particularly effective if it is a representation of its creators' current understanding, for which an explanation has to be given to justify its acceptance. And since improving this object is the goal of the joint

activity, recognizing weaknesses or limitations in the object is likely to motivate revision, which in turn leads to greater understanding. (p. 290)

This chimes with a view of the increasing use of technologies and resources in different communicative modes in the contemporary classroom, whereby objects can be worked on, or improved, through physical manipulation as well as spoken explanation and negotiation around their real and represented features. Key points remain however, from a sociocultural perspective: that objects as mediating artefacts are embedded through experience with awareness of their previous uses; that users are active in their engagement with and improvement of objects; and that improvement is a dialogic, interactive process between speakers, and between speakers and objects. This interactive focus thus brings us to consider the process of orchestration across teaching-and-learning activities and experiences.

2.6.2 The orchestration of learning objects, activities and experiences

As Twiner, et al. (2010) articulate, there can be pedagogic benefits of ‘orchestrated interplays amongst various modes in the same communicative event or resource’ (p. 216), whereby: ‘Teacher talk... can be viewed as offering a framework to support the “reading” of other modes, toward a cumulative, meaningful understanding of information presented via various modes’ (p. 218). In this frame some uses of specific modes of communication (e.g. speech, gesture, image) or objects may be planned, and others in spontaneous response to unfolding lesson interactions. This identifies orchestration as an interactive and reactive process, which is necessarily influenced by the pupils as active participants in their use of learning objects, as well as drawing on the teacher’s original lesson plan.

Following a similar thread of addressing IWB use alongside other resources through an analytic focus on the ‘multimodal orchestration of resources’, Littleton, et al. (2010) state that:

we build on the work of Bourne and Jewitt (2003) who in characterizing “multimodal orchestration” drew attention to the ways in which learning and teaching take place

through the complex interplay of a range of modes (which we define as organized sets of semiotic resources for meaning making that instantiate the work of culture and social usage; see Jewitt, 2009). (p. 131)

In their work they highlight the relevance of Sawyer's (2004) conceptualisation of teaching as 'disciplined improvisation', as described in more detail in section 2.9.2, as well as the links between orchestration as responsive to pupils, and the aims of dialogic teaching. They suggest that the metaphor of orchestration is a useful way to view teaching-and-learning practices, whereby:

Part of the spontaneous responsiveness is about managing the unexpected questions and comments the children themselves come up with. Activities can emerge from interactional contexts, not directly from the lesson plan or technology/technological resources. In this way, teaching is far more than following the curriculum, it is a creative act of transformation. (p. 139)

This offers a different way of viewing the 'transformation' discourse that has been so prevalent particularly in research at the time when IWBs were new to schools (Twiner, 2010), and particularly a different way of addressing any 'bizarre answers' pupils may offer. In Littleton, et al.'s instantiation, transformation refers to the construction of knowledge through immersion and participation in learning experiences mediated by interactions with learning objects, rather than as a direct consequence of the use of potentially 'transformative' technologies. This again is not to downplay the potential of the IWB as a tool to support such transformation, but merely to state that *how* any tool is used will determine any transformative effects created through use.

In developing and critiquing the 'orchestration' metaphor as applied to teaching, Beauchamp, et al. (2010) suggest that, whilst there is variation in how it is defined, orchestration is generally interpreted to imply a pre-set arrangement. In this interpretation, orchestration would not be considered improvisational or responsive. They consider that by inclusion of the concepts 'serendipity and improvisation' within teaching, a 'jazz' metaphor would be more appropriate,

which allows for an overall musical 'plan', but with more scope for interpretation, improvisation and embellishment within each 'performance'. They term such activity "dynamic orchestration", in which planned activities are rearranged and redesigned during the lesson in response to matters that arise' (p. 147). Having considered the process of orchestration and flexible use of learning objects within this process, I now consider in more detail uses of some of the tools commonly found in contemporary classrooms on which to create, work with and work across such objects.

2.7 The use of IWBs in teaching-and-learning

In this section I particularly address use of the IWB in resourcing teaching-and-learning experiences, and how it has been interpreted by researchers and teachers. The IWB is unique as a classroom tool as it was the first technological tool introduced to the classroom specifically suited to whole-class interaction (Gillen, et al., 2007). Following various national and local initiatives, they are now reportedly available in 70% of UK classrooms (Futuresource Consulting, 2011). The most obvious feature of the IWB is the large screen, similar in appearance to an ordinary whiteboard. Connected to a laptop or PC, the screen becomes a full colour, touch-sensitive display, showing any material from the computer screen. It can be used to access prepared resources to foster continuity of a planned lesson thread, or the vast array of information and material connected via the Internet, and to foster continuity through in-the-moment explorations of ideas by direct interaction with projected material. Various other tools can be connected to the IWB, such as a webcam or digital microscope, to share the processes or outcomes of small group work with the whole class. In this sense, the teacher can orchestrate multiple tools to provide experiences that all pupils can see and be involved in. Betcher and Lee (2009) refer to the IWB as a 'digital hub' in this regard, in its potential to integrate functionalities and material from and through other connected media.

Many researchers suggest, however, that teachers need time to incorporate IWBs within their teaching (Higgins, Beauchamp & Miller, 2007), and in the process often use the (relatively) new tool to reinforce existing and often teacher-centred practices (Lee, 2010). With this in mind, concerns have been raised particularly with regard to how the functionality of the IWB to allow an entire lesson's resources to be planned beforehand and seamlessly progressed through can significantly hamper any opportunity for pupil input, or construction of knowledge. In illustrating how a teacher addressed this challenge, Littleton, et al. (2010) describe use of a DVD within a Personal, Social and Health Education lesson with pupils aged 10-11 years. The DVD was frozen at planned points, but the frozen frame was then annotated by pupils and saved for future revision. Pupils added their contributions in writing before they were 'approved' verbally by the teacher. Thus in this case the IWB provided a resource for discussion, and was used flexibly by the teacher to allow pupils to direct the discussion and alter the learning material, literally on their own terms: interacting both physically and verbally with the resource and the topic under discussion. This identifies the influence of how a tool is perceived on how it is ultimately used, which is a key issue when considering the notion of 'interactivity' in relation to the IWB.

2.7.1 The IWB and notions of interactivity

Different types of interactivity specifically related to the IWB are offered by Smith, et al. (2005), in attempts to encourage practitioners to consider different ways they can incorporate and allow for interaction in classroom experiences. They distinguish between 'technical interactivity' and 'pedagogic interactivity'. In this sense, the IWB is a tool to enhance teaching-and-learning through (amongst other things) technical interactivity with the board – by teacher and pupils – but also pedagogic interactivity of teacher-pupil and pupil-pupil, where the class attempt to construct meaning together and further their individual and joint understanding by expressing their ideas and explaining concepts. The authors however state that pedagogic interactivity and social re/construction of meaning seem to be rare.

Hennessy, et al. (2007) present findings to address any exploitation of technical and pedagogic interactivity of the IWB to 'create the conditions that foster intersubjectivity': to see if IWB use facilitates 'active pupil participation and devolution of responsibility'; and 'whether physical interaction is important for learning' (compared to instances of vicarious participation) (p. 285). They argue that the teacher's role is to structure learning activities 'that challenge and build upon pupils' implicit conceptualisations, while integrating new scientific ideas' (p. 284). They describe the IWB as a site to display and review material, around which to explore ideas, ask questions and make 'common knowledge' explicit. Hennessy, et al., propose that 'the strength of the IWB lies in its support for shared cognition, especially articulation, collective evaluation and reworking of pupils' own ideas, and co-construction of new knowledge' (p. 298). As well as re-working it could similarly be used to encourage re-wording everyday into subject-specific terms, facilitating appropriation of the discourse. Such practice could also be considered to constitute dialogic teaching, where the IWB is used by the teacher to encourage pupil contributions and resource extended and cumulative learning experiences.

Based on the evidence reviewed above, it could be argued that the benefits of any 'interactivity' need to be harnessed toward the cumulation of learning experiences. Similarly research suggests the IWB can be influential when orchestrated by the teacher as a tool to promote technical and pedagogic interactivity both on and off the IWB, allowing exploration, development and revisiting of ideas physically, verbally, and by watching and listening to the contributions of peers.

This aligns with the work of Mercer, Hennessy and Warwick (2010) who extend previous research in addressing 'how teachers could use the *technical interactivity* of the IWB to support *dialogic interactivity*' (authors' italic, p. 195). In this they argue that 'By distinguishing between "technical" and "dialogic" interactivity, we intend to highlight the distinction between what a piece of technology can do, and what it can be used to achieve educationally' (p. 197). Dialogic interactivity is therefore related to Smith, et al.'s pedagogic interactivity, but with the emphasis

on use of dialogue as central in the sociocultural tradition, where again we notice the reference to 'dialogue' rather than 'talk' to indicate the significance of *how* talk is used in interaction. The authors report how the IWB was used in the observed lessons to write and show text, display images, play audio and video files, and how images and written text as well as blank screens were annotated, sometimes by pupils who gave reasons for their comments and annotations, and pupil-pupil dialogue was encouraged. Through such activity they claim that 'Individual and collective thinking was embodied within a series of evolving digital representations that were purposefully manipulated, reformulated, annotated, saved and/or revisited so that meanings were created cumulatively over time through sustained, responsive dialogue' (pp. 206-207). Thus focus is on the improvisational and spontaneous orchestration of the IWB as one tool amongst many, whereby talk, used to promote dialogic interactivity, is the central tool in contextualising any resources displayed and worked with on the IWB screen.

2.7.2 The IWB, dialogue and the improvable object

The complementary use and development of knowledge constructed through IWB resources and talk in the classroom has been investigated by Hennessy (2011), drawing on research conducted between 2002-2009 addressing (mostly secondary) teachers' use of IWBs in different subjects:

exploring the potential of using the tool in the classroom to support an established dialogic pedagogy, and by foregrounding the role of mediating artefacts in this process...

The potential is for new dialogues to revolve and evolve around digital artefacts jointly created by teachers and learners on the IWB. (p. 464)

Within this, Hennessy invokes Wells' notion of the 'improvable object' in considering how such digital artefacts are constructed over time, where the technological resource as an instantiation of dialogue around it can be used to represent and document the cumulative process of knowledge construction. Thus the process of constructing such objects is as important as the objects produced, as they are revisited and revised across successive uses and in interaction with others, and as further complexity and detail is added through physical, technical and dialogic interaction.

Material presented on the IWB can therefore be manipulated, annotated and saved for future use, by multiple participants, in supporting a cumulative learning experience. The growing use of devices such as the IWB also increases the explicit multimodality of lessons, and I now explore issues around multimodality in the classroom context.

2.8 A multimodal approach to teaching-and-learning experiences

Having identified the central importance of language, a sociocultural perspective to teaching-and-learning acknowledges that all activity is situated and interactional, whereby it is appropriate also to consider modes other than language (such as image or movement) as they are used to mediate teaching-and-learning experiences. In this section I outline key issues in a multimodal consideration of teaching-and-learning experiences and how this can be incorporated within a sociocultural framework, and how use of classroom technologies fit within a view of resourcing multimodal learning experiences.

Jewitt and Kress (2003) address how tools in different modes are appropriated, and the 'affordances' a specific tool has that suggest a particular type of instantiation:

Modal affordance has a physical, material side (the material features of mode), and it has a social, cultural, historical side (what has been done in the past with this material, and how the meanings made in the past affect what can be done with a mode). (p. 15)

Thus the affordances of each tool, in being appropriated within communicative interaction and interpreted by each new user, are influenced by each user's previous experiences and awareness of the tool. Equally, Bearne (2009) describes how 'a multimodal text is created by the combination of: image, sound (including speech and music), gesture and movement and writing or print, communicated through paper, the screen, face to face meetings, performative space' (p. 163). Thus a multimodal text can have many guises, in line with the common view that all communication is inherently multimodal (Gillen, et al., 2007; Johnson & Kress, 2003).

Directing attention more specifically at analysis of multimodality in education, Wells (1999) argues that:

situated communication always involves multiple dimensions and modalities of meaning making, some simultaneous and others playing complementary roles at different points in achieving the overall goals of the activity. Just as progressive discourse needs to be complemented by discourse in other modes, therefore, it also needs appropriately to exploit the full range of modalities of meaning making (Harste, 1993). (p. 116)

In considering such 'situated communication', some researchers highlight the 'embodied' nature of communication (Minogue & Jones, 2006; Roth, 2002), whereby information is conveyed through a number of modes including physical movement in spontaneous interaction. Some of this action may be considered intentional and conscious, such as in the words spoken, whereas other aspects may be regarded as less intentional, such as gesture or tone of voice, but may equally alter or add weight to the communicative act.

Having outlined a rationale for addressing the multimodal nature of communication within teaching-and-learning practices, I now consider some of the theoretical and analytic tools that have been developed to address this.

2.8.1 Multimodal analysis tools

Baldry and Thibault (2006) introduce a number of tools to consider how meanings are made across different modes of communication, including the 'meaning-making trajectory' as mentioned earlier. Lemke (1998) also offers the notion of a 'multiplying effect', whereby any meaning conveyed or interpreted contains more information than a mere addition of that offered in each mode. Such concepts therefore refer to how communication seen as a whole, across the range of modes used, can offer a fuller picture from which to make meaning than that obtained from each individual mode. Hennessy and Deaney (2006) also identify the concept of 'matched resources'. In this, content presented or referred to in different modes or media can offer

different avenues to the same objective, and any one 'resource' in this frame may offer information in a number of modes (such as a worksheet with both written text and image, matched to a large projected version of the same sheet). Thus there is the possibility of a multiplicative effect, but the idea of 'matched resources' also allows for viewers, listeners or readers to choose which mode or resource they find most helpful in understanding the concept of concern.

Also addressing the multimodality of communication but moving away from focus on a static text, Bopry and Hedberg (2005) claim that we must attend to the physical and affective aspects of communication. Through this they are perhaps suggesting that there are some modes of communication, in not leaving a physical 'trace', that tend to be overlooked – such as can be considered by an 'embodied' view of communication. Vass and Littleton (2010) also highlight the need to attend to the emotional dimension of learning, such as in providing opportunities for peer collaborative work, in order to more effectively support pupils' meaningful construction of knowledge. In aiming to address how teachers support and provide such multimodal teaching-and-learning experiences, the role of technologies is another topic of concern for many researchers adopting a multimodal research stance, as I now address.

2.8.2 Technologies and multimodality

In this manner, Johnson and Kress (2003) offer the forceful argument regarding:

the facility afforded by the "new media" for the easy production and use of a multiplicity of modes of representation – sound, image, writing, moving image, speech – in the message-entities that populate the screen. The screen is now the culturally dominant medium in many parts of the world. (p. 7)

In thinking about such modes of communication, Lemke (1999) claims that the reason video gives a richer picture of the interaction between different types and objects of meaning is partly due to 'the time-unfolding unities of sight and sound that makes such experiences so much more

meaningful to us than texts or still and silent images’ (p. 174). He also states that ‘Visual media such as geometric diagrams or pictures sit still for us, like writing, to allow reinspection and retracing of arguments, and their material extension in space allows iconic representation of continuous variation’ (p. 175). Thus use of both recording and viewing video in classroom activities, alongside more ‘static’ resources, offers an interesting area for further study.

Moving away from *display of* information through technology to potential *interaction with* information, a document from the Department for Children, Schools and Families (2007) proposes that use of digital technologies in teaching-and-learning facilitates interactivity with texts, such as in use of the IWB:

the essential discussion of sentence and word structure is greatly enhanced by the flexible uses of the IWB. Not only can texts be highlighted and marked, created and amended, they can be saved and returned to as learning is built from session to session... A key aspect of such teaching and modelling is explicit discussion about how the different elements of multimodal texts work together to make meaning. (p. 3)

Thus use of multimodality and interactivity as potential affordances of the IWB tool are announced here as a way of supporting and orchestrating multimodal teaching-and-learning activities that are interactive for pupils, to bring them into closer contact with learning material and content. Such opportunities however need to be interpreted as such, and teachers need confidence with their subject and tools, and a sense that use of tools matches the requirements of the content being covered, to adopt such practices. As stated above therefore, any affordance of such a tool – for instance multimodality and interactivity – does not automatically mean it will be used in this manner.

Within this is a notion of awareness and experience of how to use the tool. Such a notion is applicable to most tools, whereby ‘experts’ are more skilled at exploiting and adapting a tool’s affordances. Re-framing this within a discursive focus on the curriculum brings us to consider the

development and appropriation of talk in the form of subject-specific discourses across teaching-and-learning experiences, which I now address.

2.9 Exploring the appropriation of subject-specific discourses

In this final literature section I explore the notion of ‘discourses’, as defined earlier, as specific to different subjects. I interpret subject discourse as the way the world is structured through language within a given subject field, through, for example, the concepts identified as significant and how these are routinely referred to (drawing on Lemke, 1995). For instance in history discourse, time and evidence have been identified as important concepts (Coffin, 2004, 2006a; Deaney, Chapman and Hennessy, 2009; Derewianka & Coffin, 2008), as I discuss below. Therefore practitioners of any discipline, in communicating about their subject, will use the appropriate discourse to contextualise the subject concepts and concerns they address.

I adopt a sociocultural perspective on pupils’ entry into and appropriation of subject-specific discourses within the school environment. Focus is on the appropriation, rather than acquisition of such conceptual knowledge, as a process rather than a product, consistent with the theoretical framework adopted. Much research adopting a sociocultural approach to this area has addressed the study of science, with some exceptions as noted below. In my analysis I address appropriation of the history subject discourse, and so it is interesting to see if the same issues as reviewed here were evident in my data.

Carlsen (2008) provides a definition of appropriation in stating:

According to Bakhtin (1981, 1986), this appropriation is an individual process, and he used the term to describe the process of integration of others’ words in one’s own discourse.

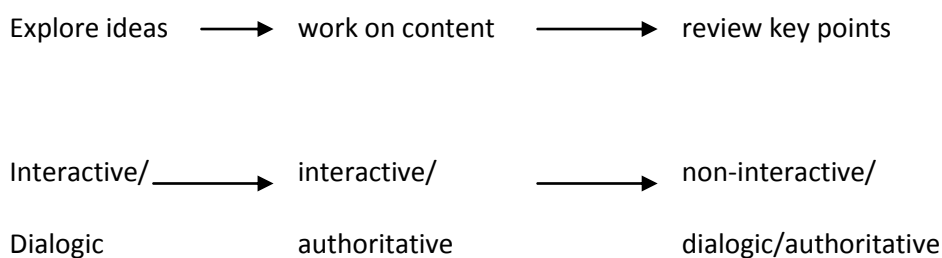
However, this integration is not a process of imitation. Wells (1999) supports this position: “Just as we learn to speak by ventriloquating others’ words, so we also take over

their ideas and values by trying them on and transforming them to suit our own needs and purposes” (p. 104). (p. 34)

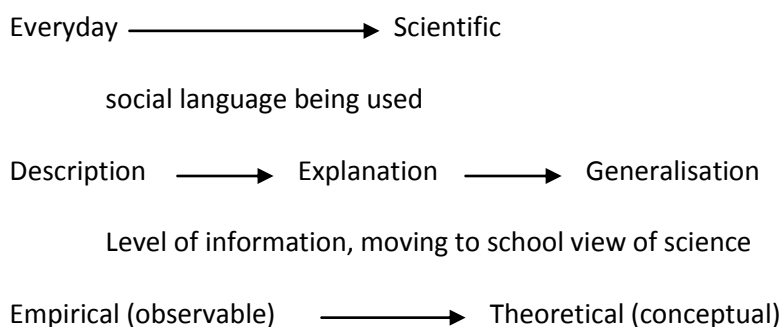
Therefore in this view, similar to that proposed by Maybin (2006), appropriation is an individual activity, but crucially it is developed through interaction on the interpersonal level – appropriation occurs when individuals transform ideas for their own purposes. Säljö (2005) also identifies how learning is a process of appropriating different tools to suit different tasks, whereby communication within a discipline is one such task, and a discourse specific to that discipline would be the tool/s to be appropriated. I now outline research on how subject discourses are seen to be appropriated.

2.9.1 Appropriation as a process

Building on the notion of communicative approach described earlier, and within the subject of science, Mortimer and Scott (2003) suggest that the development of the ‘scientific story’ in lessons tends to follow a pattern of communicative approach, where activity and approach move from:



They also identify moves in the content of science classroom interactions as:



These processes demonstrate use of pupils' existing social and everyday languages to build progressively more complex explanations, from specific to more general and conceptual. The emphasis is therefore on appropriation – identifying the importance of teacher and pupil agency – rather than acquisition – characterised by passive receipt through transmission – of discourse. It is interesting and important to note that the process is suggested to begin by exploring pupils' existing understandings, rather than with teacher transmission of established subject 'facts'.

In thinking specifically about the subject discourse of history, where I locate my work, Coffin (2006a) emphasises the importance of focusing on time in stating that 'time is a key concept in history but is not one that all students learn to handle effectively' (p. 207). She refers to the importance of understanding time as sequence – in the ongoing flow of time – segment – such as the past – and setting – of a specific date. Deaney, et al. (2009) outline a further key aspect of history discourse as the use and interpretation of evidence, whereby 'Learning history is also about mastering the concepts that historians use to construct claims about the past, such as "evidence" and "significance" (Lee 2005; Wineburg 2007)' (p. 371), identifying this as a significant point of concern in history teaching-and-learning. Thus how teachers offer opportunities for such appropriation is an important issue, and as such teachers can be considered as mediators of subject discourses.

2.9.2 Educators as mediators of subject discourses

Within any account of developing understanding there is an assumption that pupils' existing understanding is either faulty or incomplete. In the classroom environment this often involves facilitating a shift from everyday to subject-specific understanding, or from concrete to abstract understanding. Furberg and Arnseth (2009) argue in this area that addressing such misunderstanding can identify for the teacher where pupils are struggling, and be used to inform where best to direct further support. Although a focus on misunderstanding may appear negative, in the context of a general aim to reduce misunderstanding, the authors are keen to point to their

potential use in providing better support toward meeting pupils' needs and learning objectives. The identification and use of any observed misunderstanding is only really possible if the teacher can foster an environment where learners feel safe to explore their developing ideas, as identified earlier. Only then can it be used as a basis for negotiating, critiquing and justifying potential understandings.

Regarding such negotiations, Roth and Duit (2003) focus on what they term 'interpretive flexibility' and 'interactive stabilisation', and how concepts and growing conceptual understanding can be manipulated through interaction. They identify that pupils can reach conclusions that are both unexpected by the teacher, and perhaps 'incorrect' in the eyes of the specific subject curriculum. The point of concern for Roth and Duit then is how such plausible but 'incorrect' conclusions are worked with, in allowing for flexibility of interpretation. Within such a scenario, a teacher can pose as either a stabilising or destabilising influence, in suggesting alternatives for pupils to consider and thus encouraging them to strengthen or adapt their justification, or in persuading them toward a different view. Where space is allowed for a more interactive, dialogic communicative approach (in the words of Mortimer & Scott, 2003), and for pupils to weave their own interpretive flexibility, teachers have to consider their willingness to deviate from a planned trajectory if they are truly to explore pupils' contributions.

In this frame, teachers must be confident in their own subject expertise, as pupils work toward new ways of perceiving and describing issues or concepts. In this sense Sawyer (2004) conceptualises teaching as 'disciplined improvisation', which allows for learning as a social activity managed by pupils as well as the teacher. In such an endeavour, responding to pupils' largely unexpected queries and contributions, Sawyer emphasises the skill of teachers to be 'improvisational', drawing on their 'pedagogic content knowledge', which would not be necessary if teaching were a performance which could be rote learned. He argues that this improvisation is 'disciplined' as it takes place within certain boundaries and frames, such as of the subject, or

school timetable. He states that new teachers tend to 'script' their lessons in more detail, until they feel suitably confident and equipped with pedagogic content knowledge and classroom management experience to be more improvisational. This could also be the case in primary classrooms, where teachers cover all curricular areas and so are unlikely to be equally confident within all subject discourses. Distinguishing everyday and more specialised forms of knowledge and discourse is a key issue in this regard, which I now address.

2.9.3 Differences between everyday or commonsense knowledge, and school knowledge

Coffin (2006b) raises the issue that school language is different to everyday language, and that each subject has its own specialised way of using language. In this she draws on Bernstein's (1975, 1990) distinction between 'commonsense knowledge' – to make meaning within the immediate context and experience – and 'educational knowledge' – to generalise meaning to wider experiences, and relate concepts across experiences and contexts. Again this reflects a move identified above by Mortimer and Scott: from description, through explanation to generalisation; and from observable to theoretical understanding and articulation. It also potentially supports a move from ventriloquation to appropriation of discourse (Carlsen, 2008; Maybin, 2006).

Furberg (2010) also offers a theoretical foundation for these categories of conceptual knowledge and practice, in the context of science:

scientific concepts can be seen in relation to Vygotsky's (1987) distinction between "everyday" and "scientific" concepts. Whereas everyday concepts are related to the world of experience in a direct but relatively ad hoc manner, scientific concepts are characterized by their generality and systemic organization. (p. 12)

Here again we see how specialised, or in this case scientific, understanding also involves a shift from concrete to abstract forms of knowledge and representation. Furberg continues to describe how this distinction may manifest itself in the science classroom:

If there is a close connection to everyday language, the students often will start using this concept as a resource for making sense and to create some kind of social order. If the concepts are new to the students, they will need to talk them through in order for the concepts to have any meaning at all (Wertsch, 1998). (p. 15)

It is of note here that the centrality of talk is again emphasised, in introducing pupils into the discipline, and in providing opportunities for them to appropriate the discourse for themselves. This appropriation is likely to be at least initially a comparative process alongside any existing understandings pupils may consider relevant.

In considering different subject applications of terms, Mortimer and Scott argue that this repertoire makes up a 'toolkit' of ways of talking and knowing (drawing on Wertsch, 1991), where different terms can carry different meanings or meaning potentials within the separate subject discourses. Addressing the same dilemma, Säljö (1996) suggests we approach subject discourses through a consideration of appropriate use rather than isolated acquisition of terms. For instance, if different subjects make different uses of the same terms, an ability to define terms outside of the context of their use will tell us nothing of pupils' ability to use them in practice, or understand the concepts and processes they represent. Thus Säljö forwards an argument for the contextualised, and practice-based introduction to such subject-specific discourses, within a view of human learning as situated and discursive. From this we can see that understanding develops best where there are firm foundations and related concepts or practices, in a web of understanding, into which new terms and concepts can be linked, explained and further refined.

Thus not only must pupils learn both everyday and subject-specific discourses, but also which is appropriate for any given situation – when it is acceptable and expected to be informal, approximating and locally-relevant, and when it is important to be accurate and abstract. In this light, the context, activity and concomitant discourse support each other and are used to provide a cohesive environment in which to gain a contextualised, discursive and mediated appreciation

of subject practices, and appropriation of subject discourses. Only through such an embedded approach will teacher or learner be aware whether the understandings articulated are appropriate to the situation they are used to represent.

An instance where pupils may well be disadvantaged and less confident in their exploration of discursive opportunities is where English is an Additional Language (EAL). In this frame, Lemke (2001a) suggests that it is particularly important for pupils with EAL to be given opportunities to talk in learning new subject discourses. Although the emphasis is on the crucial development of linguistic competence, one means of *supporting* this which may be particularly beneficial for EAL pupils is through the use of other and combined modes and media to communicate and illustrate subject concepts.

2.10 Identifying gaps and my response to the literature

In this section I outline some gaps within the existing research as reviewed here, and how in my response to this I extend existing concepts within new contexts and theoretical frames. I show that what is of interest (and observable) from the sociocultural perspective in which I locate my work is the process rather than the product of learning activity, in how technical and psychological tools are appropriated, and meanings negotiated. To address these issues I identify how my work extends current understanding through:

- A socioculturally-framed multimodal approach to my data, addressing the central role of talk in orchestrating and drawing salience to other modes in use;
- A reconceptualisation of ‘meaning-making trajectories’ as interactional accomplishments, over time and across communicative modes;
- A reconceptualisation of ‘improvable objects’ within the multimodally-resourced classroom, and the role of the IWB and specific mobile devices in being used to resource this.

In setting this framework, observation of talk in classrooms, and particularly pupil talk, offers a potentially valuable window onto the knowledge-construction process. Therefore in this context I consider how the practitioners in my observations varied their communicative approach across and within lessons, and the activities and interactions the different approaches were employed to support, in providing opportunities for pupil talk. Within this I extend current research in using a sociocultural framework to explore how contributions regarded as ‘appropriate’ and ‘inappropriate’ use of subject discourse were taken up within ongoing classroom talk, in my case in the subject of history (chapter 5).

Through my socioculturally-framed multimodal approach to data analysis, I explore how movement was used in mediating understanding and knowledge construction particularly in chapter 6. I explore my data to consider how dynamic video and still image were used in mediating teaching-and-learning experiences, alongside other modes such as talk and movement – in a multiplying effect. This is particularly appropriate to the context of my data collection, where there were a large proportion of EAL pupils. Therefore I interpret a focus on multimodality within my sociocultural perspective whereby language, and specifically spoken language, is the central mode of communication, but any meanings are constructed or interpreted across a variety of modes. It is important to note here that the focus is on learning *through* language, rather than learning language.

From this frame, in chapter 7 I address how different meanings were instantiated and worked with in ongoing interaction, and how such meanings unfolded and were mediated by numerous influences in the course of the teaching-and-learning experiences I observed. In this endeavour I extend Baldry and Thibault’s ‘meaning-making trajectory’ in the sense of resources used in the classroom rather than those worked through by individuals using websites. In re-contextualising this concept, I address how digital, physical, verbal and other resources were introduced, re-presented and re-worked at various points across the multimodal meaning-making trajectories

negotiated in the topic lessons I observed, and how discussion and understanding of related issues by both the teacher and pupils shifted along this course. Therefore in drawing on the concept of 'meaning potential' I explore whether these trajectories, through the orchestration of various resources, provide evidence of 'meanings' being made, and how any meanings embedded within the teacher's planned lesson resources were manifest in pupils' responses.

Any instances therefore where cumulation of meaning making was broken or questioned could be an instantiation of what Agar (1994) termed 'rich points', in how they are responded to in re-establishing a shared frame of reference. (In this I interpret cumulation as the progressive integration of ideas, rather than the chaining together of agreement inferred through the notion of 'cumulative talk'.) Green, et al. (2008) also identified such dialogic events as 'frame clashes', where differences in view, or misunderstandings, are explicitly brought to light. Such events can be used as identifiable points in an individual's or group's meaning-making trajectory as I interpret the term, offering a valuable combination of these concepts: through observation of shared and individual 'rich points' over a topic, and in how 'frame clashes' are taken up in ongoing dialogue in the pursuit of meaning making.

Also drawing on the notions of participation, dialogic and interaction trajectories as outlined in this chapter, I explore the concept of meaning-making trajectory as interactionally achieved through multiple modes of communication and participation and across lesson experiences. In this endeavour the negotiation of meaning-making trajectories and use of improvable objects, such as through use of new technologies, helpfully intersect, as I explore in chapter 5: any use and re-use of learning objects provide one means of identifying significant moments in a meaning-making trajectory, and of identifying developments or 'rich points' in discussion and understanding around their use. This provides a valuable opportunity to extend Wells' concept of the improvable object in the context of the technology-mediated contemporary classroom, such

as through use of the IWB, as a tool on which to explore, display, modify, save and revisit ideas that can be authored and viewed by multiple people simultaneously.

As underlying thought processes are not accessible to the researcher (Mercer & Littleton, 2007), class discussion and manipulation of objects such as those resourced by IWB use are useful in rendering meaning-making trajectories visible. As was commented by Glover, et al. (2007) little research has been conducted regarding the place of the IWB within a temporal view of learning, making it an important area of study here. The IWB as a classroom artefact, available as a resource on which to provisionally explore and permanently represent learning events, has the capacity to support the teacher's reviewing of key points enabling them to be presented as a series of connected and cumulative concepts. The IWB as a resource for exposing the temporal dimension of teaching-and-learning, to uncover the potential for a cumulative, co-constructed learning experience through active participation in shaping the physical and virtual tools in the classroom, and in the focal role of dialogue around the represented concepts, is therefore an area I address. I explore this process of making an improvable object through activity both on and off the IWB in chapters 5 and 6, whereby it is important to focus on the knowledge construction activity around the tool, in whatever mode and through whatever media, and not be drawn into addressing the affordances of the tool itself.

In addressing the nature of tool use, I argue that Beauchamp, et al.'s 'dynamic orchestration' is similar to Littleton, et al.'s 'multimodal orchestration of resources'. Both allow for improvisation from a lesson plan in responding to the unfolding and emergent flow of classroom activities and use of resources, whilst being mindful that there can be valuable teaching-and-learning experiences achieved by working through any unexpected or unplanned contributions or queries, as well as using mistakes as building blocks toward shared understanding. This is how I interpret and apply 'orchestration' within my analysis.

Thus from a sociocultural perspective I address multimodal communication by considering how any affordances of different tools and modes are interpreted and appropriated in interaction, be they via technological or non-technological media, rather than focusing on what is added from each mode in isolation. Alongside this I address how teacher and pupil talk is used to orchestrate information gathered, presented and interpreted across modes, in the ongoing and unfolding construction of knowledge and pursuit of meaning making.

Observing use of the IWB, talk, dance/movement and other modes in this manner helps me to address my research questions, to consider how they are used:

- in exploring and documenting the dynamic and progressive nature of knowledge building,
- in the negotiation of meaning-making trajectories,
- and in the orchestration of planned and improvisational teaching-and-learning experiences.

2.11 Chapter summary

Within this chapter I provided the theoretical foundations for my methodology and analysis that follows, by reviewing the existing literature and outlining how I extend this through my work. I identified how a sociocultural perspective emphasises the mediated nature of human knowledge, in addressing the role of tools in their various guises. I articulated the need to address how tools are appropriated to suit a current purpose. This includes the appropriation of subject-specific discourses to consider how pupils are introduced to the practices and ways of talking specific to subject disciplines. I showed that knowledge construction is an interactive process, reinforcing the important role of others, of how learning experiences can be scaffolded, but ultimately require pupils' participation with and appropriation of material for understanding to ensue. Such considerations necessitate attention to talk, deemed so important within the sociocultural tradition. I therefore illustrated how talk is used in different ways to achieve different purposes, but of the importance of pupil talk to allow them to negotiate and make meaning out of meaning

potentials, and in evidencing to the teacher their current understanding or misunderstanding. Such exchanges can highlight 'rich points' and 'frame clashes', which can be useful identifiers along a conceptualisation of pupils' 'meaning-making trajectories' as interactionally realised. This requires the teacher to be improvisational in response, potentially challenging the teacher's subject knowledge and classroom management ability.

Encouraging a teacher's improvisational approach to classroom activities follows the sociocultural view that knowledge is constructed, and meanings made, through interactions with others and with available objects. In such an endeavour, I described the importance of learning experiences being cumulative, thus enabling pupils to progressively integrate knowledge constructed within and across lessons. I showed how a temporal dimension is therefore important in my research in addressing this issue, to identify how pupils are supported in experiencing teaching-and-learning events as cumulative.

I highlighted the need for a multimodal approach to be used in conjunction with a sociocultural view of the central importance of talk, in researching the various other communicative modes drawn on in conveying and interpreting meaning making in action. Within this I view communicative events as they integrate different modes, in the sense of a 'multiplying effect', rather than by considering what each mode adds in isolation. Alongside other modes and media, I stated that I consider how the increasingly present new technologies in contemporary classrooms, and particularly the IWB, are incorporated within a view that all communication is inherently multimodal. In continuing this thread, I outlined the role of learning objects, and of 'improvable objects', in viewing use, revisiting and revision of resources to support progression of conceptual understanding through and across modes. In this situation the IWB can be considered as a 'digital hub' in being used to orchestrate and integrate content from different modes and media. Thus I highlighted how I address objects as they are orchestrated to build connections between concepts and to support progressive integration of understanding in cumulative knowledge building, and

how talk is used in orchestrating information offered across learning objects and experiences within a view of talk as central in negotiating the improvement of such objects, in the making of meaning.

2.11.1 Key points

Areas of development that I address in my work are:

- Whilst maintaining the importance of talk, I emphasise the need to address the potential advantages (and disadvantages) of conceptualising, re-constructing and appropriating subject discourses in a multimodal frame.
- In the sociocultural tradition, subject discourses have generally been addressed through talk and writing, and not in terms of the multimodal framing that I adopt.
- A key feature of my analysis is the construction of improvable objects, via re-presentation and re-versioning of material within *and across* modes and media, where talk offers the narrative to this construction.
- I adopt a temporal approach to my analysis, which has only been pursued relatively recently as a research concern.
- I extend a view of meaning-making trajectories as dialogically and multimodally constructed, through participation, therefore moving beyond Baldry and Thibault's focus on the individual navigating their own personal trajectory.

Chapter 3

Methodological approach and data collection methods

3.1 Introduction

Drawing on the sociocultural theoretical framework I adopted in my work as reviewed in chapter 2, in this chapter I outline the methods I used to collect my data. Therefore it is appropriate to begin by describing the context of my data collection. Following this, I review the literature and definitions regarding the case study method I adopted. I identify some challenges levelled at this method and how I addressed them, and describe how I adopted the case study method in organising my research. This leads into consideration of the data collection methods I utilised within my overall case study method. I also describe the ethical considerations inherent in such a study, and how I addressed these in my work. Thus I now offer an initial orientation to the context in which I collected my data.

3.2 Context of data collection

My data collection was aligned to the piloting of an innovative programme devised by a London-based contemporary dance organisation. The organisation was working with school teachers to use dance combined with potentially interactive technologies in conjunction with more traditional teaching-and-learning activities, including talk, to support subject teaching. In this modus operandi a teacher was partnered with a dance specialist, to devise and deliver a series of topic lessons. I collected data from three London-based schools involved in this programme, working with one class from each school. Through this combination of modes and media for resourcing teaching-and-learning activities, I was able to address my research questions (outlined in chapters 1 and 2) by exploring the dynamic and progressive nature of knowledge building across resources and modes and over time. In order to understand more about the pupils and their context, some further details about the three classes are presented below:

A Year 2 class in a community primary school (6-7 years):

- Total number of pupils: 20
- Languages spoken in the class: Albanian, Arabic, Bengali, English, Lingala, Portuguese, Somali, Tigringa, Yoruba
- Pupils with English as an Additional Language (EAL): 16/20, although none were new to English

A Year 4 class in a Church of England primary school (8-9 years):

- Total number of pupils: 25
- Languages spoken in the class: Arabic, Bengali, Chinese, English, French, Greek, Russian, Other
- Pupils with EAL: 20/25, although none were new to English

A Year 5 class in a Church of England primary school (9-10 years):

- Total number of pupils: 30
- Languages spoken in the class: English was the only language spoken in class (one of the girls has a French father and was reported to speak French well)
- Pupils with EAL: 0/30

From these classes I collected the following video- and audio-recordings of lessons over a period of eight weeks during the Autumn term of the 2009/2010 academic year:

Year 2 class

- A four week science topic on health and growth – two 50 minute lessons a week = eight lessons
- A four week history topic on the Great Fire of London – two 50 minute lessons a week = eight lessons

Year 4 class

- A four week science topic on rivers – two or three one hour lessons a week = 10 lessons
- A one week cross-curricular topic on pirates – two one hour lessons
- A three week science topic on materials – two or three one hour lessons a week = eight lessons

Year 5 class

- An eight week geography topic on India – two one hour lessons a week (teacher absent for one lesson) = 15 lessons

For all six topics, lessons took place in both the hall and the classroom, usually with one lesson in each location per week. Where there were three lessons a week, two were in the classroom and one in the hall. Lessons in the classroom were taught by the regular class teacher. Lessons in the hall were team taught by the teacher and a dance specialist who was working with them to develop use of dance/movement in subject teaching-and-learning. Thus the intention was that the hall lessons involved more movement activity than a regular subject lesson, but that the subject objectives still drove the teaching-and-learning activities and goals.

For each of the three classes I collected the following data:

- Video-recordings of classroom and hall-based lessons on the topics specified above (approximately 48 hours in total: see section 3.5 for more detail on lesson observations);
- Audio-recordings of teacher talk in these lessons;
- Audio-recordings of a group of pupils within these lessons;
- Field notes from lessons;
- Audio-recordings and transcriptions of teacher and dance specialist interviews (separately) before, and after the series of lessons (see section 3.6);
- Audio-recordings and transcriptions of pupil focus groups after the series of lessons;

- Audio-recordings and transcriptions of Video-Stimulated Reflective Dialogue sessions (VSRD, see section 3.6) with teachers and dance specialists (separately) after the series of lessons.

The classroom and hall environments were equipped with wall-mounted IWBs, and use of this potentially interactive technology, together with other tools, was one element of the programme encouraged by the dance organisation. All teachers taking part in this programme had experience of using the IWB in their regular lessons, and all pupils were accustomed to their use in lessons, but it was a relatively new teaching-and-learning tool for the dance specialists. As well as the IWB, some Sony PSPs (handheld device) were available during the hall lessons. The PSPs were fitted with a camera, and so had the facility to record still images and video, as well as play them back on the device's integrated small screen. These recordings could also be played back on the larger IWB screen. The PSP is more generally considered as a recreational tool, but its use within teaching-and-learning activities reinforces a growing view that pupils' knowledge and use of tools from their out-of-school lives should be incorporated more fully within their in-school experiences (Brown-Martin, 2009; Futuresource Consulting, 2011). An aim of the programme therefore was to explore use of these potentially interactive technologies and movement activities and how they complement other resources and activities, in supporting the current teaching-and-learning need.

Alongside the focus on supporting pupils' learning there was a strong Continued Professional Development (CPD) thread within the programme, to guide the teachers in building their repertoire of using dance/movement within their subject teaching. Therefore as the series of lessons progressed the teachers were supported by a dance specialist to gradually take the lead in planning and orchestrating more of the hall-based lessons, in using movement activities to address subject goals. Teachers and schools were selected on the basis of existing contacts with the dance organisation, who were willing to be involved in the programme and in my research. In responding to my research questions therefore, this offered a unique context in which to view the

multimodal orchestration of teaching-and-learning activities over time, as teachers and pupils explored a mixture of new and traditional means of supporting subject learning. Given that this context was so unique, a case study method was ideal for considering how this innovative programme was utilised in the real-time teaching-and-learning experiences that unfolded. In this frame, I now outline the scope and interpretation of the case study.

3.3 The case study: Background and definitions

In outlining how case studies are used, Gomm, Hammersley and Foster (2000) stated that ‘usually, “case study” refers to research that investigates a few cases, often just one, in considerable depth’ (p. 3), which is the manner in which I employ this method. They contrasted the case study with the experiment, regarding the control of variables, stating that in experiments ‘the researcher *creates* the case(s) studied, whereas case study researchers construct cases out of naturally occurring social situations’ (authors’ italic, p. 3). This notion of ‘construction’ is important in the context of my theoretical background and approach to my data, and reinforces a notion that my data collection and analysis is used to construct *a version* of events, based on the events constructed as I observed them, rather than attempting to uncover ‘truth’, or to ‘reproduce’ events through analysis.

Yin (2003) offered a definition of a case study, stating that it:

- investigates a contemporary phenomenon within its real-life context, especially when
- the boundaries between phenomenon and context are not clearly evident (p. 13).

This definition portrays the interwoven nature of any issue of interest with its context of production. Thus the focus may be initially and predominantly on a phenomenon, but the real-life context in which it presents is a crucial element of the analysis of data and interpretation of findings.

Yin continued to argue that a case study:

- copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result
- relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, as another result
- benefits from the prior development of theoretical propositions to guide data collection and analysis. (pp. 13-14)

Therefore I explore the innovative programme that formed the context of my data collection (described in section 3.2 above) as a naturally-occurring, 'technically distinctive situation'. Equally, within this wider programme there were further 'technically distinctive situations', such as the use of specific technological and non-technological tools. I offer analysis of the unique ways in which such features present themselves in my data, and what can be said about evolving educational practices, but also refer to previous research on similar and more general issues to enhance the applicability and external validity (see section 3.3.3 below) of my claims. I do however wish to make one point of clarification regarding Yin's definition of a case study as cited above, in terms of how I apply it in my research. I draw on multiple sources of evidence, but often these are used to see if there are similar or different interpretations of the same issue (such as from teacher interviews and pupil focus groups, or even teacher pre- and post-interviews), rather than to achieve 'triangulation' through an assumption of 'converg[ing]' data sources. This is an important point of clarification for my work, in efforts to explore and describe participants' perspectives and understandings of their teaching-and-learning experiences.

In also outlining criteria for use of a case study, Silverman (2005) stated that there are:

three analytic features of case study research:

1. Each case has boundaries which must be identified at an early stage of the research...
2. Each case will be a case of something in which the researcher is interested. So the unit of analysis must be defined at the outset in order to clarify the research strategy.

3. Case studies seek to preserve the wholeness and integrity of the case. However, in order to achieve some focus, a limited research problem must be established geared to specific features of the case.

adapted from Punch (1986: 153). (p. 127)

In light of these features therefore, for my thesis I chose to present detailed analysis of one of the above cases. This means I adopted a single-case (embedded) design, with the class topic lessons as the single case, and the different units of analysis being 'embedded' within this case. I focus on a four week history topic on the Great Fire of London from the Year 2 class, through which I address different, 'embedded', units of analysis (e.g. use of talk, movement, objects, technologies, over time and from different participant views: see figure 3.1). I chose to focus on just one case so that I can do justice in my analysis to the complexity of this context, and to use the multiple sources of data to offer a comprehensive interpretation of the new programme within this context, rather than spread my analysis more widely across many cases. I chose the Year 2 class as my focus, as for the topic lessons from the Years 4 and 5 classes there were some lessons that could not take place due to teacher absence or other school events taking precedence (e.g. preparations for Christmas activities). I chose the second topic covered by this class, of the Great Fire of London, as by this point I had been present in their class for eight lessons, whereby they were relatively accustomed to my being there. Therefore my overarching concern was to use my data to address my main research question: How is knowledge building pursued and orchestrated as a temporal and cumulative process, by teachers and pupils, through their use of talk, digital technologies and other meaning-making resources?

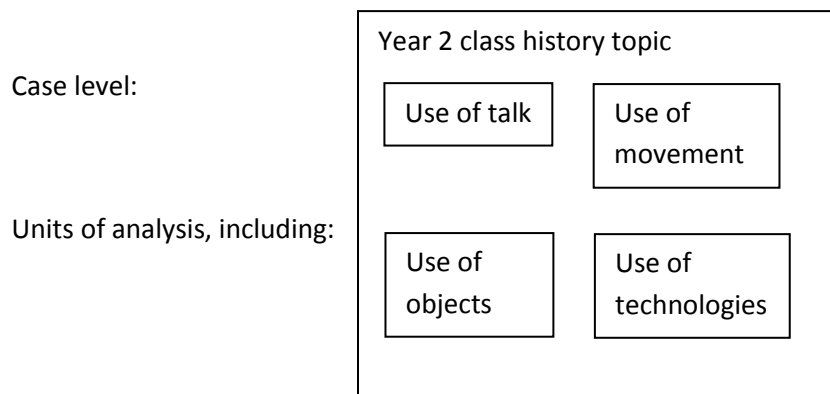


Figure 3.1: Illustration of single-case (embedded) design, drawing on Yin (2003)

It is important to address analysis not only at the units of analysis, but also at the overall case level, otherwise the units of analysis would be more appropriately referred to as multiple cases. As use of the different units as I defined them tended to co-occur this was not problematic. Such a combination of unit of analysis and overall case view – in an embedded design – is also useful in suggesting some stable features of the programme and enabling more robust support for findings, as well as in generating innovatory insights. The ability to offer support and evidence for claims and findings is therefore an important issue for case study research.

The use of previous research and multiple sources of evidence identify different ways in which researchers have attempted to answer to the debate around the generalisability of case study research findings. Distinguishing types of generalisability has been another concern, as I now address.

3.3.1 Generalisability

Schofield (2000) argued for a distinction in the type of generalisations made from case study research, between generalising ‘to *what is*, to *what may be* and to *what could be*’ (author’s italic, p. 76). In this sense, I aimed to use the following premises in order to generalise:

- from 'what is' physically occurring in my data – on an objective level of the tools used, of who says what;
- through my interpretation of 'what may be' a progression of events (although without identifying cause) – adopting a subjective, outsider level of analysis;
- to a more general sense of 'what could be' an issue of concern or consideration for other practitioners.

Also regarding generalisability of case study research and findings, Stake (1978) emphasised the importance of addressing knowledge as a form of 'naturalistic generalisation', 'arrived at by recognizing the similarities of objects and issues in and out of context and by sensing the natural covariations of happenings' (p. 6). He continued to explain:

Naturalistic generalizations develop within a person as a product of experience. They derive from the tacit knowledge of how things are, why they are, how people feel about them, and how these things are likely to be later or in other places with which this person is familiar. They seldom take the form of predictions but lead regularly to expectation.

They guide action, in fact they are inseparable from action (Kemmis, 1974). (p. 6)

Stake applied this reasoning regarding the size of a case, and the scope and relevance of generalisation, whereby generalisations can be made to similar cases, rather than to whole populations. In this sense, generalisations are made as readers find similarities between the described case and their own circumstance, thus through the author's accurate portrayal of a case readers can form their own 'naturalistic generalisations'.

From this we can see that generalisations come in many guises. I am not therefore aiming to generalise to the wider population on the basis of my case study evidence, but it is an advantage of the case study method to be able to highlight points of interest within my data with which readers may find resonance in their own practices. Regarding the challenge that it is difficult to summarise case studies, Flyvbjerg (2006) drew on his own research to suggest 'The goal is not to

make the case study be all things to all people. The goal is to allow the study to be different things to different people.' (p. 238). Thus my aim in reporting my work is to make the case accessible, in order that readers can draw on what they see as relevant to themselves.

With this in mind, it is appropriate to consider the 'type' of case study that I adopted. Based on Yin's labelling of 'explanatory', 'exploratory' and 'descriptive' case studies (Yin, 1981a, 1981b, 2003), I adopted a descriptive case study method, to illustrate, provide rationale behind and greater significance of what I observed, but not necessarily to relate phenomenon x with effect y – I am not looking for causal explanations. In order to make accurate descriptions and generalisations of any kind, it is important to think about the process of gathering data and the issue of 'sampling', which I now address.

3.3.2 Sampling

For my research design I used 'purposive sampling' – generating cases around the classes that were adopting the programme that formed the context for my data collection. As identified above, having collected my data I then selected one of these cases for detailed analysis for this thesis. Silverman (2005) stated that the flexibility of this sampling method is beneficial in that:

- As new factors emerge you may want to increase your sample in order to say more about them (for instance, a gatekeeper has given you an explanation that you doubt on principle).
- You may want to focus on a small part of your sample in the early stages, using the wider sample for later tests of emerging generalizations.
- Unexpected generalizations in the course of data analysis lead you to seek out new deviant cases. (p. 133)

Within such an approach therefore, the case study researcher can manipulate the focus or scope of their data collection and analysis, but typically engages in minimal manipulation of the research context of a real-life event itself, unlike the experimental researcher, other than those factors

inherent in observing or recording the event. My data for instance was gathered on series of lessons that would have occurred regardless of my presence. As identified by Silverman above, this flexibility facilitates a later focus on the finer detail of data collected, supporting the generation of findings that may not have been anticipated at the outset, and that would thus not have been available via a more controlled, experimental design. This was a benefit of my application of the case study method.

This issue of flexibility and control and its applicability to the case study method was also raised by Yin (2003), who argued: 'In general, case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context' (p. 1). Yin added to this, 'the case study method allows investigators to retain the holistic and meaningful characteristics of real-life events' (p. 2). Thus a major advantage of the case study and purposive sampling is the ability to concentrate on fine detail of data, or to address the wider context, and suggest links between the two levels – this is the relationship already identified between the case as a whole and the units of analysis.

Considering this issue, in his interpretations Von Wright (2004) identified the complementarity and difference between 'explanation' and 'understanding', claiming that 'Practically every explanation... can be said to further our understanding of things. But "understanding" also has a psychological ring which "explanation" has not.' (p. 6). Drawing on my sociocultural theoretical framework, this interpretation of 'understanding' would resonate with the emphasis on *construction*, where active involvement is needed to construct understanding.

Drawing on this distinction regarding explanation and understanding as voiced by Von Wright in his 1971 edition, Stake (1978) forwarded a notion that:

When explanation, propositional knowledge, and law are the aims of an inquiry, the case study will often be at a disadvantage. When the aims are understanding, extension of experience, and increase in conviction in that which is known, the disadvantage disappears. (p. 6)

Relating these aims of case study research to how they are presented, Stake suggested that:

in the social science literature, most case studies feature: descriptions that are complex, holistic, and involving a myriad of not highly isolated variables; data that are likely to be gathered at least partly by personalistic observation; and a writing style that is informal, perhaps narrative, possibly with verbatim quotation, illustration, and even allusion and metaphor. (p. 7)

Thus in aiming to offer different understandings and perspectives on the innovative programme around which I collected my data, generating rich descriptions so as to allow readers an immersive sense of the orchestrated experiences as they unfolded without attempting to identify causal relations, the case study is an appropriate method of approaching data collection for my research context. One of the benefits of such in-depth collection, analysis and presentation of data is that it enables case study researchers to address challenges levelled at the validity and reliability of the method. I now outline some of these challenges, and how I responded to them in the context of my work.

3.3.3 Validity and reliability

Yin (2003) identified different forms of validity and reliability, and how to address them in the presentation of a case study. He distinguished between:

Construct validity: establishing correct operational measures for the concepts being studied

External validity: establishing the domain to which a study's findings can be generalized

Reliability: demonstrating that the operations of a study – such as the data collection procedures – can be repeated, with the same results (p. 34)

I address each of these now in turn.

For construct validity, there is a need to define the issues of interest. In the context of my data this includes issues related to:

- talking about and appropriation of subject discourses,
- use of dialogue more generally in meaning making,
- knowledge building as a cumulative process,
- multimodality of communication,
- a temporal view of the use of objects.

There is also a need to demonstrate how the data presented is illustrative of and relevant to addressing these issues. My data collection context provided a rich arena in which to focus on, and pan across, these issues, as they occurred in the natural course of lessons. I also wrote a summary of initial findings for the dance organisation, and presented initial findings at their own conference (based on data from all three classes), offering participants an opportunity to review and feed back on my interpretations. Through such sharing activity, Yin (2003) claimed that 'the likelihood of falsely reporting an event should be reduced' (p. 159), even in instances where there is no 'truth' to be revealed but different perspectives as gathered from different sources (as in my data), which thus increases the construct validity.

Regarding external validity, Yin identified that the case study is concerned with 'analytic generalization' – linking phenomena with theory – whereas experimental designs are concerned with 'statistical generalization' – linking phenomena with the wider population. For single-case studies, where possible, external validity of claims can be enhanced by indicating where phenomena are observed or referenced across the units of analysis, and how theory can be used to support findings made against practice ('replication logic'). This is the approach I adopted to enhance the external validity of my analytic claims.

One further means of enhancing the validity of a qualitative study is to use different data sources to evidence and illustrate a claim, as suggested in my use of interviews, focus groups and VSRD sessions. This is not to conclude that the teachers and pupils would have the same experiences when talking about the same event, a conclusion that would not fit with my sociocultural framework, but such differences in interpretation themselves can be analytically interesting.

The validity of research design is another potential area of concern, whereby there is a trade-off between the advantages and disadvantages of a participant or non-participant observational study, as well as an ethnographic approach. Adopting a participant observation would potentially add more weight and validity to any claims, by coming from an 'insider' member of the community. To do this however I would have needed to be immersed in all three classes, and such an approach potentially raises some ethical issues regarding informed consent, as well as issues of biased interpretation. Non-participant observation leaves me one step removed from the community, and potentially makes participants wary particularly of being recorded, but means that informed consent can be gained before data collection. I also observed (but did not record) three lessons each with two of the classes a few months earlier (and with a different class in the third school), so they were relatively accustomed to me being there (see figure 3.2). In then recording events for the main data collection period I did so in as unobtrusive a manner as possible. This was helped by having a wireless microphone, so that the microphone could be close to the activity I was focusing on, without me having to stand directly nearby (see section 3.5). An ethnographic approach would allow access to more dimensions and environments of participants' lives, but would be very difficult to organise and gain consent for as well as being immensely time-consuming, given the large number of participants within three primary school classes in which I observed lessons. It would also involve a greater invasion into participants' lives, which was not necessary and may indeed have detracted from my focus in my research questions to address the meaning-making activities that occurred and were resourced during their school-based topic

lessons. Thus a non-participant approach was deemed the most appropriate to the concerns of my participants and my own research needs.

By adopting a non-participant observer stance, I did not directly intervene in the activities as they happened, other than being in the same room. Words and actions recorded were therefore the spontaneous contributions of the participants in their real-life setting. In attempting to gain a participant perspective of those who were legitimate members of the teaching-and-learning communities, I conducted interviews, focus groups, and VSRD sessions, to give a further opportunity for participants to express their views so that I could use and apply *their* interpretations when forming my analytic ideas. Having addressed notions of validity, reliability was the final key issue of concern outlined by Yin (2003, above).

Regarding reliability, Yin (2003) emphasised the need for transparency of research design:

The objective is to be sure that if a later investigator followed the same procedures as described by an earlier investigator and conducted the same case study all over again, the later investigator should arrive at the same findings and conclusions. (p. 37)

As this situation would not be possible in case study research, as from a sociocultural view the exact same conditions would not re-present themselves for observation, a thorough and transparent laying out of research procedures is the common way to establish reliability (which I offer in sections 3.5 and 3.6). The research design could therefore be repeated, but on different data.

Also in response to the challenge levelled at case study research that it perpetuates bias and views already held by researchers, Flyvbjerg (2006) emphasised the importance of maintaining 'rigour' within the case study method, alongside the ability to use it to "close in" on real-life situations and test views directly in relation to phenomena as they unfold in practice' (p. 235). Flyvbjerg also commented that through the process of in-depth data collection and analysis, a

case study researcher often generates findings that are substantially different to their initial interpretations of their data. This latter point was what I found regarding my ideas about use of subject terms in the lesson data, and in-depth analysis around this issue revealed some interesting, unexpected findings (see chapter 5). Such findings would not have been possible without the detailed data collection that a case study involves, and detailed analysis that it allows. The quotation above also highlights the aspect of addressing 'phenomena as they unfold in practice', which would not be available within the controlled requirements of an experiment, and thus identifies an advantage of the case study in addressing the often unexpected nature of real-life events as they occur in real-time.

Having outlined the background and issues related to use of a case study method, I now offer more detail on how I adopted this method relative to recent research.

3.4 My adoption of the case study method

I used the term 'case study' as applied in previous work I was involved in, such as referred to by Gillen, et al. (2008). In illustrating their research design, Gillen, et al. outlined the video-recording of sequences of lessons from four teachers, conducting teacher interviews, and presenting data based on analysis that spanned the recorded lessons. Within my work presented here, three teachers and three dance specialists working together in pairs, along with the three classes of pupils, were video-recorded during a sequence of topic lessons over an eight week period (covering a maximum of three topics, and a minimum of one topic), conducted in two learning environments. Each teacher and dance specialist was interviewed before and after the series of lessons, to address their expectations and reflections (respectively) of the topic and use of resources to support teaching-and-learning activities (see figure 3.2 below for outline of data collection).

A pupil focus group was conducted with some pupils from each of the three classes after the series of lessons, to discuss their reflections and experiences from topic lessons. Teachers and dance specialists also took part in a VSRD session, viewing and reflecting on some video footage of their topic lessons, after the post-interviews and focus groups had been conducted. I outline the nature of these methods and my rationale for their use in more detail in section 3.6. Such a combination of data collection techniques and modes of collected data for analysis was also proposed by Flewitt, et al. (2011), in their statement: 'Visual data are just one methodological tool among many, and researchers remain reliant on supplementary methods, such as interviews, documentation and field notes, that give insights beyond the limited focal range of a video lens' (p. 44). Therefore by aligning these data collection techniques I was able to gather different perspectives from the participants, from which to form a comprehensive interpretation of the teaching-and-learning experiences, whilst also gathering data that could be analysed in different ways and for different purposes in response to my research questions (for more detail on methods of analysis see chapter 4).

Given the vast amount of data collected, for the purposes of this thesis I present a detailed case study from one topic covered by one of the class groups: of a four week, eight lesson history topic on the Great Fire of London with a Year 2 class. Focusing in this way enables me to do more justice to the complexities of the teaching-and-learning activities, and participants' views and experiences of these activities, than if I were to present data from all topics and classes. This single case included video- and audio-recordings of all eight topic lessons, two pre-interviews, two post-interviews, two VSRD sessions, and one focus group (see figure 3.2 below). All of these data sources for this topic were transcribed (see chapter 4).

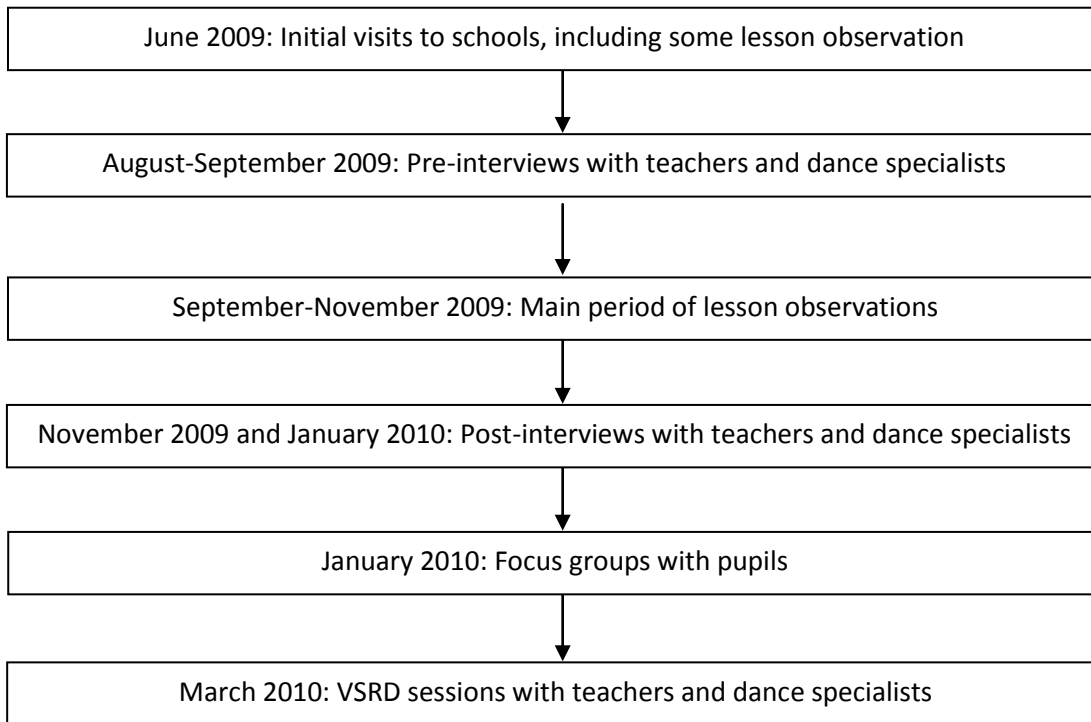


Figure 3.2: Data collection outline

In justifying my use of lesson observations, and the various interviews, I draw on Yin's (2003) claim that 'the case study's unique strength is its ability to deal with a full variety of evidence – documents, artifacts, interviews, and observations' (p. 8) whereby using multiple sources of evidence is usually preferable, in supporting the external validity of findings. This is not, however, to suggest that the different sources of evidence will support the 'same' interpretation, as identified earlier, but they may offer useful insights into difference of interpretation, or of how understanding was constructed in interaction from different starting points of the different participants.

Referring to the same research project as Gillen, et al., above, I draw on the application of the case study method as contrasted with experimental comparison by Mercer (2007):

The opportunities and limitations of the small-scale, intensive, case study approach were incompatible with making pre/post comparisons of learning or other quantitative assessments. Rather, we examined the process of teaching-and-learning with

whiteboards over time, identifying pedagogic strategies employed by teachers and the responses these engendered in students. (p. 23)

I adopted a similar approach to tool use, which also included use of the IWB technology, to focus on any patterns of tool use or development of meaning making as they evolved and were co-constructed across the series of lessons. Thus my use of pre- and post-interviews was not intended to produce comparative assessment, but to allow observation of and insight into perspectives and interpretations as they unfolded over time.

I also adopted the case study method in exploring the development of contextualised tool use, in a similar frame to that described by Hennessy (2011) again in the context of classroom IWB use:

The case study serves to demonstrate how the teacher mediated the cumulative interaction with the IWB to support progressive discourse. The piecemeal, graphical construction of the joint artefact illustrates learner agency in the process of constructing and modifying meaning (Gee & Green 1998). We can see how this process... encompasses an ongoing interaction between individual expertise and common knowledge. (p. 476)

The above approaches to research as cited by Gillen, et al., Mercer, and Hennessy relate to and influenced how I employed the case study method. In this way I offered an approach to the data which can accommodate the temporal and cumulative nature of real-life events, together with how pedagogic challenges are addressed and meaning making is viewed as a co-constructive process where meaning is built, de-constructed, negotiated and re-built over time and across use of different modes and resources. Detailed case study analysis allows the intricacies of such interactions to be addressed, to identify the progression and use of understandings and misunderstandings, that could hold wider significance for educational practices. I now outline the methods of data collection I used in forming my case study, starting with the lesson observations.

3.5 Data collection: Lesson observations and ethical issues

As I wanted to explore the temporal dimension of topic progression and meaning making, it was

necessary in each case to be present for and record all lessons on a topic. All topics were chosen by the teacher, and were topics they would have been covering regardless of my presence. I needed to record use of objects and technologies, whereby it was important to collect both video- and audio-recordings. I used one video camera to record activity. Where the activity was a whole-class session, I panned as widely as I could to include all participants (for whom I had consent to video-record) and resources in use. During group sessions I followed a group, and the group I followed was again often partly determined by all pupils in the group having consented to being recorded. I had considered using two cameras, as advocated by a number of researchers (such as Beauchamp & Kennewell, 2008), with one looking to the front of the class, and so predominantly facing the teacher but seeing the backs of pupils' heads, and one facing the other way to predominantly record pupils' faces. I decided not to do this however, and for two reasons. Firstly, not all pupils consented to being recorded on video, and so having a static camera focused toward the pupils would have been problematic. Secondly, activity in the lessons tended to shift in terms of its physical location throughout the lessons, particularly in the hall-based movement lessons, and so it was more appropriate to follow this with one camera than try to record different aspects with two static cameras.

As I was keen to explore teacher and pupil perspectives, it was important where possible to record contributions from practitioners and pupils. For this, in addition to recording video, I used two microphones in each lesson. One was an audio recorder given to the teacher for each lesson, and so moved with him/her wherever s/he went and recorded whoever s/he spoke to in the lesson. The other was a Bluetooth microphone connected wirelessly to the video camera. This was moved throughout the lesson depending on the type of activity (such as at the front for whole-class sessions, or on a pupil table during group work). As it was a wireless microphone I could record pupil talk in their groups, with the microphone on their table, while I was standing a short distance away with the camera. This made the recording process far less intrusive, and recorded most of the discussion between pupils from the table I was focusing on, amongst the

general noise level of many small groups working together in the same room. This is no small challenge in the context of at least 20 young children. Using both sources of audio enabled me to match up where one recorder had picked up something that the other had not, and so provide a rich picture of the dynamic teaching-and-learning experience.

Before recording any data, all teachers, teaching assistants (TAs), pupils, pupils' parents and dance specialists were given information about the aims of my study, and asked a number of questions regarding the extent to which they were or were not willing to participate. Consent forms included issues of: my video-recording them in lessons; my reporting their verbal interactions from lessons within publications; and my use of their image (video and still, regular or pixelated) from lesson interactions within publications. All were told they could withdraw from participation in my research at any point, and were given space on the form to offer comments. They were also asked if they were willing to be involved in, and for me to report verbal interactions from interviews, VSRD sessions (teachers and dance specialists), and focus groups (pupils, and parents in respect of the pupils). My presentation of data is therefore focused on those for whom I had consent to use their contributions in my work.

3.6 Data collection: Interviews, Video-Stimulated Reflective Dialogue sessions, and focus groups

Across the three schools, I collected:

- Six pre-interviews with the teachers and dance specialists, before the series of lessons
- Six post-interviews with the teachers and dance specialists, after the series of lessons
- Three focus group discussions with a group of pupils from each class, after the series of lessons
- Six VSRD sessions with the teachers and dance specialists, after the series of lessons.

The interviews, VSRD sessions and focus groups were semi-structured, whereby I identified general issues I wanted to address in the sessions, but I wanted to allow the interviewees to guide

the content as much as possible. They were all audio-recorded, and subsequently transcribed (see chapter 4 for transcription conventions). The aim of each aspect of the research design was to build with the teachers, dance specialists and pupils as full a picture as possible of expectations, experiences and activities, and reflections on experiences within the programme across both the classroom and movement lessons, using the combination of new and more traditional tools and activities. All three types of interview (to include the pre- and post-interviews, VSRD sessions and focus groups) were conducted face-to-face. Having outlined the interview procedure, I now describe the theoretical basis for my use of the interview tool (referring to the pre- and post-interviews, focus groups and VSRD sessions as a whole).

3.6.1 Theoretical background to use of interviews, VSRD sessions and focus groups

As with my approach to the lesson observations, my use of interviews is located within the sociocultural framework and interpretation of the interview as a research tool. This views the interview as a dialogic construction between interviewer and interviewee, influenced both by the research setting of it being an interview, and the physical context in which the interview is conducted. Therefore as interviewer I needed to be aware of my role and influence in co-constructing the experience and unfolding conversation with the interviewee/s.

As outlined in chapter 2, the importance of language in mediating human activity is strongly maintained by many researchers adopting a sociocultural approach, and the interview makes substantial use of talk as a tool to make meaning. Such knowledge construction and creation of joint understanding could be similarly evident, from a sociocultural viewpoint, in the unfolding dialogue of the interview, which is the approach I adopted in analysing the interviews (as I explain in more detail in chapter 4).

As articulated in chapter 2 therefore, merely talking does not automatically lead to the construction of understanding, and so we must consider how talk is used in context. Thus how

questions within interviews are planned, phrased and followed up – as open or closed, as a list of questions to be followed and answered or a set of issues for discussion, with further questions contingent on preceding answers – are important features to consider in the sense of guiding answers or facilitating exploration of each interviewee’s views and perspectives. For instance in the focus group I asked pupils initially what they could remember about a topic, following this up if necessary with prompt questions to ask them about the activities they did, and what they learnt. By allowing pupils to talk with each other in the focus group context, I intended to give them space to re-construct a version of what they had learnt in the observed topic lessons (see appendices 8-11 for interview templates). Therefore I adopted a semi-structured approach to all interviews, and was particularly keen to leave the VSRD sessions as open as possible, in order to gain as much interpretation from the participants’ perspective as I could. Thus it is appropriate now to offer more detail on the VSRD sessions.

3.6.2 Video-Stimulated Reflective Dialogue

For the VSRD sessions, teachers and dance specialists were invited to select extracts from videos of their lessons that they wanted to talk about, and some did take me up on this offer. Others did not have time to select their own extracts, but were happy to talk generally about the lesson I selected, or to add their interpretations of some extracts I chose.

Some of the purposes of VSRD were identified by Moyles, Paterson and Kitson (2003) as:

- to bring to the surface practitioners’ personal knowledge and professional theories;
- to highlight assumptions practitioners make in their thinking about teaching;
- to help practitioners critique their own thinking and practice;
- to provide a model of reflective practice and to encourage practitioners to think reflectively;
- to develop practitioners’ awareness of their learners and of themselves as practitioners;
- to support developments in practice;

to provide practitioners with meta-cognitive opportunities – that is, opportunities to think about their own thinking processes in relation to their teaching. (p. 146)

Considering these statements, the notion of ‘bring[ing] to the surface practitioners’ personal knowledge and professional theories’ could be interpreted as suggesting that there is a ‘truth’ to be revealed. This would seemingly conflict with the authors’ stated adoption of a “‘socio-constructivist” paradigm’, which would view the discussion during any VSRD interaction as one possible interpretation or version of events constructed by both parties involved in the interaction, thus practitioners may ‘bring to the surface’ different views on different occasions and when talking to different people, which may all be equally ‘true’. What seems more appropriate is the authors’ articulation that through this theoretical framework, ‘the research examined the thesis that, through review and reflection on practice with a sophisticated partner and in the light of video evidence, teachers might articulate their conceptualizations of interactive teaching [what the study was addressing] and refine their practice of it’ (Moyles, Paterson & Kitson, 2003, p. 5). Again however it needs to be acknowledged, if adopting a socio-constructivist, or sociocultural, stance that these ‘conceptualizations’ are unlikely to be permanent and stable, but flexible reflections that can be influenced by many factors. Following this line of thinking around the potential for events to be interpreted in different ways, I agree with the statement by Ivarsson, Linderöth and Säljö (2011), that ‘All representations have meaning potentials, but what aspect of those potentials that are exploited is a situated affair’ (p. 210). In my use of VSRD therefore I acknowledge that the discussions between myself and each teacher/dance specialist, in the context of viewing some video of their lessons, were a product of the social and cultural environment in which they were collaboratively formed through dialogic exchange around the video data. As I articulate below these discussions represent one of many versions of events, which together with my other data sources enabled me to offer a rounded interpretation of my findings.

Merry and Moyles (2003) identified using VSRD to ‘encourage genuine reflection based as far as

possible on the teacher's own perceptions and understandings' (p. 27). They highlighted one of the key elements of this method, whereby:

The video offered not simply raw data to be analysed by the researcher, but a shared experience that gave some structure to the dialogue and acted as a focus for both research-partners. The researcher's role was not to pose pre-set questions, but primarily to listen, to encourage the teacher to explore their ideas and to develop them through a balance of support and challenge. (p. 27)

With this in mind, VSRD is a technique often employed by researchers which aims to put practitioners in control of how they reflect on and talk about their practice, stimulated by watching video footage of their lessons. This was very much what I intended to do in sharing some video footage of the teachers' and dance specialists' lessons with them, to gather participant perspectives around the issues of resourcing knowledge construction and meaning making over time and across modes as framed by my research questions.

A key component of VSRD is that where possible teachers select extracts of the footage they want to discuss, before the dialogue session. As mentioned, I offered teachers and dance specialists the opportunity to select extracts, and/or to discuss extracts that I identified. Acknowledging that practitioners' time is often a scarce resource, it was pertinent to select some possible extracts myself for discussion. I selected extracts based on some of the key issues I was keen to address in my analysis, such as to discuss reasoning behind and responses to specific, combined or recursive tool use, use of movement activities, and the emergence, extension and progression of teacher-pupil verbal exchanges. Proponents of VSRD are keen to highlight that researchers can draw on a range of questions or prompts to explore the teacher's reflections, but they are not there as 'the one with the answers': both can gain insights into the practices they review and reflect on in the session. Thus it is important that teachers see VSRD as a chance to explore and reflect on their practice, rather than as a test of how they have done. This particularly supports the CPD aim of

the programme I observed, offering teachers and dance specialists a chance to reflect on their developing practices with the new teaching-and-learning tool and techniques.

One of the benefits of the VSRD tool as identified by Moyles, Paterson and Kitson (2003) was reported that 'the reflective dialogues resulted in shared rich data that constituted a "comfortable" challenge for both partners and also increased learning for both' (p. 152). Thus the research tool was found to be beneficial both for teachers' own professional development, and as a means of gathering practitioners' reflections and views on their own practice, as the teachers guided the direction and pace of discussion around the video material. In light of this, Moyles, Hargreaves and Merry (2003) claimed that:

Unlike many research methods, the control of the VSRD process is mostly in the hands of the teacher. It is likely that this encourages deeper reflection and richer dialogue about the themes in focus. This, in turn, enhances research validity. (p. 188)

Within the context of the above project by Moyles and colleagues, teachers selected which lessons they wanted recording, that they felt would use 'interactive teaching' (what the project was investigating). From this, they selected video extracts to discuss in VSRD sessions. Teachers and dance specialists in my study were able to select the topic that I observed and recorded, but they were aware that I needed to record all lessons within this topic, in order to view development over time. Where practitioners had identified extracts for discussion these were addressed. Otherwise we talked about general reflections on the topic lessons, and more specifically about the extracts I selected. The VSRD sessions added to the audio data of the teacher interviews and pupil focus groups that I conducted, as well as the video data of the lessons, by providing an insider, reflective perspective of the video record of the classroom activities, prompted by having the physical video record around which to focus discussion. I now outline how I prepared for and interpreted the interviews (referring to pre- and post-interviews, focus groups and VSRD sessions as a whole).

3.6.3 Preparing for the interviews, VSRD sessions and focus groups

In each of the interviews I aimed to start initially broad and general to allow interviewees to ease themselves in and feel comfortable with the topics under discussion (see interview templates in appendices 8-11). Through such an approach I hoped to put the content and weight of the discussion more in the hands of the interviewee, giving them the opportunity throughout the interview to raise any points and issues they considered relevant, whilst being guided also by the main areas of interest I wished to cover. This was intended to reduce any feelings of power differential between interviewer and interviewee, and reinforce a sense that their views were both appropriate and valid, rather than the interview being seen as a search for the 'right' answers. Thus in preparing for the interviews I aimed to lay out a number of areas for discussion, rather than devise the 'right' questions (Westcott & Littleton, 2005). In addition, prior to the pre-interviews I had met and observed lessons with four of the six interviewees, and so they were aware of my role with regard to the programme and to my own study.

Drawing on Bruner's (1984) distinction of life as lived, experienced, and told, the interviews could be framed as providing a window of reflection and interpretation from teachers, dance specialists and pupils through the notion of life as told – how events are re-presented to purpose. In essence this version of life as told was situated relative to, and also constructed with, the interviewer, as well as the pupils amongst themselves in the focus group context, and so subject to variation. It is important therefore to emphasise the subjective and contextualised nature of data from this research method. This complements a glimpse of life as experienced, gathered from the observations and video-recordings of the lessons as they occurred, though filtered through my interpretive gaze. There are therefore interesting points of note for the analysis, in viewing how records of life as experienced, from video footage, combined with and became re-worked in a life as told version within the VSRD sessions after the series of lessons. Westcott and Littleton's (2005) comment regarding use of objects or artefacts in interviews is relevant here, stating that 'the introduction of an object or artefact into an interview context can dramatically impact on the

process of joint meaning-making, serving as an effective joint referent' (p. 148). The introduction of video stimulus from the interviewees' lessons was employed as such an artefact for joint meaning making in the VSRD sessions.

On the basis of this therefore, in my approach to the interviews and use of identified issues for discussion (see section 3.3.3, and appendices 8-11), I viewed the interviews as:

- informal discussions;
- within the general parameters of, but not restricted to, my identified issues;
- for the pre-interviews, having the purpose of gaining broad contextualisation, familiarisation with the practitioners and their expectations, perceptions and anxieties;
- for the post-interviews and focus groups, having the purpose of gaining reflections and feedback on experiences;
- for the VSRD sessions, having the purpose of gaining focused reflections and interpretations of events;
- leaving space for answers;
- where questions were contingent on previous answers;
- where follow up questions were used to gather more detail where appropriate.

The broad structure of issues that I wished to cover related to my research questions, to enable me to use the case study data to provide perspectives and interpretations around my particular issues of interest (as identified in section 3.3.3).

3.7 Chapter summary

Within the context of the sociocultural framework of my research, in this chapter I outlined the methods used to collect my data, and the context within which data was collected. I described how I collected data on an innovative teaching-and-learning programme, which promoted use of dance/movement activity together with exploration of potentially interactive technologies in conjunction with more traditional educational practices and tools in subject learning. I explained

that I video-recorded lessons from three classes involved in this programme over an eight week period, conducted teacher and dance specialist interviews and VSRD sessions, and pupil focus groups.

I documented how I utilised a combination of data collection methods within a case study method, to offer understandings from a sociocultural perspective on teaching-and-learning as a dialogic and mediated process, constructed through interaction. I adopted a descriptive case study method, observing teaching-and-learning practices within the context of the environment and activities in which they occurred, to address issues of interest within my own research agenda. This allowed me to consider what I thought might occur, but also to be open to the potential value of analysing unexpected events. This enabled me to combine my own video-recorded view and interpretation as an outsider, with interview material to gather expectations, insights and reflections from practitioners and pupils as insider members of the observed community. Thus I was able to address various units of analysis (such as use of talk, movement, objects and technologies) as they co-occurred in the unfolding flow of real-life events. The aim in collecting multiple sources of data (lesson observations, interviews, focus groups and VSRD sessions) was not to suggest that all sources would offer an 'agreed' or converging view, but to identify points of similarity and difference in interpretation and perspective, of 'life as told' and through a lens of interpreted experience.

I described that in the course of preparing for the data collection phase of the research, the gaining of informed consent necessarily influenced a number of decisions, such as video-recording lessons mindful of which pupils gave consent to be video-recorded. This therefore influenced my choice of using just one video camera, which I moved in parallel with lesson activity while also taking into account which pupils I could and could not record. Thus what was recorded on video was necessarily filtered through my directing of the camera, and whose activity I could record. I aimed where possible not to disrupt the natural flow of lesson interactions, which was facilitated

by having a wireless microphone that enabled me to video-record a group working a short distance away, whilst the microphone was situated on their table.

Despite collecting data from a number of cases, in my thesis I present a detailed analysis of one case, in order to more fully analyse the events and activities that occurred, and expectations and reflections around them. This is particularly pertinent with regard to my use and analysis of multiple sources of data, whereby the expectations and reflections offered by teachers, dance specialists and pupils were all contextualised with regard to the specific topic/s of lessons they experienced. Whilst many issues may have been shared across cases, and there is scope for investigating these points of agreement and contention across cases elsewhere, it was more appropriate for the work presented here to employ this focus on one case as one of the 'boundaries' of my approach. The use of quantitative Sociocultural Discourse Analysis, in presenting concordance analysis of lesson transcripts, was also more appropriately applied to one topic's lessons, whereby the analysis was focused on the use of talk as it occurred in one class and in the curricular context of one topic. (All methods of analysis are explained in chapter 4.) My aim therefore was not to over-generalise from my findings (presented in chapters 5, 6 and 7), but to make the case accessible to readers so that they may take from it what they consider pertinent to their own concerns.

Through my case study approach utilising a number of data collection sources, I aimed to offer sociocultural understandings of the temporal and cumulative nature of real-life events in the context of a new teaching-and-learning programme. My intention was to highlight how pedagogic challenges were addressed and how meaning making can be considered as a co-constructive process where meaning is built, de-constructed, negotiated and re-built over time and across use of different modes and resources. I therefore used the descriptive case study to allow the intricacies of such interactions to be analysed, to identify and plot the progression and use of

understandings and misunderstandings, that could hold wider significance for educational research and practice.

3.7.1 Key points

- In this chapter I outlined the context of my data collection: an innovative teaching-and-learning programme which promoted use of movement activity and potentially interactive technologies alongside more traditional educational practices and tools in subject learning.
- I identified the descriptive case study method I adopted to data collection, in observing lessons from three classes over an eight week period, conducting teacher and dance specialist interviews and VSRD sessions, as well as pupil focus groups. Through this I was able to observe educational practices within the context of the environment and activities in which they occurred, to consider what I thought might occur, but also to be open to the potential value of analysing unexpected events.
- I adopted a single-case (embedded) method in reporting analysis for this thesis. This enabled me to offer an in-depth analysis of one case, rather than adopting a relatively surface level approach across different cases.
- I identified some challenges levelled at the case study method, and how I addressed them in my work.
- By gathering data from a number of sources, and by aiming to address multiple units of analysis, my intention was not to offer an 'agreed' version of events. I aimed instead to identify points of similarity and difference that may in themselves provide valuable insights into practice as experienced, and to offer sociocultural understandings of naturally-occurring teaching-and-learning practice from which readers can draw on what they find relevant to their own concerns.

Chapter 4

Methods of analysis and presentation of data

4.1 Introduction

In this chapter I explain my rationale for the methods of analysis I adopted, based on existing research and the research questions that my analysis was orchestrated to address, as outlined in chapters 1 and 2. I therefore discuss the theoretical influences on my choice of methods and research questions, in framing my analytic approach. Following this I introduce the methods I adopted, before offering more detail on the methods themselves, how I applied them to my data and how they were appropriate in my investigation of the research questions. I begin by offering my research questions.

4.2 Research questions

I used my analysis to address my overarching research question (which I elaborated on in more detail within chapter 1):

How is knowledge building pursued and orchestrated as a temporal and cumulative process, by teachers and pupils, through their use of talk, digital technologies and other meaning-making resources?

And two more specific questions:

1. How are talk, digital technologies and other meaning-making resources utilised to resource and make visible meaning-making trajectories within and across lessons, and to scaffold the development of improvable objects as progressive and historical representations of developing understanding?
2. How do instances of, and allowance for, improvisation and reciprocity in teaching-and-learning experiences influence the negotiation of meaning-making trajectories?

Through this chapter I outline how I used my analysis to address these issues, starting with my theoretical interests that gave rise to these questions.

4.3 Background to my analysis methods

In approaching my data, I used sociocultural discourse analysis (SCDA) and multimodal analysis as complementary methods to address the use of talk and other tools to understand the teaching-and-learning around a topic over a series of lessons. Through this combination I could focus in detail on the use of talk, but also pan more widely to address how communication was achieved across modes and over time, incorporating an important temporal approach in my analysis. In this and the following two sections I offer the theoretical background of these methods, and how I applied them in my research.

Starting with discourse analysis in general, Kleine Staarman (2009) proposed that when using such methods of analysis the 'phenomena of interest' are often identified once the process of analysis has started, rather than set out beforehand. This is certainly relevant with regard to my analysis. Adopting SCDA, as I outline in section 4.4, enabled me to guide my approach to the data around my theoretical concerns and research questions, but also to address these concerns in the context of the data I collected, which in turn led me to explore some previously unanticipated patterns in the data. For instance, in the context of my data collection, I was particularly interested in the educational use of talk in conjunction with technologies such as the IWB to resource co-construction and cumulation of knowledge over time. Through analysis of my data I was able to address this, but in more detail than I had anticipated. As the analysis progressed it became clear how the IWB could be considered a 'digital hub' (Betcher & Lee, 2009), in being used alongside other digital tools, thus analysis needed to take account of all tools in use, how they were used, and by whom. In approaching my analysis I also became increasingly aware of how communicative modes other than talk, such as movement, can be used in an integral way, not to replace but to support the development and reinforce the importance of talk in making meaning.

Thus my analysis needed to accommodate these multiple aspects of communication. For instance I wanted to see how teachers and pupils 'choose from, engage with, and in the process transform, the representational and communicational affordances... of all the modes available to them in the classroom' (Bourne & Jewitt, 2003, p. 71). I wanted to explore how modes were used together to convey complementary and different information, where a variety of modes offered a variety of means of working with ideas.

As a guiding principle I viewed talk as the central mode in meaning-making activity, as a 'social mode of thinking' (Mercer, 2004), but aimed to explore also the use of other modes in the development and cumulation of conceptual understanding. This required me to observe a consecutive series of lessons in order to monitor any progressive development as it occurred, and to attend to any resources or objects used in the making and re-making of meaning. In focusing not just on the illustrating but also the re-working of resources and meanings, it was important to gather pupil as well as teacher contributions and perspectives, in action and in reflection. I was also keen to observe and analyse the process of working with objects or activities, rather than simply to analyse the resources in isolation, in line with a sociocultural interpretation that objects and activities can serve different purposes on different occasions or for different users (Gillen, et al., 2007; Roth, 2006). My aim was to consider 'objects' in various modes in terms of how they were 'improved' (drawing on Wells, 1999) through use and re-use, and how a temporal analysis of ongoing interactions on a topic could be used to explore 'meaning-making trajectories' (extending Baldry & Thibault's (2006) concept) through the activities and contributions shared. I therefore used my analysis to show how knowledge building could be considered as cumulative and progressive by analysis of the use and re-working of objects, as they were employed in a form of 'dynamic orchestration' (Beauchamp, et al., 2010), or 'disciplined improvisation' (Sawyer, 2004), where a teacher builds on the issues at stake in response to pupils' contributions which potentially involves some deviation from the lesson plan, to support and expose the movement from 'flux' to 'stability' of meaning (Ludvigsen, et al., 2011) within developing meaning-making

trajectories. To achieve this I aligned SCDA with multimodal analysis, to foreground the central importance of language in communication, but within the context of other modes being drawn on in interactions. Through this alignment I was able to provide a rich picture of unfolding interaction, through the combination of verbal, annotated and multimodal transcription for analysis. This also enabled me to utilise the benefits of the different approaches:

- to scrutinise the development of patterns of verbal interactions across a prolonged period of time;
- to add detail to verbal interactions to view use of tools and modes other than talk;
- and to address in detail the mediation of activities carried out largely non-verbally, but with verbal input evidenced where it integrates information conveyed in other modes.

Thus I recorded teacher talk to the whole class, any pupil responses, and pupil talk in group work, as well as any non-verbal contributions and use of resources across series of topic lessons. This was complemented by interviews with teachers and dance specialists before and after the series of lessons, discussions with practitioners around some video of their lessons, again after the series of the lessons, and pupil focus groups after the series of lessons. (See table 4.1 for an outline of the lesson data collected and analysed within the different analysis methods. As the data presented in this thesis focuses around one case, details are only included in the table for this case. See chapter 3 for topics and data collected in the other cases). The different methods of analysis that I describe below focused to some extent on different aspects of the data, but ultimately the process of working within each method and subsequent findings was informed by the others, in an iterative cycle of analysis, to offer a more rounded and valid interpretation of the data as a whole.

Table 4.1: Data collected and selected for analysis and presentation

	Data collection	Quantitative SCDA	Qualitative SCDA	Multimodal analysis
Year 2 class	Weeks 5-8: history topic on the Great Fire of London = eight lessons (for data collected from other classes and topics see section 3.2)	Transcripts of verbal exchange from all eight topic lessons (Total word count = 52 522) (See chapters 5 and 7)	Video, audio and detailed transcribed extracts from lessons (See chapters 5 and 7)	Video, audio and multimodal transcribed extracts from lessons (See chapter 6)

In the following sections I describe how and why I adopted certain methods of analysis to address the above research questions, starting with SCDA.

4.4 Sociocultural discourse analysis

SCDA adopts a view of language as ‘a social mode of thinking - a tool for teaching-and-learning, constructing knowledge, creating joint understanding and tackling problems collaboratively’ (Mercer, 2004, p. 137). It integrates specific qualitative and quantitative methods, to offer complementary means of viewing the same raw data. Thus it was appropriate within my overall sociocultural framework, and in line with my research design, to observe full series of consecutive topic lessons to view dynamic and historical, verbal and multimodally-resourced topic progression as it unfolded.

In part, SCDA was devised in response to various criticisms and perceived weaknesses of individual methods: of qualitative, interpretive analysis of small-scale observational studies on the one hand, and to the context-stripped nature of analysis of large datasets, such as through coding

or 'systematic observation' (Croll, 1986) on the other (Wegerif & Mercer, 1997). Thus it allows context beyond the talk data to be included in analysis, which some other methods of discourse analysis do not. For instance, it also allows focus on the talk within the context in which it is produced, to a level of detail that cannot normally be sustained by a full and in-depth ethnographic study (Mercer, Littleton & Wegerif, 2004). Equally, in contrast to sociolinguistic analysis, my aim was not to focus on the minutiae of dialects or accents, or differences in verbal interaction between boys and girls. Nor did I intend to focus on the 'micro-level of social interaction' common to conversation analysis (Mercer, Littleton & Wegerif, 2004). I intended to address any progression or evolution of patterns of talking within the groups from which I collected my data, as a means of *co-constructing* understanding over time. As Mercer, Littleton and Wegerif (2004) identify "'Sociocultural" discourse analysis differs from "linguistic" discourse analysis in being less concerned with the organisational structure of spoken language, and more with its content, function and the ways shared understanding is developed, in social context, over time' (p. 203). What SCDA shares with other methods of analysis such as conversation analysis is the use of data extracts and accompanying commentary to illustrate findings. The importance of context within SCDA was reinforced by Mercer, Littleton and Wegerif (2004) in their reference to research addressing use of technologies in teaching-and-learning activities as mediational tools, as was the case with the data I collected, as they highlighted the need to address the contextualised and mediated nature of learning.

Thus through my use of SCDA I was able to utilise the benefits of the quantitative and qualitative approaches (that I outline below) to address my research questions through the data. I could do this by attending in different levels of detail to the various modes and resources drawn upon in the real-time interactions of the teaching-and-learning environments in which I collected my data, in line with my overall sociocultural framework. I now describe how other researchers have used SCDA in their work, and any similarities and differences to my research.

4.4.1 SCDA in practice

SCDA has frequently been used by researchers addressing the use of computers in education, whereby 'both the computer-mediated communication system and the ideas from other participants that influence an individual's thinking can be regarded as mediating tools' (Mercer, Littleton & Wegerif, 2004, p. 203). Mercer, Dawes, et al. (2004) used this method to combine close qualitative analysis of pupil talk in groups, with quantitative concordance analysis of many pupils' pair-work discussions when working on a computer-based task, to address the usefulness of an intervention programme. The aim therefore was to use qualitative analysis to provide contextualised samples of the raw data for illustration, and quantitative analysis of a larger dataset as the basis for arguments and generalisations of overall patterns of those pupils involved in the intervention and control classes. This was combined with statistical analysis of SAT results from the two groups of pupils, to put generalisations in a context to which other practitioners, policy makers and researchers would easily relate.

While I did not use intervention or control classes in my study as in Mercer, Dawes, et al. (2004), nor comparison of test scores, what I have drawn from such studies is the mixture of focused analysis of classroom activity with concordance analysis of lesson transcripts, to facilitate both a surface view of patterns of talk, and a rich picture of contextualised meaning making through various communicative modes available to and utilised by participants. Broadly speaking, there are two main elements to SCDA: a quantitative element and a qualitative element. I now outline the quantitative element, and how I applied this in the context of my data.

4.4.2 SCDA: Quantitative approach

Mercer (2004) outlined the use of concordance software such as Wordsmith Tools for the quantitative element within SCDA, to identify keywords (words which occur particularly frequently), and contexts in which keywords occur and recur across the corpus of transcripts or

(predominantly written) data. Raw verbal data is not lost, as it remains in the context in which it was originally said, though in the case of transcripts it is converted from spoken to written form:

Not only can the repetition and frequency of occurrence of items be measured, but the analysis can also indicate which words tend to occur together (collocations) and so help reveal the way words gather meanings by the company that they keep...

Collocations and repetitions can reveal some of the more subtle, local meanings that words have gathered in use, meanings which are not captured by literal definitions.

(Mercer, 2004, p. 143)

This can be useful to view a large dataset, for instance transcripts from a series of lessons, such as to plot the use of subject discourses (as I explore in chapter 5), and where words used by teachers were queried and taken up, or 'appropriated' (Bakhtin, 1981, 1986) by pupils. Such an approach can be applied to a large corpus of data, to complement and inform the more detailed qualitative analysis of smaller extracts (see section 4.4.3).

4.4.2.1 How I applied a quantitative SCDA approach to my data

To approach this element of the analysis, I prepared transcripts of lessons on one topic from my data, as outlined in chapter 3. I analysed one topic as a case study, rather than the whole dataset, which meant I could use the concordance analysis to identify emphasised terms and meanings made throughout the progression of the topic. Were I to include all topics within the same concordance analysis, this might obscure the key issues and meanings made by the multiple foci that were addressed by the different subject topics, different groups of teachers and pupils, and different school concerns (for details on the different classes and topics see chapter 3).

For the concordance analysis I prepared transcripts to include only verbal communication. In addition to listing their contribution, I identified whether a speaker was a teacher (T) or pupil (P). I did this as it may have been an important indicator of how any terms that were considered particularly significant through the concordance analysis were introduced, or taken up, in terms of

whether, when, how often and in what context they were used by teachers or pupils. Other modes of communication are addressed in the qualitative analysis, outlined below, but for this analysis it was appropriate to include only verbal information. For presentation of extracts within my thesis, I included line numbers to ease referencing. A sample of transcription for concordance analysis is presented here, to illustrate these transcription conventions in the transcribed data:

Extract 4.1: Sample of transcription for quantitative SCDA

Week 6, class lesson (3rd topic lesson – see table 4.1), 44.55-45.16

The teacher (T) asked a pupil (P) to read out her work to him, putting together sentences on why the fire spread quickly and how it was stopped.

1. T: Can you read this sentence to me?
2. P: The fire spread because the houses were made out of wood.
3. T: Good, next one.
4. P: The fire stopped because firebreaks were used.
5. T: Good.
6. P: The fire spread so quickly because
7. T: buildings
8. P: buildings were so close together.
9. T: Good girl, well done.

I used the concordance analysis software Wordsmith Tools to uncover patterns of talk as they unfolded across the eight topic lessons. This enabled me to follow the development of meanings as they were made, whether they were made by teachers or pupils, and any changes in meanings that occurred through the emergent verbal interactions. Within my data I could identify which terms were particularly common across the eight lessons. I could then investigate what other words were frequently used alongside these common terms (collocates). Equally I could investigate who tended to use certain terms more than others (such as by teachers or pupils), and

any developments or evolutions in the way particular terms or phrases were applied across the time period. Having outlined what the software allowed me to do, I now outline how I carried out the concordance analysis.

Drawing on the proposed use of this method by Mercer (2004), principles for selecting words or phrases to search in my data were as follows:

- I initially generated a keyword list, to see which terms were used particularly frequently across the eight lessons and across all participants.
- From this I identified particularly common words that were related to the history topic, and then generated collocate lists (words used near to the identified term) and cluster lists (three word strings including use of the word in question) for those words (e.g. for 'fire', collocates included 'the', 'because' and 'Great'; and clusters included 'the Great Fire' and 'the fire spread').
- I selected words based on what I predicted to be interesting (e.g. teacher's encouragement of pupils to use subject terms), and looked at patterns of when they were used and by whom.

The findings from this quantitative analysis both informed and were informed by my qualitative analysis, where I offer a more detailed view of how some of the identified keywords and meanings made were drawn on and built up in interaction. As the concordance analysis can only attend to the actual words used, within the qualitative analysis I was able to focus on how other modes were used together with talk, such as through the use of physical and digital objects, and movement. This is not to downplay the role of talk, which remains central in my analysis, but to outline the valuable interplay and multimodal orchestration that occurred, and was revealed through a multimodal approach to the data. I return to the multimodal aspect of my analysis shortly, but now introduce the theoretical rationale for the qualitative element of SCDA.

4.4.3 SCDA: Qualitative approach

The second approach within SCDA is a qualitative, interpretive approach, based on the assumption of the central role of language as a cultural and psychological tool in making and negotiating meaning. This implies a focus on language within the social context in which it occurs, and so on the joint activity, content and structure of talk between participants: how knowledge is jointly constructed or disputed. The importance in this method of the talk remaining in the context in which it was produced was highlighted by Mercer:

We have had no wish to reduce the data of conversation to a categorical tally, because such a move into abstracted data could not maintain the crucial involvement with the contextualised, dynamic nature of talk which is at the heart of our sociocultural discourse analysis. (Mercer, 2004, p. 146)

In attempting to address the contextualised nature of activity, a sociocultural perspective recognises that schooling, and all experiences, are part of our larger existence and experience within social worlds. All communicative events are therefore situated experiences, and so are shaped by and addressed to those with whom we share such experiences, or those who do not yet know about them. This highlights the sociocultural conceptualisation of education as a dialogic relationship between teacher, pupils and the resources and environments in which teaching-and-learning experiences take place.

In analysing such a process, Mercer (2008) argued that talk has a historical and dynamic aspect. I analysed some of the historical aspect by addressing data from a series of lessons, in which the historical dimension of the learning was built. The dynamic aspect was evident as the lessons progressed, to view how opinions and concepts were introduced, queried and developed, where new experiences and understandings became explicitly appropriated as part of the 'common knowledge' (Edwards & Mercer, 1987). It was not possible to be aware of the entire historical aspect of the classroom talk, due to the vast experiences the class have to which I could not have access or knowledge. Thus the dynamic aspect of the talk, as participants drew on historical

resources available and that they perceived to be salient to the ongoing dialogue, was my entry and window onto the common knowledge being used and developed.

SCDA offers a means to observe how people use talk to establish and maintain such shared understanding:

We can see how they use language to introduce new information, orientate to each other's perspectives and understandings and pursue joint plans of action. Various methods for studying talk also deal with these concerns. But... [SCDA] also enables those processes of communication to be related to thinking processes and to learning outcomes. (Mercer, 2004, p. 166)

Therefore analysis of the talk allows a view of temporal development, where the researcher can identify any changes in talk patterns and content over time. Combining this with an analysis of the activities being done, that were being talked about, facilitates a view of how the subject and content of their evolving discussions were manifest in the work pupils produced. This in turn is one way in which the quantitative and qualitative elements complement each other, as I used the concordance analysis to identify particular keywords, and the qualitative analysis to explore in more detail any evolutions and corresponding activity around use of such terms. Having broadly outlined the approach, I now describe how I applied the qualitative SCDA approach to my research context and data.

4.4.3.1 How I applied a qualitative SCDA approach to my data

One benefit of SCDA is that it allows analysis of events that occur over a prolonged period of time. This fits my intention of analysing a series of topic lessons, as they occurred in the unfolding course of ongoing school activities. (See chapter 3 for an outline of the data collected.) In the analysis chapters (5, 6 and 7) I offer a contextualised rationale for selecting data for analysis and presentation, as relevant to the research questions. Broadly speaking, analysing a whole series of lessons on a topic enabled me to view the introduction of concepts; temporal development of

shared understanding; how activities, concepts and objects from early lessons were utilised in later lessons; use and re-use of representations in describing and exploring understanding; what was in the teacher's domain, and what was the property of the class; uptake and appropriation of key terms by pupils; and learning outcomes. Such a view enabled me to address some of the theoretical concepts I was interested to explore in the context of my data, for instance the use of talk and other tools, and concepts of meaning-making trajectory and improvable objects, as outlined in chapter 2. The combined analytic approach offered different ways of addressing these concepts, adopting a temporal view of any change or progression in patterns of talk as well as use and re-use of objects across the series of lessons.

In terms of such tool use, and whilst I did not focus solely on use of the IWB, the comment by Hennessy (2011) below is relevant regarding my aim to view knowledge building as a cumulative endeavour, and use of a variety of tools within this aim, across a series of lessons:

Analysing lessons in sequence has illuminated how teachers can exploit the IWB through cumulative interaction with a succession of linked digital resources, and through archiving and revisiting earlier artefacts. The tool thereby helps to support the progression of dialogue over time, across settings and even across learner groups. (p. 463)

In this aim I was able to view use of the IWB as one tool amongst many in the resourcing and orchestration of knowledge-building activities, across a series of lessons and different learning environments. I was also able to explore how it was used alongside other tools, as part of the 'multimodal orchestration' (Bourne & Jewitt, 2003) of teaching-and-learning opportunities. (A more detailed consideration and approach to analysis of this multimodal orchestration is outlined in section 4.5.)

I viewed the original video files to identify extracts for further close analysis, based on my research questions. This was supplemented by the quantitative analysis of the transcripts for the

selected topic, in identifying frequency and collocations of topic-related keywords. I selected extracts for qualitative analysis, based on their:

- relevance to my research questions,
- relevance to findings from the quantitative analysis,
- ability to be used to illustrate key findings that relate to and extend existing research, around the particular theoretical concepts I was developing.

Thus for this thesis I prepared detailed case study analyses of a series of eight topic lessons from a Year 2 class topic on the Great Fire of London (see table 4.1 above). Selecting the topic for analysis was therefore the first aspect of selection from the overall dataset. I outlined above the selection process of material for the quantitative concordance analysis. For the qualitative analysis, extracts were selected for presentation where they illustrate consistent practices, or particularly innovative uses of regularly-found tools, alongside some negotiation of human and technological error or misunderstanding common when working with new practices and tools. Thus in my data collection I was not looking to generalise to all school practices, but equally I was not looking for best practice examples. Following Littleton, et al. (2010), the examples presented in the analysis chapters 'are not intended to be representative of the totality of lessons observed, but are rather used as vehicles for exploring the issues of interest' (p. 133). What I present therefore are examples of practitioners making the tools at their disposal work as they fit within the pursuit of their pedagogic goals, in the context of the school and pupil group with whom they were working.

On this basis, and in acknowledgement that it is not possible to represent all data in my analysis presented here, drawing on Mercer, et al. (2010) I chose to present extended analyses of a relatively small number of data extracts, 'because we accept Alexander's (2004) view that one important aspect of dialogic teaching is its cumulative nature. That is, dialogue should be used to help students develop a learning trajectory, or pursue a "learning journey" over time' (p. 201).

This is the strategy that I adopted: I used extended examples as well as short examples from separate lessons that built on the same issues, to illustrate progressive and integrated use of tools, including but not limited to talk, across time, in response to my research question to address the cumulative nature of knowledge building. In preparing these examples for analysis they needed transcribing, which I now address.

Due to the amount of data collected from all three classes, it was not feasible to transcribe it all. Having collected video of 51 lessons of roughly an hour each, based on an estimate that for a reasonably detailed transcript it takes 10-15 minutes to transcribe each recorded minute (Edwards, 2001), it would have taken me 14-21 weeks working full time to transcribe just the video data. I also had audio-recordings of six pre- and six post-interviews with the teachers and dance specialists, six VSRD sessions with teachers and dance specialists, and three focus group discussions with pupils, all of which I did transcribe. Therefore as mentioned I opted to transcribe the verbal interactions for all eight lessons in one topic, for the quantitative concordance analysis, and to use findings from this analysis alongside the raw video data to identify extracts for detailed qualitative analysis. These extracts were then transcribed in more detail, to enable them to be used to illustrate my conceptual arguments.

When transcribing extracts for the qualitative element of SCDA, I agree with Kleine Staarman (2009) that 'the transcription stage is a matter of selection and thus becomes an important part of the analysis. Secondly, transcription is also a process of selection with regard to the amount of information that is included in the transcript' (p. 107). Therefore it is important here to outline and justify my choices of what to transcribe.

In my transcriptions for qualitative SCDA I included line numbers, to aid referencing of the transcribed extract within commentaries. I included all audible talk, and marked any points where talk was inaudible (see key below). I used standard punctuation to ease readability of the

transcript. I noted where there were extended pauses that would be noticeable to the listener, but I did not note the length of the pause as I did not feel this would add value to my analysis. For instance, knowing that a pupil paused a number of times within a contribution may indicate that they were struggling to explain something, and also that the teacher and other pupils allowed them time to work through verbalising their thinking (or 'thinking socially' to rephrase Mercer, 1997) without attempting to finish their sentence. Knowing how long the pauses were in this instance would not add value to this interpretation, and may distract from the reading of the transcript. For similar reasons, I noted where overlaps in contributions occurred.

I identified whether a speaker was a teacher or a named pupil (using a pseudonym), as I was keen to explore both teacher and pupil perspectives and interactions between expressed perspectives, and so knowing whether a contribution was made by a teacher or pupil was important within my analysis. I transcribed movement, including gesture, as it occurred alongside or in emphasising points made in talk. I also identified objects used and referred to in talk, to aid understanding of the referent when reviewing the data. The focus therefore was still on the talk, in line with my sociocultural framework of the centrality of talk, but acknowledged the role that other modes play in conveying communicative intention. The basic transcription conventions that I applied, as also used by Gillen, et al. (2007), are:

(pause) = pause that is noticeable as such to the listener

(inaudible) = verbal contribution is evident but cannot be understood

(laughs) = gestures or other non-verbal actions

[= indicates overlapping speech

On the basis of these conventions it is important to acknowledge, as have other researchers (including Hammersley, 2010; Kleine Staarman, 2009), that any written transcription is in many ways a translation of verbal and physical activity into written form, thus reducing a multimodal

interaction to a monomodal script, however detailed it may be. In doing this, it carries my own interpretation of what is important, and what information is necessary for the transcription to be understood by both myself and another reader. As Hammersley (2010) related 'neither transcripts nor electronic recordings should be treated as data that are simply given, in an unmediated fashion' (p. 556). By adding the detail I did to the transcripts, in addition to that conveyed in speech, I attempted to make more transparent to the reader the basis on which I make my analytic claims. Applying these transcription conventions, a sample of transcription for the qualitative SCDA is presented here to identify use of other modes alongside talk by multiple speakers, and pauses in speech:

Extract 4.2: Sample of transcription for qualitative SCDA

Week 6 class lesson (3rd topic lesson – see table 4.1), 12.31-12.34 and 12.41-13.28

The teacher was using an image on the IWB of a painting of the Great Fire of London, to talk about how the fire spread.

1. T: So, if you look at this (points to image on slide) picture here, ... the flames (tilts hand in
2. same direction as flames on image) are all facing which way? (lowers hand, looks back
3. to Ps)
4. Mia: That way
5. T: All the fire, who's doing that? (pause) Is it Superman blowing? (makes blowing gesture)
6. Ps: No
7. T: What's happening? Who, is pushing (moves hand to other side of slide) it that way?
8. Ps: (intake of breath, raise hands)
9. T: I'm not doing it. (points to chest) Can people (makes pushing motion) push the fire?
10. How did it happen? How is the fire going that way? (points to P)
11. Nina: From the wind
12. T: The wind, well done. So the wind, was, was (pushes hands away from his body)
13. blowing, all the fire across from (jumps hand across points on image on IWB slide)

14. house_to house. So that's one very important reason why the fire was spreading so
15. quickly.

Having selected extracts for presentation, I offered commentaries in using the transcribed extracts to illustrate my analytic findings, in relation to my research questions and in extending the existing literature.

For some activities that particularly foregrounded non-verbal modes of communication, but that were still ultimately bound by verbal narration and integration, I adopted a more multimodal approach to transcription and analysis, and I now outline my rationale for this approach.

4.5 Multimodal analysis

SCDA particularly emphasises the importance of talk. In addition to my use of SCDA, I incorporated multimodal analysis (Jewitt, 2009; Kress & van Leeuwen, 2001), to acknowledge the multimodal nature of classroom interaction. For instance, as Maybin (2009) argued, 'Studying language in context inevitably raises questions about the ways in which it is integrated with visual images, shape, texture and movement in children's learning' (p. 73). It is precisely this notion of the interplay of modes that I was addressing in my incorporation of multimodal analysis. This was addressed via the video data and my field notes written whilst collecting data. I feel this is a strength of my methodological approach, in combining the benefits of SCDA and multimodal analysis to interrogate my data at different levels of detail. A multimodal analysis goes further than a transcript of verbal exchange with extra detail regarding other modes in use. The aim in use of this type of transcription and analysis was to reflect the multimodal nature of classroom interaction, and how use of specific tools, including the IWB, can be seen to foreground and background the salience of other modes alongside classroom talk. I now outline the theoretical premises behind a multimodal analysis of interaction.

4.5.1 Theoretical background: Communicative activity in general

In the sense of using different resources as well as talk, as I identified in my qualitative transcriptions, Bourne and Jewitt (2003) described teaching as 'multimodal orchestration' to emphasise the need to transcribe more than the speech in classroom interactions. They identified the theoretical background of their approach, and the implications of this for analysis of 'communication' and 'meaning':

The starting point for multimodality is to extend a social interpretation of language and meaning to a range of representational and communicational modes. Multimodality assumes that all these modes, like language, have been shaped through their cultural, historical, and social usage to realise social functions. We understand all acts of communication as socially made and meaningful. At the same time we view meanings as realised differently in different modes. (p. 65)

Thus we see here correspondence with my view of meaning and knowledge as constructed in interaction, developed cumulatively over time. The authors reflected the views of many (such as Johnson & Kress, 2003) in continuing to stress the importance of addressing modes in addition to speech, despite talk being the dominant mode for the majority of the observed lesson:

Even where speech is foregrounded as in this lesson, the teacher also uses image, gesture, and body posture, both her own and that of her students, to construct meaning. To look only at language denies the meanings carried in other modes, and the complex interplay between modes in social interaction. Many of the meanings and connections made in the lesson which were carried in modes other than language would have been too time-consuming and contentious to verbalise. (Bourne & Jewitt, 2003, p. 71)

Thus a multimodal transcript uses the affordances of visual and written modes to do what they do best, to more accurately re-present the event they portray. In terms of Bourne and Jewitt's reference to a 'social interpretation of language and meaning' in addressing the function of multiple modes of communication, the influence of cultural-historical activity theory is evident in

the literature on multimodal transcription. Roth and Lee (2004) drew on the work of Engeström in making this link, stating ‘that human consciousness can only be understood when all relevant aspects of practical activity are taken into account (Engeström, 1987)’ (p. 267). I would argue that from a sociocultural perspective, all activity has a dynamic and historical dimension (Mercer, 2008) and thus researchers as outsiders are unlikely to have access to ‘all relevant aspects of practical activity’. However, I agree that it is beneficial to view all interactions, and data or reconstructions of data recording such interactions, within as much detail of their original context as possible, hence the more detailed transcript. Again the importance is raised concerning the site of and activity around communication – the ‘social interpretation’ – in constructing meaning.

The role of culture and culturally-transmitted meanings in analysing multimodal communication can also be linked to Halliday’s (1978) theory of social semiotics. Within this we see the origins of Halliday’s work primarily as a linguist, focusing on the role of language (particularly clause level grammar) as a meaning-making resource (a social semiotic). Despite this focus on language however, Halliday asserted that communication is achieved and meanings made through the interactions of multiple semiotic modes, as a multimodal experience.

Semiotics are considered as the forms of (modes) and systems for (media) meaning making, through use of ‘signs’. Jewitt and Kress called this ‘the fusions of meaning and form’ (2003, p. 10). The ‘social’ in social semiotics refers to the human element, thus leading a simultaneous consideration of mode, media and sign-maker within the context of the activity. This emphasises the importance in my work of addressing both teacher and pupil perspectives and the interactions between teachers and pupils, and how different meanings can be made from meaning potentials in the course of interaction.

The nature of texts and increasing potential for multiple modes to be used is one particular area of interest in multimodal transcription, and the theoretical basis of this will now be reviewed.

4.5.2 Theoretical background: Multimodal texts

The very nature of what constitutes a text, which would traditionally have been considered a written document, is changing with the increasingly widespread access to multimedia authoring and delivery tools. The layout, presentation or delivery of such multimodal texts can be analysed in many ways, and has become a growing field of interest. Kress and van Leeuwen (1996) for instance, within their framework derived from Halliday's social semiotic theory of language, focused on the layout of physical texts, such as books or leaflets, in introducing the concepts of 'given' and 'new' information. Using these concepts, they provided an analytic framework for how information tended to be presented. Information already known, or 'given', tended to be presented first, generally on the left or at the top to reflect a convention of reading from left to right, top to bottom. This preceded 'new' information, on the right or further down the page, but which was connected graphically or in terms of content to the earlier, 'given' information. Thus an intended reading trajectory could be designed into texts by the author/designer, whether the text consisted solely of written words or a combination of word and pictorial information. I apply these concepts in chapter 5.

Within a multimodal analytic approach, some researchers have analysed modal combinations. In attempts to view communication via multiple modes, a number of 'effects' or 'principles' have been proposed, such as Lemke's (1998) 'multiplying effect', as outlined in chapter 2. Such an analytic view can also be used to explore the point cited earlier, that repeated use of the same object or resource can serve different purposes on different occasions, or for different users, whereby analysis purely at a linguistic level may miss how words are used alongside resources in other modes and in different ways, as meanings are instantiated. As I intended to view the meaning-making process, this was a strong reason for including a multimodal analysis in my research design.

This focus on modal combinations can also be partnered with a consideration of modal choice, such as through Hennessy and Deaney's (2006) 'matched resources' as described in chapter 2, for instance in allowing pupils to write a story or draw a picture to represent a concept of interest. In this, modes or resources could be used together, in a multiplying effect, but the notion of matched resources predominantly allows for viewers, listeners or readers to choose which mode or activity they find most helpful in understanding the concept of concern. This was a particularly useful way of analysing the complementary use of movement, visual image and talk in my data.

In addressing use of resources over time, and as outlined in chapter 2, I develop Baldry and Thibault's (2006) 'meaning-making trajectory'. Where Baldry and Thibault however focused on personal meaning-making trajectories as pursued by individuals working through webpages, I use the concept to consider how such trajectories can be addressed through interactions between multiple active agents, as a collaborative knowledge-building and meaning-making endeavour. Thus in addressing the various modal resources employed in making meaning over time, I was privy to some of the common knowledge as it was developed across modes in the course of the teaching-and-learning interactions, such as in the use of subject discourses or actions to demonstrate conceptual understanding. Use of such a strategy in itself is some evidence of cumulative knowledge building in action. Without a temporal approach to analysis this form of knowledge sharing may not be salient, drawing as it does implicitly on experiences from shared past, rather than explicitly on resources available in the current shared activity. In this sense participants could draw on their common knowledge such as in references to past shared events, to relay a larger amount of information than is verbally expressed. Equally they could employ a resource as an iconic representation, drawing on Baldry and Thibault's (2006) 'meaning compression principle', where a representation is utilised to signify more than its decontextualised presence or use would convey. A multimodal analysis that follows meaning making over time therefore has the potential to allow use of common knowledge or 'meaning

compression' in action to be explored. This discussion now moves to focus on the practical need and preparation for multimodal transcription.

4.5.3 What is multimodal transcription, and why is it necessary?

Multimodal transcription reflects two major shifts in research practices. Firstly, with the increasing quality and decreasing cost of video-recording equipment substantially more video data is being collected for analysis, such as of classroom behaviours and interactions, which would previously have been recorded solely in audio form. Secondly, greater attention is being paid to aspects of communication other than, or in addition to, those communicated via speech alone. These two elements are of course likely to be interrelated: with the greater ease of collecting video data supporting an increased capacity to analyse visual as well as verbal activity, and increased interest pushing a demand for collection and analysis of video data. Collecting video data was also particularly important in my study, as I wanted to record the movement activities and use of resources that were such integral parts of the programme of lessons I was observing, and in relation to my analytic aim to observe use of such resources.

Within this increased interest in the multimodal nature of communication, views are split as to the role of language. Generally in those aiming to produce multimodal transcription, language is considered as potentially equal to other modes, though any mode can be foregrounded or backgrounded as appropriate (Jewitt & Kress, 2003). Multimodal transcription is therefore posed as an integrative model, rather than presenting material from a set of isolated modes. In this sense of compression and combination of modal information, Baldry and Thibault (2006) claim that in their approach to multimodal transcription they do not automatically privilege language over other modes:

the meaning of the text is the result of the various ways in which elements from different classes of phenomena – words, actions, objects, visual images, sounds and so on – are related to each other as parts functioning in some larger whole. (p. 21)

From this we can see that in aiming to view how modes are combined in production and interaction, the authors' aim was to provide a sufficiently 'thick' description (p. xvii) of activity within resource systems, whilst maintaining the combination and relationship between modes in analysis of a coherent 'text'.

In contrast, other researchers view language as the central component, used to orchestrate other modes as appropriate (Mercer & Littleton, 2007). This is the view that I adopted, of the centrality of language, with other modes drawn into use or narrated through talk. I adopted this stance as a core element within the sociocultural approach that framed my research, in the sense that all human activity is both discursive as well as mediated, thus implying a need to attend to the talk but also the use of other tools in resourcing teaching-and-learning experiences. Thus I agree that talk can at times be backgrounded to other modes, but that it remains critical in drawing salience to features communicated via other modes.

Despite their differences, both views – of the potential equality of all modes or centrality of language – recognise that transcription of just speech potentially misses a substantial amount of the communicative event, and conveyed or interpreted meaning. In many senses, any transcription will be a construction of an event as interpreted from the view of the transcriber/analyst (both of which would be me in the context of my data) in terms of what is deemed relevant or important. However, such interpretations are based on my intensive data collection and presence in the environments over a prolonged period of time (Hammersley, 2010), and I used different levels of transcription to allow for different analyses of the data.

Having established a need for multimodal analysis within my theoretical framework as described above, I now outline how this influenced my approach to transcription for this analysis.

4.5.4 Preparing for multimodal transcription

Within a view of multimodal transcription and analysis which maintains the centrality of language, any multimodal transcription from this viewpoint would prioritise speech, with other modes included as they are brought into the communicative act. Despite this prioritisation however, the interaction is still seen as an integrated, 'multimodal ensemble' (Bezemer & Jewitt, 2009) rather than modes working in isolation. There is also a substantial view as already mentioned, that any attempt at transcription will in itself only ever be a re-presentation of the event: that by being a written or categorised re-production of an integrated and bodily experience, it cannot capture the true nature of the event as it occurred (Bezemer, Mavers & Sidiropoulou, 2007). This is an issue that cannot truly be resolved, but it is important to acknowledge it in order to present findings of qualitative analysis.

Baldry and Thibault (2006) underscored the link between the two processes of multimodal transcription and analysis in stating that:

Transcription is a way of revealing both the codeployment of semiotic resources and their dynamic unfolding in time along textually constrained and enabled pathways or trajectories. Analysis synthesises the results of transcription in order to ground statements about textual meaning in a principled and replicable way. (p. xvi)

Just as the researcher should consider what modes they wish to analyse before collecting data, as I outlined for my data in chapter 3, it is argued that the process of transcription should inform and provide impetus for the analytic work – thus transcription is an important part of analysis. There are a number of issues to consider in this process, as the following discussion explains.

4.5.4.1 Issues in multimodal transcription

One issue to consider is that any transcriber, in reviewing an event, will focus on aspects of perceptual and semiotic salience to them, whereby interpretation is likely to be specific to the analyst, and so differ between participants or observers (Baldry & Thibault, 2006). As mentioned

earlier, in instances where common knowledge or compressed meaning are referred to, or inferred through use of familiar material, the analyst may not be privy to the full range of resources being utilised. Therefore what such material means to a member of, for instance, the classroom community who is familiar with it, is likely to differ to the meaning attributed to the same resource or event by an outside observer. This was one reason for also conducting interviews, VSRD sessions and focus groups.

Further issues to consider were outlined by Alant, Bornman and Lloyd (2006). In transcribing they highlight that the researcher should reflect on the 'activity setting' in which the interaction occurs, such as the classroom, family location or event, and how this might influence the activity. They also urged consideration of how describing in words various factors in interaction may reduce their interactional impact with regard to other factors, and result in perceived isolation of modal information. With this in mind they argue for 'a more holistic approach towards the study of human interaction' (p. 148). This again calls for further attempts to transcribe events multimodally, and genuine thought to what a 'holistic approach' would entail.

In aiming for a 'more holistic approach', the issue referred to earlier re-emerges of whether a multimodal transcript can convey the multimodality of the event being transcribed. Bearne (2009) summarised this concern in reflecting on her own data presentation:

There is, perhaps, an irony about using these three examples of children's multimodal texts, precisely because of issues of affordance. The printed page of this journal does not allow for colour, sound, movement and gesture so that the texts produced by the children can only be partially appreciated through description. (p. 167)

Of course most multimodal transcripts could include accurate colour re-presentation of an original text or event, although print-based journal conventions may not permit their reproduction. (The growing availability of online journals may facilitate a shift in this trend.) Many if not all multimodal transcripts would also include a written description of sound, movement and

gesture, or still images of frozen movement and gesture. But the point still remains that these are re-presentations of information in one mode – written description or static image – of acts originally produced in a different mode – in dynamic interaction. If modes are said to combine to produce a more coherent meaning than that available from the sum of isolated modes, it is quite likely in this view that a written description of much material produced in other modes will not accurately reflect the communicated meaning or act. Many researchers are attempting to address this issue in their approach to multimodal transcription, and this influenced my choice of multimodal transcription convention. As above, this is an issue that is difficult to resolve, but must be acknowledged in presenting findings resulting from multimodal transcription and analysis.

In using still images within a multimodal transcript of a dynamic event, thus presenting a still form of a moving object, I agree with Hancock, Gillen and Pinto (2010), that:

The ability to grab stills enabled us to scrutinize our video and view data more attentively. Indeed, the stills often appeared more “alive” than traditional photographs because stills, extracted from a stream of video, contain an increased sense of the life that both precede and follow them. (p. 41)

In this sense, through the multimodal transcription conventions that I employed and explain below, I used stills to identify the relationship between linguistic and non-linguistic features. Thus I utilised the strengths of the visual and written modes to illustrate the ongoing activity. I now outline the conventions I adopted in my multimodal transcription.

4.5.5 Multimodal transcription conventions

Baldry and Thibault (2006) provided a framework for multimodally transcribing a dynamic event, although the example given was in the scripted, rehearsed and directed form of a television advert, rather than a ‘real-life’ event. Their transcription was presented in separate columns, each for a specific kind of information, or mode of communication. Thus whilst information for different modes was separated into columns, reading the transcript in rows offered

correspondence between modes, rather than different modal information being listed in the course of ongoing written description. Table 4.2 below outlines the columns used by Baldry and Thibault. Included in this description are comments on how I applied their use of columns in my work, and an example of how I applied this transcription method using my own data follows in extract 4.3.

Table 4.2: Columns in Baldry and Thibault's (2006) multimodal transcription

Column	1: Row number and time specification	2: Visual frame	3: Visual image	4: Kinesic action	5: Soundtrack	6: Metafunctional interpretation
Content	To show 'real-time progression of the text' (p. 186).	Frozen frame image of activity, split into 'shots', with identification of any 'thematic anchoring points'.	Written description of static elements of the frozen frame (not movement or gesture) presented in column 2. Highlighted aspects such as camera position, perspective, distance, gaze.	Written description of movement, linked to the frozen frame in column 2.	Speech, description of music, loudness, tempo (tempo defined as slow, medium or fast), pauses, overlap. Some use of notation for common occurrences, e.g. females singing, silence, music.	Interpersonal, experiential, textual and logical (based on Halliday, 1978). This column can cover a number of rows with one entry.
My application	I included row numbers to aid referencing of the transcript within	I re-interpreted this column in the context of	I re-interpreted this as phases, and re-named the column	I applied this in the same manner, but re-	I used this column to identify verbal exchange, and other sounds such as	I did not use this column in my transcription, as

	<p>the analysis. Time specification was useful in maintaining chronological flow of a piece that could be read both across the transcript, for the different modes, and down the transcript, for development of the event.</p>	<p>unstaged classroom interaction, drawing on the authors' concept of 'phases'* to determine when to offer a new image of the frozen visual frame.</p>	<p>'description of visual frame' to highlight the link between columns. As my recordings were not staged it was not appropriate to register camera position, perspective or distance. I did include direction of gaze and body.</p>	<p>named the column 'action' for simplicity.</p>	<p>music. Given my focus on language as the central mode, I moved this column before the columns offering visual information (see extract 4.3 below). I used the same conventions for pauses, overlaps and inaudible speech as outlined earlier.</p>	<p>this was not a prominent focus of my analysis.</p>
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* 'Phases' were defined as 'an intermediate level of textual organisation that integrate microlevel selections of resources from diverse semiotic modalities in a consistent way' (p. 188)

I now describe how I approached these considerations and conventions in my own multimodal transcription and analysis.

4.5.6 How I applied a multimodal analytic approach to my data

Having viewed the lesson videos, together with the verbal transcripts prepared for the quantitative SCDA, I selected extracts for multimodal transcription and analysis based on a number of issues. As before, I considered their

- relevance to my research questions,
- relevance to findings from my SCDA,
- ability to be used to illustrate key findings that relate to and extend existing research.

In this analysis I was particularly looking to address the multimodality of interactions, in conjunction with verbal exchanges. Within this frame therefore movement activities and tool use that offered insights into how meanings were being made, and especially where such modal combinations offered scope for negotiation of views, were particular foci that I was keen to explore.


Using these criteria, there were some extracts where the interactions particularly utilised other modes alongside talk. I wanted to re-present this multimodal richness, and thus a more multimodal form of transcription was valuable in highlighting the combination of modes in communicative use. These transcribed extracts then enabled me to offer a detailed consideration of the multimodal nature of teaching-and-learning activities, and what this can add to our understanding of how knowledge building can be a cumulative and temporal process built up and re-worked across different modes. Below is an example of multimodal transcription as I applied it to my data.



Extract 4.3: Sample of transcription for multimodal analysis


Week 5 hall lesson (2nd topic lesson – see table 4.1), 08.07-08.25

Pupils (Ps) sat facing IWB at front. A few pupils are standing at the front

The teacher (T) was introducing a warm up activity, with a small group of pupils to make an arch – representing the houses at the time of the Great Fire of London as close together in narrow streets. The other pupils (off camera) were to represent the fire, spreading through the houses.

Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 08.07	T: What I'd like you to do (pause) you guys are all houses from the past. Can you please, put your hands up (pause)?		T looking at Ps at front 'House' Ps look at T	T raises hands on 'can'

<p>2 08.16</p>			<p>'House' Ps look at each other</p>	<p>Ps raise their hands</p>
<p>3 08.17</p>	<p>Hold each other's hands, yeah.</p>		<p>'House' Ps look at T</p>	<p>T brings hands together on 'hold'</p> <p>T holds Ps' hands together</p>

<p>4 08.20</p>	<p>So, now this is like a street in London,</p> <p>it was all very</p> <p>narrow and close together.</p>		<p>T looks at rest of class</p> <p>'House' Ps look at each other</p>	<p>T moves to the side of Ps at front</p> <p>Pulls hands up opposite each other from 'it'</p> <p>and squeezes them together and apart quickly five times across the words 'narrow... together', leaning forward</p>
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The sample extract above only contains teacher talk (although use of this transcription method within my analysis also includes pupil talk), but the fine detail enables the pupils' physical contributions to be noted. It shows the scope for addressing the different ways in which all participants are involved in lesson activity, and how verbal exchange is used to orchestrate activity across other modes such as the teacher's gestures and pupils' actions. For this reason I moved the 'soundtrack' column to the second column, rather than the fifth column as it appeared in Baldry and Thibault's use (see table 4.2). Use of the 'row and time specification' column enables the transcript to be more easily referred to, as well as indicating how quickly an instruction was offered. Following the presentation of information across rows allows the reader to view how different modes were used in combination. The 'visual frame' column allows an instant 'paused' and 'summary' view of a moment in time, with the 'description of visual frame' column useful in drawing the reader's attention to directional aspects of the visual frame. The large number of images re-presenting paused moments in time in this way facilitates a sense of continuity in the activity. The 'action' column is useful in bringing a sense of the dynamic and unfolding flow of interaction back to the frozen images displayed in column 3.

Having identified the theoretical background to SCDA and multimodal analysis and how I applied them to my data, it is important to address potential challenges to the reliability of such an approach. In the next section I highlight some challenges and how I responded to them through my approach to organising my data for analysis and presentation.

4.6 Issues of methodological rigour

Within any research project it is important to consider issues of methodological rigour. In addition to the review of concerns about validity and reliability as related to the case study offered in chapter 3, I now outline how I addressed issues concerning the reliability of my analysis and analytic claims from the SCDA and multimodal analysis.

Some criticisms have been levelled at qualitative studies, for a potential lack of testable claims. Thus it is important to address ways in which my approach to data analysis was principled and rigorous, in arriving at the claims I made. Furberg (2010) for instance argued for the ‘thorough documentation of the research procedures’ (p. 63) as a means to enhance a study’s reliability, such as through use (and justification) of specific transcription conventions and using actual data to justify/illustrate claims. In this regard, I specified the transcription conventions that I adopted and the reasoning for different types of transcription for the different types of analysis. I use data extracts to support and illustrate the points I argue in my analysis chapters.

As I articulated above regarding the transcription conventions I adopted in preparing my data for analysis, Kleine Staarman (2009) argued that:

The most important issue with regard to the reliability of the observations is that the researcher reports accurately what has been seen or heard. Working with audio and video data instead of data gathered in systematic observations (in which interaction is coded as it happens), is one way to enhance this reliability. (p. 113)

In my transcription of the video and audio data and use of extracts in presenting my analysis I attempted to make the evidence base of my claims transparent to the reader. Equally in efforts to be transparent about my interpretations of the data, the temporal dimension of my analysis allowed me to present extracts from across the series of lessons and thus spanning a period of four weeks, in illustrating how certain patterns evolved over time.

Use of the quantitative concordance analysis also offered a more ‘testable’ method of indicating potential points of interest and patterns of interaction, and supported the process of developing findings from the more detailed qualitative analysis. This combination of methods made the overall process more rigorous, by not assuming that every use of the same term or even phrase carried the same meaning, but allowed more in-depth analysis of any potentially changing patterns of use over time. As Mercer (2004) argued, use of SCDA attempts to answer to some of

the claims that qualitative research is lacking in reliability by its inclusion of both quantitative and qualitative methods. I extended this by using multimodal analysis as a further way of interrogating my data. Having outlined how I analysed the lesson data, I now identify how I analysed the interview data using thematic analysis (referring here to the pre- and post-interviews, VSRD sessions and focus groups together).

4.7 Thematic analysis

Thematic analysis is described as a 'method for identifying, analysing and reporting patterns (themes) within data' (Braun & Clarke, 2006, p. 79). Working in this method, the analyst has an active role in identifying and interpreting data, and so themes do not 'emerge' from the data. The analyst must therefore be explicit about the assumptions and theoretical background in which data are interpreted. Braun and Clarke distinguish between a constructionist theoretical position in conducting thematic analysis, aiming to identify how 'events, realities, meanings, experiences and so on are the effects of a range of discourses operating within society' (p. 81); and a contextualist theoretical perspective, to 'acknowledge the ways individuals make meaning of their experience, and, in turn, the ways the broader social context impinges on those meanings' (p. 81). I adopted a sociocultural theoretical approach in analysing my data. Thus comments made in interviews, VSRD sessions and focus groups, where I utilised this method, were interpreted as situated both within the discourses of the educational practices that were the subject of the discussions, and also in the context of the research setting in which the discussions took place. The impact these cultural (school) and psychological (research environment, being recorded) settings may have on the data generated were acknowledged in analysis. As my analysis of the lesson data focused on one of the series of topic lessons, it was appropriate to analyse interview data for presentation in my thesis only from participants associated with this topic. The same sources of data were therefore collected from each of the three classes, as indicated in the 'data collection' column of table 4.3, but the table only indicates that collected and analysed for the work reported here.

Table 4.3: Interview data collected and selected for analysis

	Data collection	Data analysis
Year 2 class	Audio of: Pre-interview with teacher Pre-interview with dance specialist Post-interview with teacher Post-interview with dance specialist Focus group with group of pupils VSRD session with teacher VSRD session with dance specialist (all of which were transcribed)	Audio and written transcripts of: Pre-interview with teacher Pre-interview with dance specialist Post-interview with teacher Post-interview with dance specialist Focus group with group of pupils VSRD session with teacher VSRD session with dance specialist Identified themes (see figure 4.1 for thematic map) Themed extracts from above sources

The units of analysis within thematic analysis are:

- theme: which ‘captures something important about the data in relation to the research questions, and represents some level of patterned response or meaning within the data set’ (Braun & Clarke, 2006, p. 82)
- subtheme
- code
- extract

I find there is some confusion between coding and identifying themes, in particular which contrasts with the SCDA approach I used for the lesson data. Therefore I chose to keep my thematic analysis at the level of theme, with some use of subtheme, rather than the potentially de-contextualised focus of code. For instance, I was interested in reflections and interpretations,

rather than use of particular words. I used extracts in writing commentaries on the data, to illustrate and support the analytic claims I put forward, as exemplified in the SCDA approach.

In identifying themes, Braun and Clarke indicate that researchers can adopt an inductive/bottom up approach, where themes are linked to the data itself (data driven), and there is no pre-existing coding frame. Alternatively, researchers may follow a theoretical/top down approach, where analysis is driven by theoretical interest in the data. Whilst I did not use a pre-set coding system, my analysis of the interview data was aligned to my theoretical concerns and research questions, as well as to the findings from my SCDA and multimodal analysis of the lesson data. Thus it was more theoretically-driven in this sense. As Braun and Clarke articulate, a theoretically-driven thematic analysis 'tends to provide less a rich description of the data overall, and more a detailed analysis of some aspect of the data' (2006, p. 84). As I was predominantly using the thematic analysis to resource understandings of the issues I was addressing in my SCDA and multimodal analysis, where the themes I interpreted from the interview data related to my wider findings, this was an appropriate use of thematic analysis in supporting a rich description of points of interest within my descriptive case study. This issue also supports my choice of thematic analysis over, for instance, grounded theory, whereby I was not explicitly using analysis to formulate theory 'grounded' within the interview data. Equally I was not intending to generate statistical figures around my interview data, whereby content analysis was also not appropriate. It is therefore important now to outline how I used thematic analysis in the context of my data.

4.7.1 How I applied a thematic analytic approach to my data

Braun and Clarke argued that 'clarity on process and practice of method is vital' (2006, p. 80), and that 'rigour' is a key requirement of any thematic analysis. Therefore the process of thematic analysis I followed can be summarised by the process outlined in table 4.4 below, based on the procedure and 15 stage checklist for 'good thematic analysis' offered by Braun and Clarke (p. 96).

Table 4.4: Process of thematic analysis

Stage	Label	Description
1	Become familiar with the data	<p>Transcribe data</p> <p>Read/watch/listen and re-read/watch/listen</p> <p>Make notes on points of interest</p>
2	Search for themes	<p>Generate a list of what is in the data, and sort into potential themes</p> <p>Produce initial thematic map to illustrate relationships between themes as a start to collating them</p> <p>Collate all themes with associated extracts</p>
3	Review themes	<p>Refine themes – analyse all themed extracts to see if they form a coherent pattern</p> <p>Check the thematic map represents the meanings within those extracts</p> <p>Re-read data for any sections missed in earlier analysis, and to check the themes accurately represent the data</p>
4	Define and name themes	<p>Check coherence of data in themes, and identify what is interesting in themes</p> <p>Consider how each theme fits within the overall story of themes</p> <p>Ensure there is not too much overlap between themes</p> <p>Identify subthemes: identify structure and hierarchy of themes</p>
5	Produce report	<p>Tell the story within the data, within and across themes – I used this to link in with the stories I was telling from the SCDA and multimodal analysis</p> <p>Use extracts, embedded within interpretation, to justify and evidence interpretation within the context of the research</p>

		questions and theoretical frame, rather than just as a description of the data
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In considering the process identified in table 4.4, and as the interviews, VSRD sessions and focus groups were audio-recorded, I transcribed only the verbal interactions, unlike the video data analysed using qualitative SCDA and multimodal analysis. As Braun and Clarke indicated, when transcribing, care and consideration should be given to re-presenting verbal data in written form, 'in a way which is "true" to its original nature' (2006, p. 88). Thus the transcription conventions I followed were somewhere between the level of detail used for the quantitative and qualitative SCDA outlined above. In preparing for my thematic analysis I transcribed all audible spoken words and identified any inaudible words. I identified any overlaps in speech and noticeable pauses, although most pauses particularly for the focus group were within my speech after asking a question. I used punctuation to ease readability, and to keep the flow of a contribution similar to its verbal expression, though this was necessarily funnelled through my interpretation. I identified who offered each contribution, and numbered the lines in presented extracts to make clearer any references made to them in the commentary. A sample extract of a transcribed interview prepared for thematic analysis is shown here, illustrating particularly the use of punctuation to keep the written transcript as 'true' as possible to its original spoken form:

Extract 4.4: Sample of transcription for thematic analysis

Teacher's (T) VSRD session with myself (Interviewer) (06.52-07.06)

We were watching a section of the lesson video where a pupil had asked if they could write an answer just given onto the IWB.

The extract represents the themes: pupil participation, improvisation from the plan, and IWB use (see thematic map below).

1. T: I should have, I should have, ah, yeah (pause).
2. Interviewer: What do you think you should have done?

3. T: I should have erm, got them to write it in the first place. I don't know, only when they
4. said 'can I write it?' did I think 'oh yeah of course, that's an even better idea, why
5. didn't I think of that?'

I focused on the theme as unit of analysis, as a tool which, as above, 'captures something important about the data in relation to the research questions, and represents some level of patterned response or meaning within the data set' (Braun & Clarke, 2006, p. 82). Therefore once the interviews were transcribed, I used the software Atlas.ti to support organisation of the data and collation of created themes. This allowed links to be maintained and revisited between themes and themed contexts, to ensure that the themes accurately represented the data they were used to illustrate. This meant I could move easily between the identified themes and written transcripts, to support my interpretations in staying as close to their original form as possible, whilst acknowledging that they were filtered through my own interpretation.

I identified themes when listening to the data and reading the transcripts, rather than constructing them before, but in my identification of themes I was driven by the issues contained in my research questions, and by my sociocultural theoretical framework (see thematic map in figure 4.1). As the figure illustrates, I formed three main 'groups' of themes that were used in presenting data to support the lines of argument within my thesis, and three other 'groups' of themes that were not presented in my thesis. The structure of the map is useful in identifying the types of relationships between themes in the groups, as of parallel (joined by lines) or hierarchical (joined by arrows) prominence.

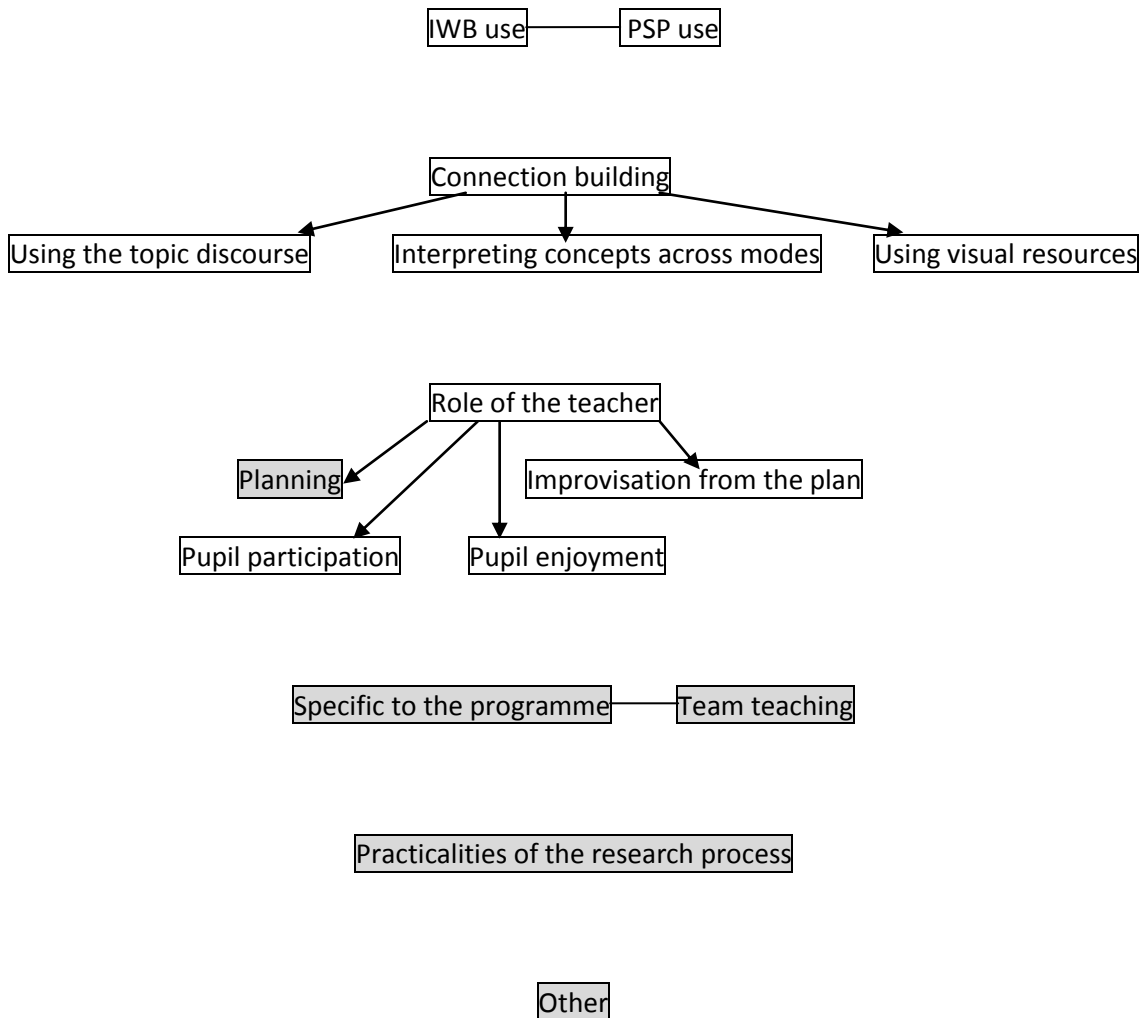


Figure 4.1: Thematic map

Lines indicate related themes; Arrows indicate hierarchy of themes

Text in grey indicates themes not drawn on in thesis

Once identified, themes were aligned where they were represented throughout the data, but kept within the context in which the themed data occurred, so as to avoid Mercer’s comment above of reducing conversation to a ‘categorical tally’. I used interview extracts to present stories from the data within and across themes, to resource understanding of findings from the analysis of lesson data. This enabled me to justify my interpretations within the context of my research questions and theoretical frame, and so go beyond providing a description of, or unfounded claims about, the data. Analysis therefore was a dynamic process of moving between audio files, written transcripts, themed transcripts and themes, and of creating, clustering and refining themes, to ensure coherence and representativeness of the themes being developed.

Many of the points regarding reliability and validity that were addressed for SCDA above are relevant here, and so I will not repeat them. There are however a few additional issues which I now outline.

4.7.2 Reliability

One general comment on the use of 'coding schemes' is that it removes the context from the data. This is why I chose to keep my analysis at the level of theme, and to use a software package that enabled consideration of all themes in the context of the data from which they were devised.

A further challenge is the suggestion that gaining inter-rater agreement of coding schemes increases its reliability. As Kleine Staarman (2009) suggests however, this merely shows that two people can code a sample of text in the same way, and says nothing of the ability of the subsequent findings to accurately reflect the data. Thus I did not consider it helpful to establish inter-rater reliability of my themes. Inter-rater reliability also tends to be used in studies where coded data are statistically compared. As this was not the aim of my use of themes in the thematic analysis, I considered this to be less important. I chose instead to use the interviews to add weight to the findings from my SCDA and multimodal analysis, where the data coincided (in terms of agreement or disagreement), and to offer extended extracts of interviews in my data presentation in order that readers could see more transparently how the claims being made related to the data from which they were developed.

Also regarding the issue of 'prevalence' (identified as an important concern by Braun & Clarke), in terms of theme allocation based on how often an issue is raised, or within how many interviews it is referred to, I elected to consider something as a theme in terms of 'whether it captures something important in relation to the overall research question' (Braun & Clarke, 2006, p. 82). This is a more appropriate measure for a qualitative study than trying to count how wide or deep

an issue is embedded, and may indeed support the exposure of difference of opinion or experience across the interviews, which could in itself be analytically interesting.

4.8 Chapter summary

In this chapter I outlined my rationale for the methods of analysis I adopted, grounded in existing research and the research questions that my analysis addressed. I introduced the methods of SCDA and multimodal analysis that I used to address lesson data, and thematic analysis to focus on the interview data, and suggested how I applied and adapted these methods in the context of my data and theoretical approach to analysis. I outlined how and why I selected data for analysis and presentation within each method of analysis, from the substantial amount of data collected, and how I brought findings together across the different analyses.

I documented how my approach to analysis prioritises the sociocultural emphasis on the importance of talk. Alongside this, through my analysis of the lesson data I was keen to address how other communicative modes, such as movement, can be used in an integral way, not to replace but to support the development and reinforce the importance of talk in making meaning. Thus my analysis needed to accommodate these multiple modes of communication, for instance through consideration of concepts such as a 'multiplying effect', or 'matched resources', as well as the construction and use of 'common knowledge' as multimodally resourced. Therefore my focus in analysis was firstly on how knowledge building was framed as a cumulative endeavour for both practitioners and pupils, drawing on a notion that educational experiences should build on previous ones and in anticipation of future ones, in a 'purposeful educational journey' and, as 'stepping-stones to understanding'. Secondly my focus was to view how this cumulative knowledge building and meaning making was pursued through the 'multimodal orchestration' of various resources and activities, which could involve both mismatch and alignment of meaning making across modes, requiring a multimodal and temporal analytic approach.

I explained how through my combination of different methods of analysis, I was able to view the data at different levels of detail and temporal range. This necessarily involved different forms of transcription, and mixture of quantitative and qualitative methods, which I outlined. I feel this was a strength of my approach, as the findings I presented from the different analyses both informed and were informed by the other methods. This in turn, through transparent reporting of data extracts in presenting my findings, enhances the reliability and validity of analytic claims.

In preparing my data for analysis, I described the challenge that any transcription from one or many modes into another will involve some subjective interpretation, and re-construction of data. This is a matter that is difficult to completely eradicate, but it is important to acknowledge in analysis and reporting findings generated against transcribed data.

Regarding the interview, VSRD and focus group data, I described how I used thematic analysis to consider similar issues as I was addressing in my SCDA and multimodal analysis of the lesson data. I explained how I focused my thematic analysis at the level of theme, presenting extracts of the themed interview data where they resourced understanding of concerns and insights raised in my wider findings from analysis of the lesson data. This does not imply that I was searching for agreement or consistent reporting across the data sources, and sometimes what was equally valuable was that it allowed exposure of difference of opinion or experience. This was an appropriate use of thematic analysis in supporting a rich, or 'thick', description of points of interest within my descriptive case study.

In light of my applications of SCDA, multimodal analysis and thematic analysis, I feel that my methodology offers a good mix of analytic methods, focused on a sociocultural view of the importance of talk and tool use in making meaning in the context in which activities take place. Thus it was appropriate to keep analysis at a local and contextualised level, without use of pre-defined codes or generic frameworks. My methodology allowed me to access the historical and

dynamic ways in which meanings were created and developed, and to gather both practitioner and pupil insights and reflections on their experiences. It also enabled me to view the role of specific tools and modes, some of which were expected to be significant and some which became evident as such through the process of my analysis, in their place as individual tools amongst many available to practitioners and pupils, by how they were appropriated and perceived within the practitioners' and pupils' ongoing classroom experiences.

4.8.1 Key points

- In this chapter I outlined the strength, comprehensiveness and complementarity of my chosen research design and methodology, to be able to present developing meaning-making trajectories and illustrate the means by which these were resourced and exposed, from teacher and pupil perspectives in interaction and reflection.
- My approach to analysing the lesson and interview data enabled me to address teacher and pupil perspectives together: much existing research tends to prioritise one or the other, and not necessarily the interaction, similarity or difference between the two.
- SCDA enables me to focus on the role of talk, such as in following the development of subject discourses. Used alongside multimodal analysis I could more fully appreciate the role of movement, which was so important in the programme of lessons I observed, and other modes in use, how they could be used together in making meaning across different semiotic resources in play, and how any conflicts of view were subsequently negotiated.
- In aligning SCDA and multimodal analysis, this adds a potentially rich view of the lesson data. It also offers a methodological innovation in bringing together two complementary approaches that consider the importance of viewing interaction within its context of production.

Chapter 5

Use of talk, digital technologies and other meaning-making resources to render meaning making visible and to scaffold the development of improvable objects

5.1 Introduction

In this chapter I present findings from my SCDA to address my first research question:

How are talk, digital technologies and other meaning-making resources utilised to resource and make visible meaning-making trajectories within and across lessons, and to scaffold the development of improvable objects as progressive and historical representations of developing understanding?

Specifically, I outline how different resources were used over time to support cumulative knowledge building, identified as an important educational challenge in chapter 2. In presenting my analysis I explore the use of particular resources and modes as they were employed in the course of a series of topic lessons on the Great Fire of London. I also evidence development of meaning making within and across modes of communication, and within and across lessons. Through analysis of a particular resource, I explore new forms of tool mediation through the significance of the dynamic between stability and flexibility, and the opportunity to edit or improve the resource as a reflection of current shared understanding.

I explore how teachers and learners can utilise technological and physical objects to encourage dialogue – with talk as the central mode in communicative interaction – to resource and evidence meaning making, and to spontaneously and flexibly alter a resource in line with current pedagogic need. I explore the use of ‘learning objects’, as objects in a variety of modes used to support the teaching-and-learning process. I consider how such objects can be used to enable understanding to be negotiated, and accumulated and common knowledge to be documented and made

permanent, for revisiting on subsequent occasions rather than needing to be re-built from scratch. In this I consider how use of such resources can support an effective balance between working through planned content and responsive and dynamic orchestration.

Implicated in this focus on tool use and development over time in the construction and re-working of ideas, and as identified in the research question framing this chapter, I draw upon two theoretical concepts in particular. The first of these is the 'improvable object' introduced by Wells (1999). The improvable object refers to how resources, usually in written form, can be edited and 'improved' through progressive alteration and alongside progressive discourse around their use, as a more permanent indicator of developing understanding. Specifically I explore how an IWB slide was used as an 'improvable object', as a means around which to build 'common knowledge' (Edwards & Mercer, 1987) across learning events. In this I am not however restricted to a view of the written text of the IWB slide as an object to be improved, but also explore any development or 'improvements' through dialogue around its use. The concept of 'improvement' therefore is mostly subjective, but I consider an object to be improved where any alterations are used in efforts to further understanding. In the following chapter I extend this notion of the improvable object in a more multimodal frame, to address the revision and development of movement activity as used to explore and progress understanding of key concepts. Both a technology-mediated and multimodal consideration of the improvable object concept, as presented in this and the following chapter respectively, extend the original conceptualisation in important ways, giving it new resonance in the context of new media engagements.

The second theoretical concept I particularly draw on is the 'meaning-making trajectory', as initially introduced by Baldry and Thibault (2006). Baldry and Thibault employed the term to refer to how a website user navigates links in websites. I extend the concept to address how meanings are constructed across learning experiences, by participants in interaction, and across different modes of communication. Thus the *temporal* focus is crucial in my analysis, as Mercer (2008)

articulated: 'Analytic methods that do not recognize or deal with the temporal development of talk, its reflexivity, and its cohesive nature over longer timescales than one episode or lesson will inevitably fail to capture the essence of the educational process' (p. 56). In writing this, Mercer was focused on identifying a 'dialogic trajectory' in pupils' learning experiences. I draw on this notion, considering learning as both fundamentally discursive and mediated, to address the teacher's use of their 'linguistic toolkit' (Mercer, 1995), as a central part of their wider 'mediational toolkit' (drawing on Wertsch, 1991), in an attempt to understand how a teacher worked to facilitate a cumulative learning experience across a series of topic lessons.

Within my extension of the meaning-making trajectory concept, I also utilise Rasmussen's (2005) notion of a 'participation trajectory' in considering how pupils involve themselves in teaching-and-learning activities, and the importance their participation in activities can play in their participation in the construction of knowledge. Furberg's (2010) 'interaction trajectory' has also informed my theoretical thinking, in terms of how the nature of pupils' participation can shift over time, such as from searching for 'facts' to presenting explanations. I combine and extend these notions of trajectory by analysing a teacher's use of their own and their pupils' talk, and other mediational means including focal IWB slides, over a series of consecutive topic lessons. Although I do not focus solely on the technology, in this case the IWB and its technical affordances, I draw on the metaphor introduced by Lee (2010) of the 'digital toolkit', which would also be a sub-category of the overall mediational toolkit. The IWB would be a tool within this digital toolkit.

I now outline how I present the data analysis within this chapter to evidence development of the theoretical concepts suggested above.

5.2 Outline of the data to be presented

For my thesis I present analysis of a series of eight consecutive topic lessons around a Year 2 history topic on the Great Fire of London. The topic was taught as part of a development of a new

teaching-and-learning approach that incorporated use of dance/movement and potentially interactive technologies in subject teaching. Four of the lessons (one a week) took place in the regular classroom and were taught by the class teacher. The other four lessons (one a week) took place in the school hall, and were taught by the teacher alongside a dance specialist (for more information on the context of data collection see chapter 3).

In light of this subject context, to organise the presentation of analysis in this chapter I selected extracts from the lesson data to address two key issues within history discourse and practice, and how these were addressed by the teacher. These issues are time, and the use and interpretation of evidence, identified as important within history (Coffin, 2004, 2006a; Deaney, et al., 2009; Derewianka & Coffin, 2008: for more detail see chapter 2). Images are used in this chapter for illustrative purposes, to support and evidence points made within written commentaries around the lesson extracts. I also include extracts from the interviews where they relate to the lesson data analysis, and in illustrating some of the key themes from my thematic analysis of the interview data.

For the first issue of time, I analyse use and re-use of an IWB resource across the topic lessons to address the location of the Great Fire on a timeline, and how the resource was employed as a tool to mediate meaning-making activity. Drawing on the work of Coffin (2006a) and Derewianka and Coffin (2008), I present findings from detailed qualitative SCDA to address time in terms of sequentiality, segmenting and setting, as outlined below.

Regarding use and interpretation of evidence, I present analysis of apparent promotion and conflict of discourses by focusing on specific terms and their contexts of use across the topic lessons. I employed quantitative concordance analysis to address the frequency of particular words used. Drawing on this I also used frequency counts within my qualitative analysis of the lesson transcripts, to identify in more detail how certain words pertinent to the issue of evidence

within history were used and developed over time. For this I addressed 'phases' of use rather than each instance where a term was used, as only in the context of words surrounding each term was it possible to identify in what sense a word was used. There may therefore have been more than one use of a word, and indeed different uses of the same word, within a given phase. I defined a phase as beginning when a new issue, idea or question was raised, and to end when participants' focus shifted. This therefore is related but not identical to my use of phases, as identified by Baldry and Thibault, for my multimodal transcription (table 4.2), as it refers to where an issue was seen to be addressed, but modal resources were not necessarily used in a 'consistent way'. In my usage phases tended to be shorter than 'episodes' as identified by Gillen, et al. (2008), relating often to a short interaction but where a single term may be used more than once within the interaction. Two extracts are presented that were only audible on the teacher's microphone, whereby only verbal data was available.

Drawing the two analytic strands together, I outline how my analysis evidences attempts and some success in pupils' appropriation of history discourse. Some interesting and at times unexpected findings emerged around these issues, as discussed below. I begin this with presentation of qualitative analysis around how the teacher resourced understanding of the concept of time.

5.3 Detailed analysis of a technology-mediated improvable object: Time as a feature of history discourse

In preparing the Great Fire of London topic, the teacher had planned a number of the same IWB slides into his resources for each lesson. In this section I analyse how the teacher orchestrated use of one of these slides in particular – used to locate the event on a timeline – as a focal, pre-prepared resource to support progressive meaning making over the course of eight topic lessons, and the ways in which talk and activity around the resource stabilised and shifted over this period. Ludvigsen, et al. (2011) for instance referred to use of an 'emerging object' (whilst not necessarily

digital) and importance of a temporal analysis in addressing the *process* of emergence, in attempts to support 'stability' from the 'flux' of competing or developing understandings. They stated that '*time* is built into the analysis both as a chronological and as a historical feature through the focus on artifacts, tools and objects' (authors' italic, p. 107). This therefore refers to the notion of time in terms of analysis of unfolding events, and how use of such resources shifts over time. I incorporate this to address how the learning of time as a historical concept was technologically-mediated through and around use of the IWB slide resource, through the notion of a 'technology-mediated improvable object', used as a means around which to create and re-create common knowledge across learning events.

I address the multimodal resourcing of teaching-and-learning experiences around this focal tool within the two learning environments of the classroom and hall where lessons occurred. Whilst addressing a variety of modes however, I maintain a view of the central role of language in communication. This example of use and re-use of a focal resource provides a valuable means of evidencing how the teacher aimed to 'scaffold' (Wood, et al., 1976) support for his pupils as they moved toward appropriating topic content, both verbally and through the projected visual resource and annotations added. Hennessy, Deaney and Tooley (2010) also outlined how a teacher in their study used an IWB representation across a series of secondary science lessons, employing different IWB functionalities across different uses. This demonstrates a similar repeated and progressive use of IWB resources to that which I will demonstrate, where my focus is on how the same slide was used in different ways and eventually physically interacted with less, in supporting the development of verbal understanding within the more discursive, interpretive frame of the subject of history. I now introduce the IWB slide, and how it was used across the lessons.

Figure 5.1 below shows a slide on the IWB (prepared by the teacher beforehand), of a blank timeline from 1400 to 2009 (the year in which the lesson took place). Under the line are the

words 'Time Line' in large, bold font. As Coffin (2006a) outlined, 'an understanding and use of chronological divisions is fundamental for success in history, for, without the ability to sequence, "the past is chaos" for students (Wood 1995: 11)' (p. 212). Thus in this section I explore the teacher's use of this IWB resource to support the pupils' appreciation and organisation of time as a sequential and important concept in learning about history.

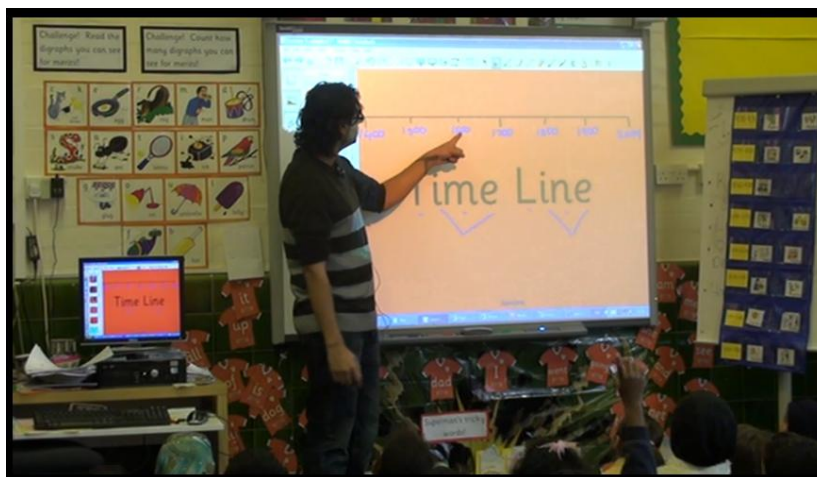


Figure 5.1: Image of first use of the timeline – teacher has just added markings to indicate how to sound out 'timeline' – week 5, class lesson, 10.00

That the teacher had included this slide within his prepared lesson resources for all eight topic lessons suggests that he planned to use it in each lesson. This resource was thus a focal element of the teacher's 'mediational toolkit'. Its recurrent presence on the specific digital tool of the IWB enabled him to utilise the affordances of provisionality – writing onto the board knowing that it can be removed – and permanence – in terms of the prepared slide, and of the ability to save changes or annotations made (Twiner, et al., 2007). Having introduced the IWB slide, I now present and comment on an extract from the first topic lesson where the timeline slide was first used. Through this I explore how the teacher used the digital tool to both offer structure and allow scope for re-structuring through annotation onto and dialogue around its use.

5.3.1 Introduction to lesson extract 5.1

In this section I illustrate the need to understand mediational means in their context of use, whereby the role of talk and technological resource, as well as physical interactivity with the resource were brought into play. Analysing the object outside of the context of any 'improvements' made to it and dialogue around it would in any case ignore the very interactional nature of teaching-and-learning experiences. In my commentary below therefore I address how the slide was used in resourcing appropriation of history discourse and specifically the issue of time as a historical concept. (For transcription conventions see chapter 4.)

5.3.2 Lesson extract 5.1: Structure and re-structuring the IWB timeline slide to resource understanding of the concept of time

Week 5, class lesson, 09.50-12.10

(Teacher = T, Pupil = P, Pupils = Ps)

1. T: This (points to slide) is a (pause, moves phrase 'Time Line' on slide) [timeline
2. Ps: [Timeline
3. T: (picks up IWB pen) I'm just going to, do the sound words (marks dot under 'T' of Time') T
4. (marks 'v' shape next to dot, puts dot in 'v') -ime (marks dot under 'L' of 'Line') L (marks
5. 'v' shape next to dot, puts dot in 'v') -ine (looks back to Ps). Can you say timeline?
6. Ps: Timeline
7. T: Timeline
8. Ps: Timeline
9. T: And erm, where (moves hand across line on slide, then looks back to Ps), where are we
10. right now, on this timeline? Are we in the (turns to face slide, points to 1600 marker,
11. keeps finger pointing to 1600 but looks back to Ps) the 1600s?
12. Ps: No
13. T: Are we in the (looks and points to 1500 marker) 1500s?
14. Nina: 1-9-9

15. T: (points to 1900 marker and looks temporarily at Ps then back to IWB) Are we in the
16. 1900s?
17. Ps: No
18. T: (looks and points to 2009 marker) Are we in 2009? (looks back to Ps)
19. Ps: (louder) 2009
20. T: (raises finger to lips) Ah, ah, ah, ah, ah, ah, ah, hands up (raises hand then puts back down
21. again) please if you have an answer
22. (Ps raise hands)
23. (T points to a P)
24. Nina: 2009
25. T: We are in 2009, so this (turns to face slide, and moves hand with pen in toward 2009 end
26. of timeline, makes mark above line at 2009) must be the (pause) p, p, p
27. Ps: Present
28. T (turns to face Ps): Present, thank you (starts to go back to mark just drawn)... (writes
29. 'present' where he made the marker above 2009). So we are in the present (turning
30. back to face Ps), in 2009. Now the [Great Fire of
31. Lior: [Where's the past?
32. T: The Great Fire of London (moves to point toward 2009 marker) happened, not 100 (makes
33. jump pointing move from 2009 marker to 1900 marker) years ago (turns back to face Ps)
34. Cath: 1666
35. T: Not 200 (points to 1800 marker with IWB pen) years ago. Not thr (points to 1800 marker),
36. ooh, 1 (points to 1900 marker), 2 (points to 1800 marker), 300 (points to 1700 marker)
37. years ago (looks to Ps). It happened (marks line in mid 1600s) about here, in the year
38. (writes '16' above mark just drawn) 16 (continues writing '66' to date) 66
39. Lior: Were we born then?
40. T: 1666 (turns back to face class)
41. Cath: We wasn't born then

42. T: None of you were born. Were you born 400 (points to IWB with thumb) years ago?
43. Ps: No
44. T: Were your parents born 400 years ago? (holds first finger out to join thumb)
45. Ps: No
46. T: Was I (points both hands in towards his chest) born 400 years ago?
47. Ps: No
48. T: (shakes head) No (looks back to IWB)
49. Lior: You're not 400
50. T: (looks back to class) Was Tracy (holds hand out to where Tracy [TA] is) born 400 years ago?
51. Ps: No
52. T: Was Alison (holds arm out to where Alison [Twiner] is) born 400 years ago?
53. Ps: No
54. T: No way Jose. (points to 2009 end of timeline slide)
55. Lior: There were people who
56. T: 400 years, this is a long, long time. Our (moves IWB pen to 2009 end) our erm (lowers
57. arm and faces class), family supper yesterday (moves IWB pen back to 2009 end)
58. happened about (makes mark on timeline by 2009 marker), well happened right there,
59. you know? (looks back to class) It happened a day ago. It's not very far. (points with non-
60. writing hand to 2009 end) But 100 years ago (moves hand to 1900 marker), 200 (moves
61. hand to 1800 marker) years ago, 300 (moves hand to 1700 marker) years ago (lowers
62. hand, and turns to face class). Guy Fawkes (turns to face IWB, raises hand to around 1600
63. marker, then lowers it again) tried to blow up the houses of parliament, about (marks
64. just after 1600 marker) say about here, [in about (writes '16' below mark just made) 16
65. Lior: [Why did, why did
66. T: (looks to Ps) Are you listening? (looks back to IWB) 16 (finishes writing '05') 1605.
67. That's when er (draws arrow pointing downward, under '1605', pointing to where he then
68. writes 'Guy Fawkes') Guy Fawkes, tried his er, tried his luck. And then about (points to

69. '1666' on slide with non-writing hand), 50 years after that, well 60 years after that I
70. should say (starts to move IWB pen hand to '1666'), we had the Great Fire (draws line
71. from '1666' upwards), of London, so I'll write (writes 'Great' above line connecting it to
72. '1666') Great Fire up here. (still writing) Great (writes 'Fire') Fire. (turns side on to class
73. and IWB)
74. Lior: But what happened again?
75. T: Well (holds hands out), let's find out (moves to next IWB slide)

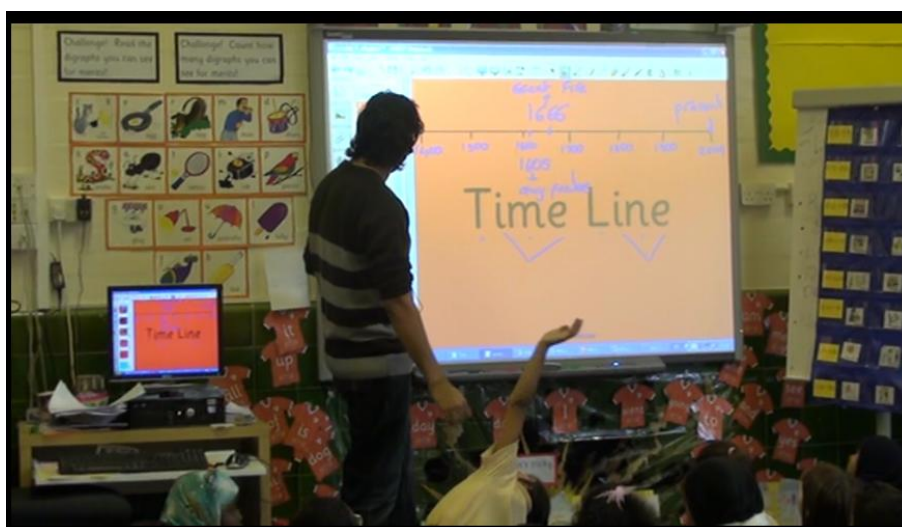


Figure 5.2: Annotated first use of the timeline, week 5, class lesson, 12.00

5.3.3 Commentary to lesson extract 5.1

In the first use of the timeline slide, the teacher initially addressed how to say 'timeline', and annotated the resource with marks to help the pupils 'sound it out' (lines 3-8). This was a concept he referred to across many lessons, as the class had a large proportion of EAL pupils and so 'sounding out' was a device used to support development of verbal expression. The sounding out strategy was a definite feature within the teacher's linguistic toolkit, with which the pupils were familiar. It also provided me the researcher with a glimpse of the historical dimension of class activity (Mercer, 2008) by using established common knowledge rooted in the collective experience of the class, through the linguistic resource used consistently across lessons. This underscores the salience of the temporal dimension of teaching-and-learning.

As well as marking (using dots and 'v' shapes under the words 'time' and 'line') how to 'sound out' the words onto the slide, the teacher encouraged the pupils to say 'timeline' twice (lines 5-8), with the potential aims of showing correspondence of written and spoken word, to increase their vocabulary, and to encourage their verbal participation in the topic. These markings are the only annotations that remained permanently 'saved' to the resource in its seven subsequent uses. Viewing the timeline slide as an 'improvable object', these were the first and only unreversed 'improvements', as the slide displayed not only the written word but also a clue how to say it. The markings therefore reflect work accomplished around how to pronounce the key term 'timeline', as an instantiation of the verbal work collectively shared around the resource.

5.3.3.1 Time as a historical, mathematical and visual meaning-making resource

Having established what the resource was, the teacher used the timeline representation to question and establish pupils' knowledge and ability to locate the 'present' in terms of a numerical figure and its relation to sequential historical time on the timeline. Through his checking hand and eye movements (lines 9-18: reaching across to the far (2009) end of the timeline before dropping his hand), and in pointing to and reading out different century markers, the teacher attempted to:

- Test pupils' awareness of the number and location of the present year (2009), without telling them directly;
- Link pupils' awareness of written and spoken numbers;
- Link pupils' awareness of dates as numbers and what the numbers mean for their place in sequential historical time.

In then adding the label 'present' above the already-written '2009' marker (line 29), he strived to consolidate at least the first and some of the last of these objectives. Through this the teacher attempted to establish shared meaning with the pupils, to gauge their understanding of the historical concepts, and of the mathematical elements involved in this, and so using talk and technology to establish correspondence and connection building.

For instance, many pupils correctly linked the cue 'p, p, p' (line 26) here with an activity the class had just done in using hand movements from left, to middle, to right, to refer to notions of time as past, present, and future, helping them to provide the correct answer of 'present' (line 27). This exchange could be interpreted in line with a concern voiced by some researchers that much use of teacher questioning involves pupils guessing what is in the teacher's head (e.g. Wood, 1992), rather than thinking for themselves what an appropriate answer might be. Using this form of 'cued elicitation' ('p, p, p': Mercer, 1995) to aid answering the question, the teacher aimed to support pupils in providing this desired response. Whilst this could be considered a closed question, it could also be considered a more open, or interactive method of covering the required curriculum material than the teacher merely providing the information. Although not a monologue then, this exchange of question, cued elicitation and response would not really qualify as 'dialogic' (in Alexander's or Mercer's sense) as there was little allowance for anything but the 'correct' response.

It is apparent however that at this point not all pupils were entirely clear of the concepts the teacher was emphasising, for instance in the pupil's question 'where's the past?' (line 31). The teacher did not reply directly to this question at this point, but continued by locating the focal 'past' event on the timeline (lines 32-38). This may have been because the teacher thought his ongoing work around the IWB resource would answer this question, because he did not hear the pupil's question, or because he was dedicated to a more authoritative and non-interactive approach (Mortimer & Scott, 2003) at that specific moment. This pupil however asked a similar question later in her group work (see lesson extract 5.2, line 7 below, 'what does the present mean again?'), to suggest that for some there may have been a (mis)understanding of past, present and future as distinct rather than continuous concepts. This juxtaposes the concepts of time as sequential, such as along a timeline, and time as segmented, such as in the categories of past, present and future. As Coffin (2006a) outlined, segmented time refers to 'the division of time whereby time loses its seamlessness and natural fluidity. Carved into segments, it becomes a

central organizing principle for historical meaning-making.' (p. 217). Thus segmenting was used more broadly by the teacher to distinguish between the Great Fire as in the past, relative to the present day of the current classroom event. Pupils however were not necessarily aware that different principles to refer to time were being used, thus potentially leading to a view of 'past, present and future' as distinct points in time, in contrast to the sequential view of time represented on the timeline.

This issue also highlights a benefit of a temporal analysis, in recording and attending to the entire lesson in analysis, to uncover where points from whole-class sessions were taken up or queried in other small group or individual work contexts. Although the hand movements of left for past, middle for present, and right for future may have been a useful tool for many, for others they may have inadvertently reinforced a perception of past, present and future as three discrete points in time. It is also perhaps interesting to note, from a social semiotic point of view, that these hand movements were modelled by the teacher, and so presented from his perspective. This follows the notion of information flowing from given to new (past to future in this case), with hands moving from left to right (Baldry & Thibault, 2006; Kress & van Leeuwen, 1996). However, the pupils were mirroring the actions of their teacher, and so for them hand movements were to the right for the past, middle for the present, and left for the future, which may have led to some confusion over the concept of progression of time. I now consider how the focal aims for which the slide was used unfolded within the above extract.

5.3.3.2 Responding to and building on the unexpected

A 'rich point' was defined by Agar (1994) as a point in language where misunderstanding, disagreement or questioning occurs – where two views are juxtaposed – which is similar to the notion of 'frame clash' introduced by Green, et al. (2008). In this sense, a rich point or frame clash is a site for the creation and negotiation of understanding, but the richness ultimately depends on

how the issue is subsequently taken up in ongoing dialogue. This issue is pertinent in the following discussion.

At perhaps the critical point in the extract, when the date of the Great Fire was annotated onto the timeline, the teacher started to use the slide to show how long ago it happened before revealing the actual date (lines 32-38), which one of the pupils was able to spontaneously offer (line 34)! Two points are of note here. Firstly, the key date had not been mentioned in class, and so the pupil had not learnt this from their classroom interaction. Secondly, the teacher did not pick up on the pupil offering or knowing this information. This is perhaps surprising given that at other points (such as the cued elicitation above) the teacher seemed to be at great pains not to provide an answer himself (as Mercer & Dawes (2008) suggest is common in teaching practice), but at this point did not take up a pupil offering the correct response. As always, there is the possibility that the teacher did not hear the suggestion. Equally possible is the explanation that the teacher did not want pupils to call out, but to raise their hands if they had an answer (as he commented a few moments earlier, lines 20-21). Alternatively given that this piece of information, that it happened in 1666, was the main reason for the timeline activity, the teacher may have wanted to 'build up' to it rather than giving the answer straight away. The teacher therefore perhaps continued in a relatively non-interactive and authoritative manner in terms of pupil involvement, but utilised the functionality to physically interact with the IWB resource, to structure and mark the key point in time. This resource structure was also used to link the two points in time – of the 'present' day and when the Great Fire happened. In this instance, the teacher utilised both time as sequence, reinforcing how many hundreds of years ago the event occurred, and also time as 'setting' (Coffin, 2006a), identifying the exact year it took place.

This need to contextualise historical time became more apparent as the extract progressed. Having used the timeline to show when the Great Fire occurred relative to the 'present', Lior's further question 'were we born then?' (line 39) identified to the teacher that the concept of

length of time in hundreds of years was still too abstract for some pupils. He used this comment as an improvisational moment, rich point or frame clash, which he was unlikely to have anticipated when planning the lesson, to involve the whole class, and drew into the frame a number of people familiar to the group (including the pupils' parents, the teacher himself, the TA, and myself as a now regular presence in their lessons, lines 44-54). Responding in this way, the teacher did not identify the specific pupil who asked the question but addressed the learning point to the whole class. In fact a pupil responded to Lior's question before the teacher ('we wasn't born then', line 41), and the teacher built on this response. Despite possibly viewing the teacher as having 'closed down' the question 'where's the past?', we can see that at this point he adopted a more interactive and dialogic approach, using the pupils' own contributions as resources in building a meaning-making trajectory about the concept of time in years and particularly hundreds of years. Thus whilst the teacher's primary linguistic tool here would be the question, these questions were also a response to the initial question and response posed by the pupils.

This also identifies how some of the potentially more 'rich points' in teaching-and-learning experiences can arise out of the unexpected, when a teacher feels comfortable to improvise and work with pupils' contributions (Sawyer, 2004). We can see how this chaining of contributions around 'were we born then?' was *progressive* and *cumulative*, by integrating comments about people familiar to the pupils who were not alive in 1666, around use of the digital timeline representation to indicate the scale of time being talked about.

As each of these responses related to the timeline slide on the IWB, and in considering use of the IWB in general educational activity, Littleton (2010) critiqued the often-cited benefit of increased 'pace' arguing that pace can be considered as a matter of degrees. In the extract above we saw how the pupil's question, prompted by use of the timeline slide and unfolding talk around it, opened an opportunity for a temporary *slowing* of lesson pace to respond to the question raised,

identifying that the advantage of controlling pace is not always to be fast. Having described here some of the verbal work around the IWB resource, I now return to some of the written work and annotations made, in correspondence with further talk around the slide.

5.3.3.3 *Building visible and meaningful connections*

As exemplified in the transcribed extract above, the teacher added and identified other dates and historical events in addition to the focal event of the Great Fire. He added the date and label for Guy Fawkes' attempt to blow up parliament in 1605 (lines 62-68), which the class had recently covered – it was early November. He mentioned the school 'family supper' which had taken place the previous evening, referring to it verbally and by pointing to 2009 on the timeline ('right there', lines 56-59), but did not alter the slide to add this detail. In doing this he offered resources and experiences to which pupils could relate, to help them see how the Great Fire 'fit' in relation to other events. He used the three outlined issues of historical time in this endeavour: to view historical time as *sequential* and the key event as a long time ago; to emphasise *segmented* notions of past and present; through specific time *settings* as located examples on the timeline.

Through these references we can see the teacher's spontaneous efforts at 'connection building' (Gee & Green, 1998), identified as an important pedagogic challenge, through 'intercontextuality' (Floriani, 1993): by this I consider how the teacher juxtaposed the recent learning context around Guy Fawkes with the current learning context around the Great Fire, as well as the social event context of the previous day's school family supper. The two historical events of the Great Fire and Guy Fawkes' attempt to blow up parliament were framed as a *distant* time context, relative to the context of the present day, 2009, and the family supper that took place 'a day ago' (line 59). They were however juxtaposed as relevant concerns by being subjects of study within the class's *recent* learning experiences. Thus the teacher used this intercontextual referencing to identify both distance and closeness in time.

This linking to aspects outside of the current teaching-and-learning situation allowed a view of what is not usually available to the researcher: the wider historical context of this class (Mercer & Littleton, 2007). I would not otherwise have known the class had already studied Guy Fawkes, or that they had a school social event the night before. Thus I was given a glimpse of how the teacher had integrated 'multiple timescales' of human social activity (Lemke, 2001b), in bringing previous educational and social activities into the frame of the current activity, as he worked to support development of an intended meaning-making trajectory consolidated through the creation of a technology-mediated improvable object.

This particular interactional moment drawing on what was known about Guy Fawkes can be considered as an educational 'rich point', which was not planned by the teacher, but was built upon as a means of easing the pupils into the historical thinking he was asking them to do. The teacher mentioned this improvisation within his VSRD session, in attempts to offer a familiar context for the pupils to locate the new topic material:

Interview extract 5.1: Improvising to make meaningful connections

Teacher's VSRD session, 03.50-04.29

The extract represents the themes: improvisation from the plan, and connection building.

1. T: luckily a few weeks before this we did do erm, a little bit of work on Guy Fawkes cos
2. it was erm, I think it was bonfire night.
3. Interviewer: I know you mentioned that in there
4. T: Yeah, yeah. I kind of did that on the spot, that wasn't planned. But when erm, we
5. had er, when I was saying 1666 I thought well they know about Guy Fawkes. We talked
6. about it. They could see the dates, 1605, so that these things happened about the
7. same time. And they have seen pictures of Guy Fawkes and you know the, London at
8. the time for those sessions so, I was just trying to give them something to, hold on to,
9. you know something to refer to, while we were doing the timeline.

This potentially marked a key point in the pupils' *instantiated* meaning-making trajectory, which was not planned at the outset by the teacher, of the Great Fire as an event that happened around the same time as Guy Fawkes' attempt to blow up parliament, both of which were located through their annotation onto the timeline resource. This point in the pupils' meaning-making trajectory was potentially at a tangent to the *intended* meaning-making trajectory as envisaged by the teacher, evidencing how meaning making is a co-constructive process, but how talk around improvable objects can juxtapose any such differences that might merit further exploration. This potential difference between intended and instantiated meaning-making trajectories offers a useful way of considering how teaching-and-learning is a dialogic and interactive process, and is addressed in more detail in chapter 7. Here and in later uses I interpret 'intention' in this sense through analysis of the teacher's prepared lesson slides as oriented to the curriculum learning objectives, and through comments made in the interviews.

To return to the current analysis, the IWB slide of the timeline – an element of the teacher's digital toolkit – thus served as a 'stabilising influence' (Ludvigsen, et al., 2011; Roth & Duit, 2003) in this pursuit to locate the Great Fire on a timeline. It can be considered a stabilising influence because only key points the teacher wanted to highlight were annotated and achieved more permanent form, alongside the more elaborated but ephemeral talk around its use, thus offering a stable point of reference for revisiting and to influence the key concepts pupils would remember from the experience. Drawing on Mercer, et al. (2010) this also highlights the beneficial and complex interplay of technical interactivity – interaction with the IWB resource – and dialogic interactivity – interaction through talk, around the IWB resource. Such practice equally illustrates Haldane's (2007) assertion, drawing on Kozma (1994), of the IWB as a stable medium, relative to talk as unstable. The extract however shows that neither of these media was inherently 'better' by being stable or unstable. The instability of talk allows for negotiation and deconstruction of ideas, and the IWB's stability can be used to good pedagogic effect when users are ready to agree and consolidate a point. I would argue therefore that a key finding from my

analysis is that it is in the interplay of the two media, in using the technology-mediated improvable object as an instantiation of a shared, developing meaning-making trajectory, that the learning objective could be seen to be addressed. Although I have predominantly focused so far on interaction around when the timeline slide was used, discussions at this point also influenced later work not directly mediated by this resource, as I now show.

5.3.4 Supporting knowledge building as a cumulative experience

To return to a point made earlier, on confusion over time and particularly notions of past, present and future as sequential or segmented, I present below a short extract also from the first lesson (week 5, class lesson). Pupils were sat at tables with three or four classmates, but each had to produce their own work. Their task was to cut out pictures of buildings and people, and stick them onto a sheet which had columns for 'London in the past' and 'London in the present' (see figure 5.4 below). During the task there remained on the IWB a slide showing the same pictures they had been given (see figure 5.3 below). The pictures on the IWB were in colour, but due to the cost of colour printing the pictures on pupils' sheets were in black and white. The IWB slide of the pictures had been used by the teacher to introduce the task to pupils, and remained on display as a source of reference during the task as the colour and size of the projected images offered more detail they could interrogate. This indicates a use of 'matched resources' (Hennessy & Deaney, 2006) on the part of the teacher (Anwar), in complementing the IWB and paper presentations of the pictures, both of which were referred to by teacher and pupils during the task.

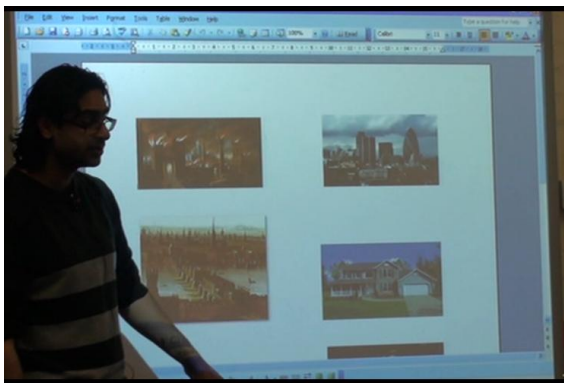


Figure 5.3: Pictures on IWB slide

week 5, class lesson, 26.40



Figure 5.4: Cath answering Lior's question (see lesson extract 5.2)

week 5, class lesson, 31.00

The extract that follows is taken from when pupils were working on this task.

5.3.5 Lesson extract 5.2: Exploring issues of time

Week 5, class lesson, 30.40-31.10

1. Lior (picks up picture she has just cut out, says to Cath sitting next to her): I don't know
2. where this goes
3. Cath (looks up, and points to column on Lior's sheet): There
4. Lior (puts picture down where Cath pointed, then picks it up and puts it in the other column)
5. Cath: We have the Gherkin nowadays (building just mentioned in whole-class introduction to
6. task)
7. Lior (shouts to T): Anwar, what does the present mean again?
8. T: Well
9. Cath (looks up from cutting and says to Lior): Where we are right now.
10. T: Er Cath why don't you answer that one?
11. Cath: Where we are now
12. Lior (looks at Cath)

5.3.6 Commentary to lesson extract 5.2

From this we can see that for some pupils, concepts of past, present and future were still not clear. In the task, the teacher provided pupils with pictures to help them gain an understanding of differences between past and present through visible differences in building materials and how people dressed, and particularly through whether pictures were painted (in the past) or photographed (in the present). Lior herself used this strategy, asking her classmate first of all where a particular picture should fit, to perhaps build for herself a context around which to understand the terms 'past' and 'present'. As Cath possibly sensed Lior still was not convinced (from Lior's moving and then re-moving the picture, line 4), she suggested how the information in the picture gives clues as to whether it is from the past or present ('we have the Gherkin nowadays': line 5). She contextualised the picture as in the present, by drawing on the prior whole-class session where 'the Gherkin' building was identified as a modern building, and so from the present. It is perhaps also important to note that this is a London school, offering a sense of relevance as the Great Fire happened in their city. This allowed direct comparison of images of their city in the past at the time of the Great Fire, with images of their city in the present and buildings they had seen. It therefore served as a connection between the unfamiliar and historical, with the familiar and current – saying 'we have the Gherkin nowadays' may not have the same personal resonance for 6-7 year old pupils in other cities.

Lior however still seemed to feel that her peer's response did not provide her with enough information to understand the difference between the past and present, or to allocate this particular picture to a column, and so she subsequently and directly asked for clarification from her teacher (line 7). Interestingly at this point she changed her question from reference to a specific picture (perhaps knowing that her teacher would not simply tell her the answer, and also given that she had rejected the direct answer just offered by Cath), in asking more generally, 'what does the present mean again?'. Her use of 'again' suggests she was aware they had covered this material, but was still unsure how to apply it within the current task. To consider the

teacher's linguistic toolkit, she framed it as if asking for a 'recap' of material covered (Mercer, 1995), rather than simply to be told something from scratch. Thus Lior acknowledged that the task she was now doing was related to the work they had already done in the lesson – she was building her own connections between lesson activities.

It is interesting also to note that Cath did not give up on feeling that she knew the answer and could help Lior herself, in offering a response to the question Lior posed to the teacher (line 9). The teacher used Cath's response, building on his own authority as teacher to validate Cath's answer, and adopting a more dialogic and interactive approach, in asking her to repeat her answer to Lior's question rather than answering it himself (line 10). In the sense of wanting pupils to 'appropriate' knowledge, and in encouraging a 'multivoiced' (Bakhtin, 1981, 1986) rather than 'monologic' classroom, the teacher aimed to facilitate Cath and Lior in making the concepts their own by encouraging them to use their own words and explanations.

Viewing the lesson as a whole, this short extract is a continuation of the earlier activity around notions of past, present and future, identifying the importance of a temporal view of the lesson data. The pupils were applying, or appropriating, what they had already covered from the whole-class session, within the individual task. They were not however always sure how to do this, which again emphasises the importance of the dialogic nature of the teaching-and-learning relationship. Questions voiced by pupils, whilst raised in genuine confusion and often indicating error or uncertainty, offered 'stepping stones' to the further contextualisation and linking of key lesson concepts and resources in a cumulative re-framing (Alexander, 2008a), along a meaning-making trajectory. The teacher chose not to take the ground back into a transmission, or non-interactive/authoritative frame, but used a more interactive and dialogic approach by drawing on Cath to respond to Lior's query. This identifies a significant point whereby pupils themselves can be resources for each others' learning.

Just as the IWB has been designated as a key item within a teacher's 'digital toolkit', such interactions illustrate how the teacher's different ways of talking with pupils, inviting and responding to their contributions, can evidence the variety of communicative approaches and types of talk drawn on within the 'linguistic toolkit'. This suggests how such mediational means as the timeline can be used as sites to resource and reinforce development of progressive discourse, as an evolving, improvable learning object. With these considerations in mind I now explore how use of the timeline slide shifted over the topic lessons, by presenting and offering a commentary on its use in the eighth and final topic lesson.

5.3.7 Reviewing the progressive discourse: Evolving use of a technology-mediated improvable object

Focusing on the ideas of 'progressive discourse' (Bereiter, 1994), and 'improvable objects', we can consider how the object (timeline slide) was used as a means to evidence progress made. Through its use, ideas around locating the Great Fire in history could be 'reviewed, rethought and revised ... in which the text under construction plays a central role' (Wells, 1999, p. 115). Viewing the object in this way, we can consider how there were both similarities and differences in how the consistent initial resource was used across the eight lessons, but how even seemingly similar uses evolved over time. By revisiting and re-annotating the slide across the lessons, it was employed as a developing resource for exploring new understandings, with the content annotated becoming more focused across lessons.

At this point then it is appropriate to present use of the timeline slide at a later point in the topic lessons, to illustrate this shift in use of the slide and foregrounded modes of communication. The following extract is from the last topic lesson (week 8, hall lesson), at the point where the timeline slide was used.

5.3.8 Lesson extract 5.3: Mediating the consolidation of key points

Week 8, hall lesson, 03.15-03.55

1. T: (uses slide viewer at side of IWB screen to change IWB to show timeline slide: all
2. annotations from previous use had already been removed other than marks to show how
3. to sound out under 'Time Line'. Looks back to Ps, standing side on to IWB) And when did
4. this happen?
5. (few Ps raise hands)
6. T: It happened in (moves hands over Ps) which year (points to P) er Mia?
7. Mia: Sixty sixty six
8. T: Sixty sixty six?
9. (few Ps raise hands)
10. T: (points to Mia and leans towards her) Try again
11. Mia: 1666
12. T: 1666. So (picks up IWB pen, looks at slide)
13. Lior: Anwar?
14. T: Was that yesterday?
15. Ps: No
16. T: (looks at Ps) Was that last week?
17. Ps: No
18. T: How many years ago was it?
19. (few Ps raise hands)
20. T: About how many (lifts hands up and down slightly) years, ago was it (points to P
21. and leans forward) Nina?
22. Nina: 400
23. T: 400 years ago, so (places pen at 2009 marker on slide, marks jump back to 1900) 100
24. (marks jump back to 1800) 200 (marks jump back to 1700) 300 (marks jump back to mid
25. 1600s) about 400 (makes mark a few times in mid 1600s) it was about here. So it

26. happened in (writes '1666' above mark) 1666. (puts pen down)

5.3.9 Commentary to lesson extract 5.3

The most obvious point to note from the two timeline extracts is how much longer the first is than the last. Looking more closely at the content of the talk and use of the timeline resource however, there are clear differences in the nature of interaction between the teacher and pupils, and in the place of the timeline slide within these interactions.

Just as unexpected queries or potential misunderstandings were voiced in the first lesson, a confusion or perhaps mispronunciation also served a pedagogic purpose in the final lesson. When asked the date when the Great Fire happened in the final lesson – in 'setting' the historical event in time – Mia initially replied 'sixty sixty six' (line 7). As this was a public and invited contribution, the teacher immediately followed this up, repeating Mia's suggestion in a questioning tone whereby a number of other pupils raised their hands – presumably guessing that the answer given was incorrect, and that the teacher would invite a further contribution. This demonstrates an 'Initiation-Response-Feedback' (IRF) pattern, common in educational talk (Sinclair & Coulthard, 1975), with the teacher posing a question, a pupil responding, and the teacher providing feedback on this reply. The educational value of this strategy has been questioned by many researchers (including Lemke, 1990; Wood, 1992), but others argue that how pupils' responses are used by the teacher can act as useful connection-building points, rather than as terminal points for evaluation (e.g. Mercer & Dawes, 2008; Wells, 1999). At this point in the lesson therefore, the teacher had four main choices commonly seen in teaching practice: ignore the error; provide the 'correct' answer himself; ask another pupil to answer; or ask the same pupil to have another go. His choice to ask the same pupil to have another go potentially indicates a couple of things:

- he felt the pupils knew the correct answer, so did not need to provide it himself. This is particularly plausible given that it was the eighth and final topic lesson;

- he felt the pupil he had asked had got her words mixed up, rather than not knowing the answer, and so wanted to give her the opportunity to show what she knew instead of casting her as 'wrong' by asking another pupil to correct her.

Given these considerations, Mia was offered the opportunity and was able to provide the correct date on her second invitation (line 11). The teacher acknowledged this instantly in his verbal repetition, and physically a few moments later by writing it onto the timeline, validating the answer through its new permanence in writing on the visual slide (line 26). Thus the incorrect verbal reply had been lost from view, as had the fact that the pupil asked had *made* an incorrect response, whereas the correct reply had been concretised and 'stabilised' (Ludvigsen, et al., 2011; Roth & Duit, 2003) in the locally progressing discourse through its physical addition onto the technology-mediated improvable object. This demonstrated an I-R-I-R-F pattern of interaction, whereby the first 'R' move ('sixty sixty six') was responded to by the teacher in drawing out rather than closing down the exchange.

Across lesson extracts 5.1 and 5.3 it is interesting to note how the prominence of verbal and written modes shifted in emphasising the key date, between the first and last use of the timeline slide. In the first lesson, the teacher went to great efforts to locate and write '1666' at the correct point on the timeline, before he himself said '1666' – addressing the sequencing and setting of time as key features of history discourse. In the final lesson the teacher asked pupils to verbally offer the date, as well as how long ago this was, thus in a more interactive communicative frame, before annotating either onto the slide: utilising the 'technical interactivity' of the IWB (Smith, et al., 2005) *after* the dialogic interactivity of the verbal exchange (Mercer, et al., 2010). We can see in this way how the scaffold of the IWB slide had been more heavily drawn on initially, but how the intellectual effort could be carried sufficiently in talk in the final lesson, with the physical resource all but faded other than as a final consolidation point of the achieved learning objective. Thus my temporal analysis has enabled me to reveal the patterning of this interaction in a

compelling way. Having considered the extracts in detail, I now give some further observations on how use of the resource shifted and stabilised over the eight lessons.

5.3.9.1 Progressive use of the resource

Use of the timeline slide across lessons in the hall and classroom was one means by which the teacher aimed to encourage pupils to link what they were learning in the two contexts, in addressing the pedagogic challenge of 'connection building' between learning experiences and environments. Hennessy's (2011) comment that use of a resource conjures up for users any experiences of its previous use, and frames any future use (also drawing on Floriani, 1993), supports the thinking behind the teacher's intention. Thus the timeline slide was used to 'bridge' (Rogoff, 1990), or provide a linking resource between, the two learning environments, by quickly re-orienting to the topic of the Great Fire of London and its place in sequential time. The evolving use of the same resource was an intuitive response by the teacher to the educational challenge that pupils often do not make links for themselves between learning experiences (as identified by Alexander 2008a; Crook, 1999).

Evolving use of the resource, such as in more rapid recap of previously-annotated points and progressive annotation of fewer points, evidences how the technological tool was used to pedagogic effect to support creation of a technology-mediated improvable object, that in its revisions illustrated the common knowledge available to the group. This evolving annotating and highlighting important features against the consistent timeline resource served to 'stabilise' the discourse about the Great Fire, as the key ideas were reinforced over the eight lessons. In this process the scaffold of the timeline slide became backgrounded in being relied upon less, as pupils' verbal contributions were foregrounded as they were able to structure the ongoing discourse verbally for themselves. The affordances of the IWB allowed these verbal explorations to be added, edited and removed from the timeline slide as required, supporting a physical and verbal work in progress as they were mutually developed.

Particularly in the sense of using the slide as a scaffold, it was evident as the lessons and discussion around material progressed, the teacher felt less need to identify or add certain aspects of the original or improving representation (such as other contextual information, or that 2009 is the present). This in turn made the key points that *were* highlighted each time more salient (that the Great Fire occurred in 1666 and that this was about 400 years ago). As aspects of the conceptual scaffold were no longer required (such as the temporal proximity of Guy Fawkes' attempt to blow up parliament to the Great Fire), they were faded from the discursive, visual and technological scaffold. Therefore the slide and representation were not just added to, or extended, they were used to enable discourse to 'progress', through how they were 'reviewed, rethought and revised'. Thus verbally and visually the class were building a context in which they could learn more about the topic: through the creation and revision of a technology-mediated improvable object.

In this sense, Hennessy (2011) proposed that 'A single rich resource can be progressively manipulated and interacted with in different ways for different purposes, often within the relatively short time period of a lesson' (p. 472). Such use of repetition of resource was identified by Gillen, et al. (2007), as the teacher in their observations combined time on and off the IWB in presenting and re-presenting the everyday image of a kettle boiling to explore the scientific concept of evaporation. Maybin (2006) also articulated the relationship between pupils' verbal repetition and appropriation of subject terms, and use of written texts to scaffold this process. In the lessons I observed the resource was revisited but also re-annotated on successive occasions, allowing the pupils progressively more opportunities to re-construct the events around when the Great Fire occurred, by providing rather than being told information for the teacher to locate the focal event on the timeline resource. This shifting focus when using a resource, from the teacher largely giving to gathering information, identifies how the notion of the technology-mediated improvable object is a useful analytic and theoretical tool in also observing meaning-making trajectories, and how they can be multimodally orchestrated. Such an analytic approach allows for

observation of shifting patterns concerning who offers contributions, how contributions are invited and responded to, and the mode/s in which contributions are offered, grounded within a theoretical view of the mediated nature of learning.

5.3.10 Section summary

Analysis of the data exemplified the search for continuity and cumulation of teaching-and-learning experiences, and attempts made to resource this. The temporal analytic approach enabled exploration of these efforts and activities. Analysis also revealed the important role of talk in the lessons, used to bring salience to key points in resources, activities or experiences (such as dates and concepts of time), and to establish links between these – in connection building. I would argue that this identified talk as the central component of the teacher's mediational toolkit, and in meaning-making activity, as well as the teacher's efforts and resources used to support formation of links between learning experiences. Through my analysis I illustrated how the IWB served as a prompt for dialogue, whereby as a contribution of my work I propose that it is in the interplay of the two media, in using the technology-mediated improvable object as an instantiation of a shared, developing meaning-making trajectory, that the learning objective could be seen to be addressed.

Use of the focal IWB resource shifted across topic lessons, and supported activities around the importance in history of the concept of time. The focal timeline slide was employed in a scaffolding role as a technology-mediated improvable object, prepared beforehand by the teacher, which could be manipulated as required and faded as it was needed less. Through my analysis, it became evident that the IWB slide was being configured in the co-construction, continuity and cumulation of knowledge-building activity – harnessing the pedagogic benefits of technological and non-technological tools.

Cumulative meaning-making trajectories were evident in the changing patterns of interaction/annotation with the resource, and (progressive) discursive activity around its use. Such cumulative meaning-making trajectories were not however always linear, as concepts were returned to and re-constructed to support developing understanding, sometimes in a more cyclical or tangential sense. With this in mind therefore, I used my theoretical framework to suggest that there were differences at times between the teacher's *intended* and pupils' *instantiated* meaning-making trajectories, as revealed in references made to resources and key issues. This may not on the surface appear to be a desirable scenario, but I outlined how deviations from a planned path can offer valuable responsive, dialogic and cumulative teaching-and-learning opportunities. I explore this distinction between intended and instantiated meaning-making trajectories, and how they could be educationally significant, in more detail in chapter 7.

Having addressed the issue of time, particularly around use of a focal IWB resource, in the next section I address the use and interpretation of evidence in terms of how it was demonstrated and appropriated, as a further feature of history discourse.

5.4 Use and interpretation of evidence in the developing history discourse: Complementary and conflicting use of terms

In this section I illustrate how the teacher and dance specialist attempted to support pupils in appreciating the use and interpretation of evidence as a relevant concern in history discourse and practice. I address how different discourses were brought into contact through lesson activities, and through a detailed analysis of the use of key terms across the lessons I suggest how this may have influenced pupils' appropriation of these terms. Due to the nature of focusing on patterns of talk within this endeavour, it is appropriate in this section to present both quantitative and qualitative elements of SCDA, whereas in the previous section I used qualitative analysis to address fewer but longer interactions in more detail. To open this section I present findings from

the quantitative concordance analysis, and how I interrogated these to address patterns in terms of reference to use or interpretation of evidence around the historical topic.

5.4.1 Identifying the language of use and interpretation of evidence: Quantitative analysis

I used concordance software initially to identify which words were used most frequently across the transcripts of the eight lessons, and which words tended to cluster (be chained together) or collocate with (be used near to) those terms. In this section I focus on use of the term 'spread', as it appeared more specifically topic related than the other verbs that occurred more frequently (see table 5.1 below), but also because of 'the company it keeps' (to paraphrase Mercer, 2004) in terms of its common collocates and clustering terms within the transcripts. The most common collocates for 'spread' were:

'the' (138),

'fire' (112),

'quickly' (88),

'because' (60),

and 'it' (43).

The most common three word clusters including the word 'spread' were:

'the fire spread' (57),

'spread quickly because' (37),

and 'fire spread quickly' (33).

These figures potentially indicate the search for explanations and development of reasoning around why the fire spread – through linking the fact (that the fire spread), to the reasons for this ('because...') – to understand rather than simply learn rote facts about the historical event. They also indicate that the term 'spread' was a keyword within the lessons and around the topic of concern, making it worthy of further analysis here.

From the initial keyword list generated, the term 'spread' was the 110th most commonly-used word in the transcribed lessons, with 104 uses: if this count includes the terms 'spreading' (41) and 'spreads' (1), it would make the term the 79th most commonly-used, with 146 uses. In comparing this with the other verbs used, and if different forms of the same verb are also combined (such as: is, are, was, were, be and am), this would make 'to spread' the 12th most common verb, as shown in table 5.1.

Table 5.1: Frequency of verbs in the lesson transcripts

Verb	Frequency
To be (is, are, was, were, be, am)	1609
To do (do, did, done, does)	943
To be able (can, could, able)	745
To go (going, go, goes, gone)	628
To have (have, had, has)	453
To look (look, looking, looks, looked)	268
To see (see, seen, seeing, sees)	255
To like* (like, liked, likes)	248
To say (say, says, saying)	183

To think (think, thinking, thinks)	173
To know (know, knew, knows)	164
To spread (spread, spreading, spreads)	146

* 'like' was not always used as a verb, such as in the sentence:

T: 'Like they didn't really expect that a huge fire was going to come did they, until it did' (week 7, class lesson, 14.58-15.03)

I had thought, from my notes kept of the lessons, that the teacher and dance specialist had been encouraging pupils to use 'spread' instead of 'go' or 'move' to describe the progression of the fire through the city, in an attempt to support development of use of terms more relevant to the topic of the movement of the fire than to general movement. Therefore I used the transcripts to count the number of times the teacher and dance specialist used 'spread' (including 'spreads' and 'spreading') in reference to the fire for each lesson, and the same for the pupils, thinking there might be a development in pupils' use of the word (see table 5.2 and figure 5.5). This did not really seem to be the case, as the table and figure indicate there was no consistent progression or pattern in use of the term by either practitioners or pupils. By looking more closely at the words used however some other issues of potential significance began to become evident.

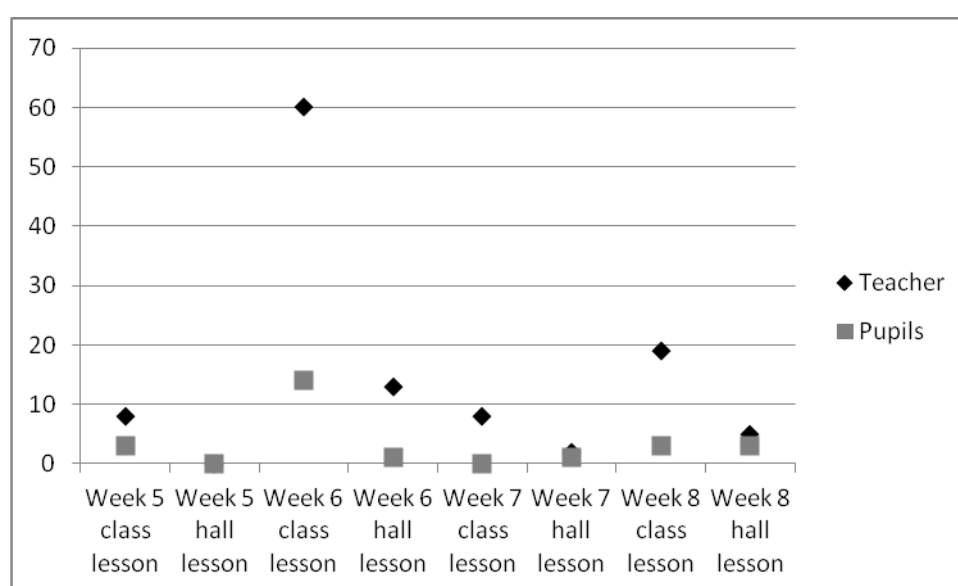
Table 5.2: Use of 'spread' across the lessons

	Week 5 class lesson		Week 5 hall lesson		Week 6 class lesson		Week 6 hall lesson		Week 7 class lesson		Week 7 hall lesson		Week 8 class lesson		Week 8 hall lesson	
	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P
Spread	5	1			55	12	10	1	6		2	1	2		2	1
									V:1							
Spread-ing	3	2			4	2	3		1				17	3	3	2
Spreads					1											
Total	8	3	0	0	60	14	13	1	8	0	2	1	19	3	5	3

T = Teacher/dance specialist; P = Pupils; V = Video

N.B. The week 6 class lesson was when they particularly concentrated on reasons for why the fire spread and stopped, including a task to cut out and put together reason statements, explaining the high use of 'spread' in this lesson as the task was introduced and worked on. I return to this in section 5.4.2.10.

Figure 5.5: Use of 'spread' across the lessons

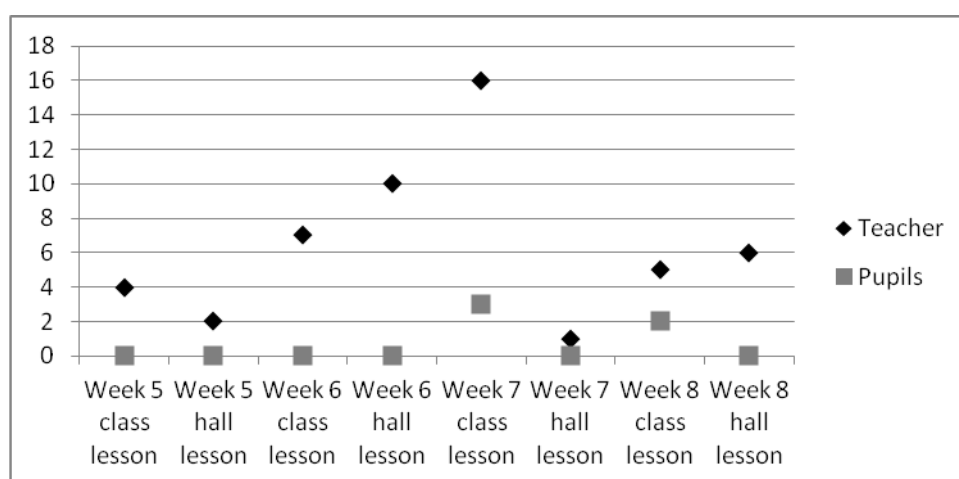


In following my line of thinking that the teacher and dance specialist were encouraging pupils to use 'spread' rather than 'go' or 'move' to describe movement of the fire, I used the transcripts to count the number of times the teacher or dance specialist and pupils used the words 'go' (including 'going') and 'move' (including 'moving') when talking about movement of the fire, for each of the eight lessons. This did not therefore include use of 'go' or 'move' to refer to general movement or other references. As identified above, I expected this to go down for the pupils, and to be constantly low for the teacher and dance specialist (see table 5.3 and figure 5.6). It emerged that 'move' was not used by pupils or practitioners to refer to fire movement, but I explore below how this term entered the frame.

Table 5.3: Use of 'go' in reference to the fire

	Week 5 class lesson		Week 5 hall lesson		Week 6 class lesson		Week 6 hall lesson		Week 7 class lesson		Week 7 hall lesson		Week 8 class lesson		Week 8 hall lesson	
	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P
Go/ing	4	0	2	0	7	0	10	0	16	3	1	0	5	2	6	0

Figure 5.6: Use of 'go' in reference to the fire



As the tables and figures show, there did not appear to be a pattern of increasing or decreasing use of such terms by pupils or practitioners. I therefore returned to the transcripts to look in more detail at how the terms were used, which I now present through my qualitative analysis findings.

5.4.2 Identifying the language of use and interpretation of evidence: Qualitative analysis

On returning to the transcripts, what became evident was that the teacher and dance specialist also used 'go' and 'move' to refer to representations of movement of the fire, particularly when including a movement activity where pupils were asked to 'move' or 'go' *as the fire* (see table 5.4). This highlights a potential conflict between the topic discourse around the Great Fire, and the discourse of movement/dance, which I explore in this section.

As identified at the start of the chapter, I chose to look at phases of use rather than each instance where a term was used, to address in more detail how the words 'go', 'move' and 'spread' were used by practitioners and pupils. Any phase (defined in section 5.2) may therefore include more than one use of any of the key words I identified – see below for an annotated example of a phase, and table (table 5.4) of the different uses of the words.

5.4.2.1 Example of a phase

Week 5, class lesson, 15.10-15.35

[teacher 'spread' fire]

[teacher 'go' fire]

1. T: Because September isn't too long after the summer, the city was very, very dry. So
2. strong winds, fanned the flames, which made them spread even quicker. So the wind,
3. was pushing the fire, onto different buildings. So the wind was fanning the flames. It
4. was making it bigger
5. Ps: The wind
6. T: And it was going across onto different, the fire was spreading across

Table 5.4: Types of use of 'go', 'move' and 'spread'

Use of term in phase	Teacher	Dance specialist	Both T and DS in same phase	Pupil
'go' fire	17			4
'go' fire movement activity	13	11	4	1
'go' movement	41	9	3	2
'go' invite contribution	32	1		
'go' other	114 (TA: 1)	71	3	17
'move' fire movement activity	5	14	5	
'move' movement	26	15	3	1
'move' other	1			
'spread' fire	52 (Video: 1)	2	1	18
'spread' fire movement activity	1	2		
'spread' movement	2			
'spread' other	1 (Video: 1)			

When looking at how the words 'go', 'move' and 'spread' were used by teacher, dance specialist and pupils (and two instances in a video played by the teacher), we can start to see a clearer picture of how the terms were used to achieve different aims, as I illustrate below with extracts from the transcripts. (It is important to note that the dance specialist was only present in hall lessons, and so in four of the eight lessons, whereas the teacher was present in all eight lessons.)

Overall the teacher and dance specialist used the term 'go' in more phases than 'move' or 'spread'. Referring to the Great Fire of London as a historical event however the teacher and

dance specialist used 'spread' (55 phases) in more phases than 'go' (17 phases) or 'move' (none). Interestingly there was a more even number of phases where 'go' was used by the practitioners across references to the fire itself (17 phases), movement activity of the fire (28 phases), movement in general (53 phases), and inviting contributions from pupils (e.g. 'go on', 33 phases – I revisit this latter use in chapter 7). Within this, the class teacher tended to use 'go' more often to refer to movement in general (41 phases) or to invite contribution (32 phases), whereas the dance specialist more often used 'go' related to movement activity of the fire (11 phases) or movement in general (nine phases). Use of 'spread' by the teacher was almost exclusively kept for reference to the historical topic, and was used only minimally by the dance specialist (in four phases across all types of use). Equally while pupils referred to the fire as a historical topic 'going' proportionally more than the teacher (four phases), this was drastically outnumbered by the number of phases where they referred in this sense to the 'spread' of the fire (18 phases). The pupils did not use 'spread' in any other context than to describe the movement of the fire. Based on these figures, I now illustrate broad patterns in the data of how the terms were used by the practitioners and pupils, and how use shifted or differed across the lessons and type of lessons (classroom or hall).

5.4.2.2 Integrated use of topic discourse without apparent confusion

In the early lessons the teacher introduced the Great Fire topic by integrating the key phrase regarding the 'spread' of the fire into his description. We can consider this in different ways. We can think about the *subject* discourse the teacher was promoting, through ways to talk about notions of time, and use and interpretation of evidence. Within this we can think about key terms and phrases, such as the use of 'spread' to describe movement of the fire, as a more specific *topic* discourse within the overarching history framework. This contrasts with a movement discourse to refer to acts of physical movement, which was also relevant due to the use of movement in the programme to address subject concepts. This distinction of discourses in theoretical terms, but integrated use of discourses in the practical activity of the lessons, is pertinent to my ongoing analysis. I now illustrate such use as a means of analysing pupils' progressive appropriation of

topic discourse, and possible implications of how use of specific terms may have conflicted with others.

The first example is from the first topic lesson, and we can clearly see the contextualised reference to the fire 'spreading', alongside the practice within history to provide evidence for claims. Here there appeared to be no confusion of the focal term, as the teacher read the first sentence from his prepared IWB screen.

Lesson extract 5.4: Contextualised use of topic terms

Week 5, class lesson, 16.26-16.50

[teacher 'spread' fire]

1. T: Once these [houses] caught fire, a strong wind spread the flames into the city. So, we
2. can see, that the winds were fanning the flames across the city, and all the houses
3. were made of wood. And all the houses were really bunched up together as well. So as
4. soon as one building caught fire, the next building would catch fire, and the next one,
5. and the next one, and the next one.
6. Lior: When did the fire stop?
7. T: Well, let's keep reading.

Commentary to lesson extract 5.4

In this extract we see the teacher linking information about the historical event and framing the facts within history discourse (through referring to his IWB slide as a source of evidence) and topic discourse (of the fire 'spreading'). In this sense he was perhaps aiming to cover the learning of subject content, and subject and topic discourse at the same time, without making explicit that there might be 'key' terms or phrases within his explanation. At this point in the topic lessons no explicit movement activities had been used to represent subject concepts, and no references to anything 'going' or 'moving' had been made. Equally however, pupil input had been minimal. A

pupil question at the end of the extract was taken up by the teacher, but to refer back to the ongoing authoritative text of his prepared agenda and resource. This is perhaps normal practice for a teacher introducing a new topic.

In contrast to this seemingly smooth embedded use of key terms, there were instances in the data where there were mixed terms used to describe the historical topic, resulting in a potential confusion of what was 'appropriate' within the historical topic discourse.

5.4.2.3 Mixing discourses

In thinking about how a teacher may promote a subject discourse or concept, and respond to pupils' queries, Roth and Duit's (2003) concepts of 'interpretive flexibility' and 'interactive stabilisation' are relevant. This can be aligned with Ludvigsen, et al.'s (2011) notion of working toward 'stability' out of 'flux', and how concepts and growing conceptual understanding can be manipulated through interaction. Roth and Duit identified that pupils can reach conclusions that are both unexpected by the teacher, and perhaps 'incorrect' in the eyes of the subject discipline and curriculum. Within such a scenario, a teacher can be either a stabilising or destabilising influence, in suggesting alternatives for pupils to consider and thus encouraging them to strengthen or adapt their justification, in persuading them toward a different view, or inadvertently in mixing everyday and subject terms and discourses. Thus how stability of understanding is achieved through flux and flexibility of terms used is an important issue to consider here, in thinking about how the teacher and dance specialist prompted pupils to use certain terms over others. The link between repetition and appropriation highlighted by Maybin (2006) will only be successful if the same terms are repeated in a similar context of use.

Within this section of analysis, the concept of 'meaning potential' (Furberg, 2010; Furberg & Ludvigsen, 2008, drawing on Kress, 2003) is particularly pertinent to a sociocultural consideration of the negotiable, constructed and contextualised nature of knowledge, whereby meanings are

made out of the dialogic exchange and negotiation of potential meanings available. In the context of my data it became evident that there were different ways to interpret and apply the same terms, and different terms used to express similar meanings, across and within contexts of use (notably of 'go' and 'spread'). 'Meaning potential' is therefore one concept which informs my analysis of the 'meaning-making trajectory', as mentioned earlier, in terms of how multiple meaning potentials can lead to differences between a teacher's intended and pupils' instantiated meaning-making trajectories. I now outline some of these meaning potentials as they were brought into contact through interaction, which were then built on in constructing a shared, instantiated meaning-making trajectory. The extract below illustrates some of the meaning making around the terms 'go' and 'spread', also within the first topic lesson.

Lesson extract 5.5: Mixing terms

Week 5, class lesson, 15.10-15.35

[teacher 'spread' fire]

[teacher 'go' fire]

1. T: Because September isn't too long after the summer, the city was very, very dry. So
2. strong winds, fanned the flames, which made them spread even quicker. So the wind,
3. was pushing the fire, onto different buildings. So the wind was fanning the flames. It
4. was making it bigger
5. Ps: The wind
6. T: And it was going across onto different, the fire was spreading across

Commentary to lesson extract 5.5

In the example above, the term 'spread' was used in the teacher's initial description (line 2), and then seemingly to check and replace his use of 'go' to refer to movement of the fire (line 6). We see therefore how easy it would be for pupils to select the 'inappropriate' term, when a number of terms were used apparently to relate the same concept.

In the next section I explore the different modes employed to describe and represent the events of the Great Fire as pupils recreated their own sources of evidence, firstly through painting.

5.4.2.4 Interpreting evidence and making meaning through painting

In line with the practices of studying history, the teacher presented and referred to sources of evidence from which to relate key issues. These acted both as authoritative texts, and other modal resources in addition to the teacher's verbal explanations. One of these sources was paintings (identified as representative of past methods of recording events in section 5.3, and in chapter 6). The extract below illustrates how the teacher framed his verbal annotation, movement and gesture around an image of a painting within his prepared IWB slides, to make key features salient. From this we see however the varied use of terms to describe movement of the fire (as underlined on the extract), none of which were necessarily wrong, may perhaps have exacerbated difficulties in the teacher's intention for pupils to refer to the 'spread' of the fire:

Lesson extract 5.6: Multimodal resourcing and mixing vivid descriptions

Week 6, class lesson, 12.31-13.28

1. T: So, if you look at this (points to image on slide) picture here... the flames (tilts hand in
2. same direction as flames on image) are all facing which way? (lowers hand, looks back
3. to Ps)
4. Mia: That way
5. T: All the fire, who's doing that? (pause) Is it Superman blowing? (makes blowing gesture)
6. Ps: No
7. T: What's happening? Who, is pushing (moves hand to other side of slide) it that way?
8. Ps: (intake of breath, raise hands)
9. T: I'm not doing it. (points to chest) Can people (makes pushing motion) push the fire?
10. How did it happen? How is the fire going that way? (points to P)
11. Nina: From the wind

12. T: The wind, well done. So the wind, was, was (pushes hands away from his body)
13. blowing, all the fire across from (jumps hand across points on image on IWB slide)
14. house to house. So that's one very important reason why the fire was spreading so
15. quickly.

Commentary to lesson extract 5.6

We can see here how exploiting the multimodality of classroom interaction supported conceptual understanding of the issue, with teacher talk used to narrate static image and dynamic movement, and to bring pupils into constructing meaning around the resources. The mixture of terms used however is apparent: in working across ways to talk about movement of the fire, the influence of the wind, and a physical means to demonstrate such movement. Although the above extract was taken from the third of eight lessons, and so relatively early in the series, it is understandable how the pupils began to pick up the terms used by the teacher, which may have fuelled their continued mixture of terms to describe fire movement. Interestingly the term the pupils tended not to instantly pick up in the lessons was of the fire 'spreading' (used here by the teacher in line 14), which is the key term the teacher seemed to be trying to emphasise particularly through the latter lessons, as I outline below.

Similar patterns of talk were noticeable when pupils were making their own painted versions of the Great Fire in the fifth topic lesson. At this point, when asked about how to represent the wind in the painting, the teacher replied, 'draw the fire going in one direction'. The teacher adequately supported the pupil in doing the task, but it may also have supported pupils' references to the fire 'going' rather than the preferred term 'spreading'. Such patterns of talking mirrored the movement activities in the hall that were used to represent the fire going/spreading/moving over, under, around and through, as I pick up shortly, and were repeated as the teacher presented some pupils' paintings at the end of the lesson:

Lesson extract 5.7: Checking evidence in a pupil's painting, framed by a movement discourse

Week 7, class lesson, 42.08-42.28

[teacher 'go' other]

[teacher 'go' fire]

1. T: This is by Cath. And she's gone for different-sized buildings, has she got different-sized
2. buildings again?
3. Ps: Yeah
4. T: And the fire, is it going in one direction?
5. Ps: Yes
6. T: Are the buildings close together?
7. Ps: Yes
8. T: I love the effect that she used on the fire. She's used long flicks. Cos the fire, it wasn't
9. just a tiny little fire was it? It was a big, huge fire, and it's all going across in one
10. direction.

Commentary to lesson extract 5.7

As this was part of a general summarising section at the end of a lesson, framed around and in showing the resource of the pupils' paintings to the class, the teacher adopted a quick-fire IRF-style interaction, to review the key points and include pupils in the exchange, but without asking for new information. The painting the teacher held up was used as a source of evidence for the pupils to refer to in answering the teacher's questions, and to reinforce the key points he wanted pupils to learn, just as they had created the paintings to represent sources of evidence about the Great Fire topic they were learning about. Thus the teacher effectively combined the *history subject discourse* (about sources of evidence) with the learning of *topic content* (about the Great Fire). The use however of *topic discourse* (i.e. use of 'spread' to relate to the movement of the Great Fire) may at times have been confused with a more everyday, or movement-based discourse (lines 4 and 9).

As well as paintings, one mode that particularly featured within these lessons was movement, and I now discuss how this may have influenced the development of the topic discourse.

5.4.2.5 Interpreting evidence and making meaning through physical representation

Within my data and the context of the history curriculum, movement was used to explore the progression, or 'spread', of the Great Fire. The teacher however was at pains to ensure that the historical content and subject and topic discourse were not lost among the movement activity, and that pupils were able to see that the activities in both classroom and hall lessons were linked. This was something he was keen to stress in his pre-interview:

Interview extract 5.2: Making multimodal connections

Teacher's pre-interview, 02.31-03.14

The extract represents the themes: connection building, and interpreting concepts across modes.

1. T: The anxiety I have is that the children might not make that link. Erm, they might not
2. see it [dance activity] as, anything to do with the topic. They might just get into the
3. movements, which is still good but, you know that's, we do that in PE anyway
4. Interviewer: Yeah
5. T: It's not really gonna be productive unless they're getting something from it, er, that
6. they can use again, in the classroom, or at home or, if they're not applying the
7. knowledge independently, outside of erm, outside of er, erm, a learning environment
8. or, you know, a setting like the dance setting, then there's no point really. The main
9. thing is that they, they, they get it, and they use it, and they understand it.

With this in mind, we can consider Säljö's (1999) comment that 'learning is in the co-ordination between language and experience' (p. 159), which is precisely what the teacher was attempting to manage. It seems however that confusion or contradiction can also occur, and so it is the success or otherwise of this process of co-ordination that was crucial in forming these links.

Within the efforts to resource learning of the Great Fire through movement activity, we can consider Lemke's (1998) notion of 'multiplying meaning', whereby: 'meanings made with each functional resource in each semiotic modality can modulate meanings of each kind in each other semiotic modality, thus *multiplying* the set of possible meanings that can be made' (author's italic, p. 92). This returns us to the issue of 'meaning potential', which could be a rich resource, but should be monitored in order that links are made between modal information, in making meaning, rather than merely overwhelming pupils with a multimodal array. Applied to my data, use of each mode (e.g. speaking, moving, painting, writing) was for the most part intentional and conscious, with the communicator using the most appropriate means of communication for a given task. Where movement as a communicative act has predominantly been considered by other researchers in terms of smaller movements or gestures however (e.g. Goodwin, 2007), in my analysis I addressed use of whole body representation in supporting the development of conceptual and verbally-expressed understanding.

Whilst I agree with Lemke's argument that each mode is used to do largely different tasks, I argue that the written or spoken word will most likely still be used to draw salience to key points in a graphical, pictorial or physical representation. This identifies again that although communication may be multimodal, and although language may not be the most appropriate tool for every communicative act, it is language that draws together the information within each mode, as illustrated in the next extract.

Lesson extract 5.8: Using talk to contextualise the physical representation of the fire

Week 5, hall lesson, 27.25-27.50

[teacher 'go' other]

[teacher 'go' fire movement]

1. DS: And we're gonna pretend that we're fire, (moves arm from right, upwards and down
2. to the left) going over

3. All: (DS scoops arms low and back up again) under, (DS and some Ps circle right arm
4. around their head) around and (DS and most Ps push arms together and forward)
5. through
6. DS: some of these buildings that we're going to make. OK so (balancing motion with two
7. hands) we're gonna swap over. So half (raises right hand) of us are going to be the
8. different shaped buildings, (lowers right hand and raises left hand) and the other half
9. are going to be the fire going around (circles right hand around lifted left hand) our
10. partner. Then (moves right hand over to right side of body) we're going to swap over.

Commentary to lesson extract 5.8

In the above extract, the dance specialist demonstrated and encouraged the pupils to use arm movements when saying the words over, under, around and through (lines 1-5), referring to the movement of the pupils as they represented the fire, rather than explicitly to the historical movement of the Great Fire of London. The dance specialist did however employ a connection-building technique, in linking the physical activity to the relationship between the buildings and the fire at the time. Pozzer-Ardenghi and Roth (2007) also made a performative reference to the importance of bodily communication within the teaching-and-learning experience:

What is called teaching, therefore, involves not only the words and sentences a teacher utters and writes on the board during a lesson, but also all the hands/arms gestures, body movements, and facial expressions a teacher *performs* in the classroom. All of these communicative modalities constitute resources that are made available to students for making sense of and learning from lectures... The purpose of this position paper is to *argue* for a different view of concepts in lectures: they are performed simultaneously drawing on and producing multiple resources that are different expressions of the same holistic meaning unit. (authors' italic, p. 96)

Such a view can be conceptualised as an embodied version of 'matched resources', whereby different resources offer access to the same concept. It is however important to emphasise that

use of some of these 'resources' in Pozzer-Ardenghi and Roth's observations may or may not be conscious, such as facial expression or gesture in emphasising a point. Thus I would argue that the different modalities make up not 'different expressions of the same holistic meaning unit', but that information in each modality provides a piece of the picture or story (to show both pictorial and linguistic influences) that together offer a composite meaning unit. I argue this because taking away one of the modalities used would in many cases potentially alter the meaning conveyed, constructed and interpreted. This I argue is the crux and the result of my combining a focus on talk with attention to the use of movement within my analysis, to view the integrative nature of communication across modes. Aligned to the extract above, the arm movements (as used across lines 1-5) had been introduced to represent the actions of 'over, under, around and through', and were given meaning in the context of the Great Fire topic, where movement and history topic discourse were brought together. The dance specialist had just shown the pupils the arm movements alongside the words over, under, around and through, and so they were able to join in with the representation in both movement and spoken modes.

Pozzer-Ardenghi and Roth identified that perhaps the *type* of concept being covered was also relevant and influential on modes of communication in teaching-and-learning complex concepts:

Static phenomena might lend themselves to presentations primarily using words— the categorical nature of facts and the categorical (i.e., typological, Lemke, 1998) nature of words share structural features. But dynamic processes are difficult to communicate by means of words, for processes involve changes, which are more easily articulated by means that are topological in nature. (p. 106)

Within the context of my data therefore, this would offer a theoretical grounding for the use of movement activity in covering the issue of how the Great Fire spread through the city of London, and how it was stopped. Even given Pozzer-Ardenghi and Roth's statement however, it would be unusual to have any representation that is completely void of spoken or written information.

Here language is used to contextualise the visual or physical representation, which thus

underscores the role of language, specialised in the form of topic discourse, as at the heart of communication of subject domains. The other modes may however prove crucial in the conceptual development and further refinement of such discursive understanding. This is exemplified in the introduction of the physical activity in the extract above, to give a reason for what they were doing and ground it within the history curriculum (if perhaps not the topic discourse), and subsequent recap references to this activity in later lessons. Such activity offered to the pupils an awareness of the sources and interpretation of evidence of the historical event, as well as their own re-presentations of these sources of evidence as more personal reference points within their developing meaning-making trajectories. In addition to the use of movement, the teacher also employed video and images to offer different sources of evidence and focus more explicitly on historical content and discourse.

5.4.2.6 Interpreting evidence and making meaning through video and photographs

Direct factual presentation of the events of the Great Fire was supported by the teacher's re-presentation through a video within his IWB resources. The video contained static images and spoken narration, as illustrated in the following extract.

Lesson extract 5.9: Using a video resource to reinforce the topic discourse

Week 7, class lesson, 12.34-12.40

1. Video: The fire started in Pudding Lane. It spread quickly and was a huge disaster.

Commentary to lesson extract 5.9

Perhaps one reason and benefit of embedding such a tool within his teaching resources, was that the video offered an alternative but equally authoritative source of evidence to the teacher's own voice and prepared slides. Being used in the fifth topic lesson, it also offered a different way of showing information they had already covered in earlier lessons, in a continuous frame, and juxtaposed image with speech to address topic content. As Littleton, et al. (2010) argue, regarding

the repetition of a concept during lessons in their data, 'Perhaps, too, it is the making use of multiple repetitions across semiotic domains, in different combinations, that conspire to make the very repetitions constantly engaging rather than boring, and challenging rather than patronizing?' (p. 138). Such a consideration of the re-presentation of material appeared to be relevant within the context of my data collection. The video offered a clear use of 'spread' to refer to movement of the fire, and offered another source of evidence and interpretation for pupils to draw on in making meaning around the history topic. It also combined image with speech, to offer a visual resource context in which to locate the new topic discourse.

Further use of images through taking photographs of pupils in the movement lessons as they made representations of the fire and buildings also offered an alternative resource to talk about movement of the fire. Again however the distinction between the discourse to talk about movement of the fire and of movement in general was not always clear for the pupils. This creation of physical representations of fire movement offered an alternative entry point into the topic discourse from the traditional dominance of talking, reading and writing. Equally, taking photographs and video of pupils' movement representations of the fire and buildings offered pupils an opportunity to see their own work, and also to use the tools that mediated their learning activities (in this case using the PSP). The following extract is taken from the sixth topic lesson when the class were viewing photographs back, taken by a pupil on the PSP a few minutes earlier, of physical activity to represent movement of the fire. The pupils were crowded around the dance specialist who was holding the PSP as she showed and described the photographs.

Lesson extract 5.10: Viewing and describing pupils' physical representations, and controlling lesson pace

Week 7, hall lesson, 44.12-44.34

[teacher 'move' fire movement]

1. DS: Look at that, that's a fantastic photo. Look at those interesting shapes. Brilliant. Oh

2. that's a terrible photo of me. Great... Excellent. That was one of a jump so it's a little
3. bit blurry. And there's the fire. See the fire's about to move over.

Commentary to lesson extract 5.10

Such activity offered both a visual and verbal way for the pupils to conceptualise their physical representations of the fire, using evidence of their physical activity *immediately* after having done it, to interpret the events of the Great Fire. Thus in one sense the lesson pace can be considered to be slowed at this point, to re-view an activity just done. Alternatively the pace with which the photographs were captured and then re-presented to pupils was far quicker than the production and use of most lesson resources. In this sense, this was a valuable alignment of speeding up the practical pace of resource production, with a pedagogic slowing to support the development of conceptual understanding, to show that enhancing pace in lessons is not a simple matter of moving quickly through. I will now look in more detail at some of the progression of discourse around the descriptions of physical representation, and conceptual movement, of the fire.

5.4.2.7 Interpreting evidence and making meaning through developing and conflicting discourses

In using the pupils' movement to represent activity of the fire, the mixing of discourses became apparent. Such mixing spanned the four lessons in the hall in particular, such as in exposing a practical need which potentially conflicted with the pedagogic content. This can be seen in the following joint construction by the two practitioners in the final topic lesson as they set up a movement activity.

Lesson extract 5.11: Attending to practical and pedagogic purposes, through movement and topic discourses

Week 8, hall lesson, 23.23-23.37

[teacher 'spread' fire movement]

[teacher 'move' movement]

1. DS: I know that the houses were really crowded together in the past, but can we have a
2. little bit more space between you
3. T: cos it's really
4. DS: so that the fire to spread a little bit easier
5. T: that's it, move down a little bit.

Commentary to lesson extract 5.11

In the above extract it was the dance specialist who reinforced the topic discourse, while relating to pupils' physical representation of the fire, whereas the teacher adopted the movement discourse as they both attended to the practical, movement issues of depicting the fire scene. In thinking how terms and concepts are brought into discursive interaction, many researchers within the sociocultural tradition have emphasised 'the discursive nature of human knowledge' (Säljö, 1996, p. 1). Thus knowledge is considered in terms of knowledge construction, through action and interaction. As mentioned above then it is perhaps more appropriate to think of 'meaning potentials', and how any knowledge or meanings made from interaction with and negotiation of concepts are appropriated in the context of use, and how these may differ on different occasions or for different interactional participants. In light of my data therefore, it is possible that the different meaning potentials of 'go', 'move' and 'spread' in particular were considered to be interchangeable by the pupils rather than subject specific, perhaps in part due to unintentional mixture of use by the teacher and dance specialist.

Another such mixture of key terms across the movement and topic discourses also occurred at an earlier point in the final hall lesson, this time incorporating the term 'spread' to describe pupils' movement as a representation of the fire when introducing the physical activity.

Lesson extract 5.12: Integrating movement and topic terms – linking content and activity, and merging discourses?

Week 8, hall lesson, 05.55-06.30

[teacher 'go' movement]

[teacher 'spread' fire movement]

[teacher 'move' fire movement]

1. T: (off camera) How can you stretch? Show me different stretching movements. Are you
2. ready? OK one, two, three go. (pause, a few pupils demonstrate the actions) Bigger
3. stretches, bigger stretches, go on, bigger legs. Careful
4. DS: Remember we talked about that these are all actions that the fire does. So when
5. we're stretching it's the fire that's reaching (stretches arms up and leg back out), and
6. spreading isn't it. And when we're turning, we can turn (turns standing up tall with
7. arms out) in different ways can't we Alice? We can turn (crouches and turns) low, we
8. can turn up high, and (makes circling motion with hand) quickly. Cos the fire moves in
9. different ways.

Commentary to lesson extract 5.12

In this mixing of terms to describe physical and represented fire movement, we could consider the practitioners as destabilising influences in the appropriation of a topic discourse. Some destabilising influences might be pedagogically beneficial, such as in a teacher suggesting alternative options for pupils to consider without priming one as 'correct'. However, in lesson extracts 5.11 and 5.12 above, the pupils may have found it difficult to identify whether there were different discourses in play at all, and if so, which to use in which subject or topic context. For

instance, in the context of this topic-based movement activity, the teacher used the word 'go' to refer to physical movement (lesson extract 5.12, lines 2 and 3). The dance specialist's actions consolidated the movement discourse (lines 5-8), whilst incorporating terms from the topic (lines 5-6) and movement discourses (line 8), but to talk about pupils' physical representation of the fire movement (lines 5-6) and of movement in general (lines 6-8). Contained within attempts to represent movement of the fire is a consideration of embodiment (as identified in chapter 2 and addressed in more detail in chapter 6), and development of specific discourses relevant to the concept being represented and the means or mode through which it is represented – i.e. does the activity support learning a means to talk about the physical representation or the concept being represented? From my data the activity appeared to support conceptual understanding but not necessarily always an 'appropriate' topic discourse for expression. I now illustrate this with a view to the issue of embodiment.

5.4.2.8 Interpreting evidence and making meaning through embodiment

Such a discourse related to physically acting out the fire was noticeable at a number of points particularly in the hall lessons, as in the following extract:

Lesson extract 5.13: Embodying the physicality of the fire

Week 6, hall lesson, 39.29-39.31 and 41.26-41.33 (teacher's microphone)

[teacher 'move' fire movement]

[teacher 'go' fire movement]

1. DS: OK she (referring to P representing the fire) can't move until the buildings (referring
2. to Ps in a line representing the buildings) are really still... Fantastic. Wow, look at that
3. fire go. Great.

Commentary to lesson extract 5.13

In this extract, we see how 'she' (line 1) and 'that fire' (lines 2-3) were used interchangeably to refer to a pupil as an embodied representation of the fire. Equally, the dance specialist spoke of 'the buildings' (line 1) to refer to the other pupils in the activity. Within this role play activity the movement discourse was privileged over the historical topic discourse, although it was the historical topic that provided the content to be represented in movement.

By empowering the pupils to create their own evidence around the topic, physically and verbally, there were also some practical issues that arose between how a fire breaks down anything combustible in its path, and how a pupil can move around the space, or among his or her peers. Such mixing of terms was apparent at the start of the fourth topic lesson, as the dance specialist recapped some key points about the historical topic, as an entry into the physical activity (see lesson extract 5.14 below). We see that she referred to the phenomenon of the fire as it 'spread', to the physical movement acts they were going to do, and to the link between the historical concepts of the wind and movement of the fire. The topic discourse term of 'spread' was used for the first of these (line 5), and movement discourse of 'moving' for the second and third (lines 11, 14, 16 and 20). At the start of the extract, the IWB displayed a slide that had been introduced in the previous lesson (week 6, class lesson), with two sentences: one stating a reason for why the fire spread, and the other a reason for how it was stopped, thus reinforcing the topic discourse.

Lesson extract 5.14: Embodiment and mixing discourses

Week 6, hall lesson, 06.33-07.23

[teacher 'spread' fire]

[teacher 'go' other]

[teacher 'move' fire movement]

1. DS: (crouching in front of Ps) And are the buildings (stretches arms out to both sides)
2. very far apart, or were they (squeezes hands close together) very, very close together?

3. Ps: Close
4. DS: (lowers hands) They were all very close together. And that was (holds finger on left
5. hand) another reason why the (moves right hand across body) fire spread so quickly,
6. because the buildings were (puts hands short distance apart in front of her, beats them
7. down to coincide with saying 'so', 'close' and 'together') so close together, so they
8. (repeats hand beat movements when saying 'easily', 'caught' and 'fire') easily caught
9. on fire. OK. So that's exactly right. (makes large circling motion with hand toward rest
10. of room) That's what we can picture in this room now. (lowers hand) We are going to
11. be the fire. And we're going to travel across the space, moving in (holds hand up with
12. four fingers outstretched) four different directions. And I have some arrows here
13. (stands up, changes IWB slide to show arrow), that are going to tell us which way we're
14. moving. And we're gonna pretend this (points to arrow on slide), is the direction of the
15. wind. So if my arrow points (points in direction of arrow on slide) this way, which way
16. do you think we're going to move?
17. Ps: (Ps then T and DS point to side of room) That way
18. DS: Fantastic, as if the wind's blowing the fire (pushes arms and follows with body in
19. direction of arrow) this way, and we're (keeps arm pointing in same direction) going to
20. move that way.

Commentary to lesson extract 5.14

In the above example we see the linking of the discourses of movement and of the historical topic content to describe the events of the Great Fire, where the topic discourse framed the topic introduction, but the movement discourse framed the physical representation. The dance specialist juxtaposed the physical activity alongside the talk as a 'social mode of thinking' (Mercer, 1997) – whilst talk may be central in this thinking, we can perhaps consider both as 'social mode[s] of thinking'. With the addition of physical movement to represent fire activity in my data, the actions and objects offered a material context for the development of conceptual

understanding, and this understanding was developed across different modes and media of communicative representation. Whilst the above extract seemingly married movement and topic content however, and some of the discourse, it did not clarify the distinction between fire 'spreading' and pupils 'moving' or 'going'. The teacher and dance specialist may not have been aware of their tendency to divide their terms of reference in this way, and the pupils if they were linking ideas between movement and topic content as the teacher intended (see interview extract 5.2) may not have appreciated this distinction. Thus it is possible the pupils were improving their conceptual understanding, but not necessarily transferring this to expressive understanding within the approved topic discourse. This is a potentially significant educational challenge, in exposing the construction of meaning from the variety of meaning potentials, which practitioners may wish to monitor if adopting such a multimodal approach to subject teaching-and-learning.

In thinking about the making of meanings, and addressing 'appropriation', rather than 'acquisition' of discourses, Säljö (1996) commented that 'understanding thus takes place within a particular discourse' (p. 11). Thus he forwarded an argument for the contextualised, and practice-based introduction to new and subject-specific discourses, within a view of human learning as situated and discursive. When two 'particular discourse[s]' are used side by side, as in the case of historical topic and movement discourses, understanding links between both physical activity and historical content may be supported. However, from analysis of my data it became apparent that the tools *to talk about, or interpret the evidence* from both subjects may also be seen by the pupils to be interchangeable. I would argue therefore that this can be considered both a pedagogic success and an issue for concern, and seemed at times to be one factor of this approach. To emphasise this distinction, an instance in the final topic lesson highlighted the difference between the fire as a force of nature and as a re-enactment.

Lesson extract 5.15: Barriers to embodying the physicality of the fire

Week 8, hall lesson, 21.46-22.00

[teacher 'move' movement]

[teacher 'go' fire movement]

[teacher 'move' fire movement]

1. T: Move over a little bit out of the way for her, just a little bit. That's it
2. Cath: (trying to find a way to move about the 'building' Ps) Excuse me
3. T: Don't say excuse me, go over. Use your movements, use your movements Cath, use
4. them. Go around and through.

Commentary to lesson extract 5.15

In extract 5.15 we see how the pupil's intuitive politeness prevented her from truly embracing and embodying the spread of the fire (lines 2-4). Again the extract identifies how the teacher used the same terms 'go' and 'move' to indicate both physical and fire movement, and the practical issue of space against the natural force of fire.

The process of my analysis therefore enabled me to address the issue: in offering different routes into understanding a topic, is there sufficient differentiation between ways to talk about doing the physical activity, and using the physical activity to form a topic representation? It would appear this was not always the case, which raises a key pedagogic challenge for the teaching-and-learning approach I observed. Attempts were however made to form connections between the movement and topic content, and at times to emphasise the 'appropriate' vocabulary within the specific topic discourse. The impression from analysis presented so far however is that pupils did not use the term 'spread' to describe movement of the fire. I now illustrate some of the ways in which they did this, and how the teacher explicitly reinforced this form of reference.

5.4.2.9 Interpreting evidence and making meaning through appropriation of the topic discourse

Despite potential concerns as raised above, one point of note is that the pupils made far more references to the fire 'spreading' than to it 'moving' or 'going'. For instance at the very start of the first topic lesson, the teacher queried the pupils' general understanding about the relationship between wood and fire, to which one pupil spontaneously used 'spread' in their answer: 'fire can easily spread on wood houses'. In this instance the pupil used 'spread' to describe fire movement before the teacher, who repeated and invited an extension of this contribution (a discursive strategy I explore in more detail in chapter 7).

We can also see early attempts by the teacher to encourage pupils' use of a topic-appropriate means of talking about the fire in the third topic lesson, as he structured his talk around an image on the IWB in the following exchange:

Lesson extract 5.16: Explicitly encouraging use of the topic discourse

Week 6, class lesson, 03.45-03.53

[pupil 'spread' fire]

[teacher 'spread' fire]

1. T: The fire is sss
2. Ps: Spreading
3. T: Spreading. [That's an important word]
4. Lior: [Anwar did that actually]
5. T: Can you all say spreading?
6. Ps: Spreading

Commentary to lesson extract 5.16

In this extract the teacher made explicit reference to 'spreading' as a key term, repeating it himself and encouraging the pupils to practise saying it (lines 3 and 5). Thus despite apparent

mixing of terms throughout the lessons as identified above, the teacher highlighted this term as important within the topic discourse at an early stage in the topic lessons.

Some success can be interpreted from the teacher and dance specialist's efforts to support pupils in using the topic discourse, and in linking the movement activity and topic content, through pupils' comments in the focus group organised two months after the series of lessons took place:

Interview extract 5.3: Remembering and appropriating the topic content and discourse

Focus group, 01.10-01.44

The extract represents the themes: interpreting concepts across modes, connection building, and using the topic discourse.

1. Interviewer: What about the Great Fire of London, what did you do for that?
2. Ibtihal: Erm, we, acted like we were the houses
3. Interviewer: Right
4. Ibtihal: stuck together
5. Interviewer: What can you remember about the houses?
6. Ibtihal: Erm
7. Lior: They were all stuck together. Next together
8. Interviewer: Mmhmm, that's good.
9. Lior: We was making shapes, in our groups, and then one person was the fire and they
10. was spreading it all around
11. Interviewer: Ah
12. Lior: We were making houses and some kids were walking through

In this extract, whilst I was asking the pupils directly what they could remember about the topic, we can see how they reconstructed the activities they had been doing physically, as part of an understanding around what this meant in terms of the historical topic. Thus the connections were

still available to the pupils, as was the topic discourse the practitioners had been trying to promote (line 10). Given the teacher's concerns that pupils might not always see these links, and the fact that the focus group took place two months after the topic lessons, I think he would be happy with his pupils' responses here!

Although the pupils used 'spreading' in this focus group exchange, it was apparent during the lessons that this encouragement to use 'spreading' to refer to movement of the fire was not always embedded for pupils. The teacher therefore continued his attempts to reinforce this phrasing even into the final class lesson, when introducing and to support pupils in understanding another phrase, through cued elicitation:

Lesson extract 5.17: Reinforcing use of the topic discourse

Week 8, class lesson, 12.55-13.20

[teacher 'go' fire]

[pupil 'spread' fire]

[teacher 'spread' fire]

1. T: (referring to statement on the IWB) Let's read this next one. Having stayed, and in an
2. hour's time seen the fire, so he's seen the fire, rage every way. What does that mean,
3. the fire raged every way?
4. (Ps raise hands)
5. T: What's happening now? Where's the fire going? (pause) It's sss
6. Ps: spreading
7. T: The fire is spreading. And Samuel Pepys is telling you, in, in just an hour's time I've seen
8. the fire rage every way

Commentary to lesson extract 5.17

This use potentially suggests that ‘spreading’ implies something more dramatic and on a larger scale than ‘going’ – ‘where’s the fire going?’ (line 5) ... ‘it’s spreading’ (lines 6 and 7). The teacher also drew on the authoritative evidence of the eyewitness diary, ‘and Samuel Pepys is telling you’ (line 7), as explored below, perhaps feeling that a source other than his own authority as teacher, and with direct reference from a named person to ‘you’, might make the telling of events seem more real.

Other activities were employed and orchestrated by the teacher potentially with the aim of developing pupils’ contextualised use and understanding of some of the key terms and phrases, through interpretation of key sources of evidence, as I now show.

5.4.2.10 Accumulating evidence and meanings made

In considering how the teacher attempted to de- and re-construct topic ideas and terms with the pupils in a way that they could follow, Roth’s (2007) comments on a discourse in development are relevant here:

Meaning, then, is but another name for a familiar, intelligible world. In such a world, words, concepts, theories, and other texts *accrue to* meaning rather than having or receiving it (Heidegger 1996)... meaning is but another name for the networks of relations that constitute our familiar world. And because it is familiar, this world constitutes a home in which new words, concepts, or representations can be received. (author’s italic, pp. 391-392)

We can interpret this in the sense that understanding, or meaning making, potentially develops best where there are firm foundations and related concepts or practices, in a web of understanding, to which new terms and concepts can be linked, explained and further refined, and whereby meaning is accrued through interaction. I would however add to this that meaning has to be actively made, reinforcing the importance of participation, thus what is meaningful is

determined by ongoing interaction and the orientation of those involved in interaction. The teacher attempted to create such a 'familiar world' by linking different activities and modes to explore the topic of the Great Fire. Thus the context, the activity and the concomitant discourse were used to provide a cohesive environment in which to gain a contextualised, discursive and mediated appreciation of subject practices, and appropriation of topic discourse. Only through such an embedded approach will teacher or learner be aware whether the understandings articulated are appropriate to the situation they are used to represent.

The teacher was keen to check some pupils' understandings, as he asked them to read their work to him. Such verbal exchange as the following extract also offers an example of the frequency and form with which pupils referred to the fire 'spreading', drawing on the evidence they had learnt, as the paper activity of writing sentences about how the fire spread and stopped was used to resource their introduction into and appropriation of the topic discourse. (As noted earlier, this task in particular substantially influenced the number of times teacher and pupils used 'spread' to refer to movement of the fire.)

Lesson extract 5.18: Checking understanding, and resourcing the embedding of topic discourse

Week 6, class lesson, 44.55-45.16 (teacher's microphone)

[pupil 'spread' fire]

1. T: Can you read this sentence to me?
2. Nina: The fire spread because the houses were made out of wood.
3. T: Good, next one.
4. Nina: The fire stopped because firebreaks were used.
5. T: Good.
6. Nina: The fire spread so quickly because (pause)
7. T: buildings
8. Nina: buildings were so close together.

9. T: Good girl, well done.

Commentary to lesson extract 5.18

The teacher later asked some of the pupils he had spoken to during the activity to read their work to the rest of the class, perhaps as an assured model of the 'correct' answers. I would suggest that this preparatory and private reading during the task possibly acted as an effective and mutual risk management strategy. For instance, pupils may feel at risk of public exposure when reading their work to their peers (as reported by Alexander, 2000; Gillen, et al., 2007), but having had it previously approved by the teacher (such as in interactions similar to that shown in lesson extract 5.18) may reduce this feeling of risk. Equally, teachers may feel a risk of offering a model of incorrect topic understanding by inviting a pupil's unchecked contribution to the public arena of whole-class talk, whereby there is less risk by knowing the contribution they invite is 'appropriate'. The teacher can thus adopt a more interactive approach in covering subject information, in the relative pedagogic safety of having pre-checked contributions. This is perhaps an interesting fusion of an 'authoritative dialogue' (drawing on Mortimer & Scott, 2003), in using alternative sources to present the accepted 'facts', or evidence.

At times it seemed that the teacher's efforts had paid off, as in the following exchange from the final topic lesson we see one pupil offering chained responses in appropriating and expressing her topic understanding and discourse:

Lesson extract 5.19: Pupils appropriating the topic discourse

Week 8, hall lesson, 02.35-03.08

[teacher 'go' other]

[pupil 'spread' fire]

[teacher 'spread' fire]

1. T: (referring to image on IWB slide) It's a painting, that's right. And, tell me something

2. about the fire, that you can see. What's going on with the fire, er, Nina? (pause) What's
3. happening with the fire and the way it's leaning?
4. (Ps raise hands)
5. T: What's going on there? Go on then Cath
6. Cath: Erm, erm, it's leaning that way and there's, erm, and [there's the fire
7. T: [So what must be happening?
8. Cath: Erm, erm, the wind's making it spread
9. T: Well done the wind is spreading it across
10. Cath: and there's fire in that house so it's spreading over to, over to that house
11. T: That's right.

Commentary to lesson extract 5.19

Within the extract we see how the teacher supported the pupil to use her expanding linguistic capacity, to form a contextualised understanding of new concepts from the existing individual and shared knowledge. In the sense of such a verbal exchange, mediated by the IWB slide, we see the importance of the mutual roles of the teacher *and* pupils in constructing dialogue together, in a sociocultural view of the mediated nature of learning, and the role of expert others in scaffolding learning and subsequently fading this scaffold support. The pupil's involvement in this verbal exchange, to a greater extent than in some earlier lessons, indicates the relevance of Furberg's (2010) 'interaction trajectory' – as she shifted her orientation from describing the events (such as in lines 3 and 17 of lesson extract 5.14 above) to explaining the reasons behind them and linking sources of evidence (lines 6, 8 and 10 lesson extract 5.19). We can also see the relevance of Rasmussen's (2005) 'participation trajectory', through the pupil's verbal participation, in the context of the physical activities used to support understanding, in constructing the common knowledge that at least some pupils were now able to express. Equally, there is evidence of Mercer's (2008) 'dialogic trajectory', through increasing use of history discourse, by drawing on and interpreting sources of evidence in making her claims (e.g. line 8, where the pupil identifies

the role of the wind). I used these concepts (and the work of Baldry & Thibault, 2006) to extend the concept of a 'meaning-making trajectory'. For instance, in the extract above from the final topic lesson the pupil was able to construct and relate the meanings she had made, from her participation in earlier lessons. Thus with the teacher she was building a cumulative understanding of the topic content, drawing on history discourse in using evidence to justify claims, supported by the teacher's questions around the displayed image.

At times therefore there may have been some confusion between how to refer to movement of the fire in a topic appropriate discourse, and detailed analysis necessarily concentrated on a small number of pupils. At other points however pupils emerged as proficient in appropriating their understanding within the history domain, effectively drawing on and interpreting the sources of evidence they had encountered in the eight topic lessons. It has been a strength of my analytic approach to be able to highlight the potential value of such an innovative teaching-and-learning programme, but also to emphasise the need to consider and monitor where discourses and practices used together, and elements in any multimodal teaching-and-learning experiences, may equally complement and conflict in terms of practical and pedagogic goals and demands.

5.4.3 Section summary

In this section I addressed how the historical practice of using and interpreting evidence can be considered and was promoted within the context of an eight week history topic on the Great Fire of London. I identified how a multimodal approach to this subject discourse was adopted, as well as to the promotion of a more specific topic discourse, utilising movement activities to represent the historical topic and concepts alongside more traditional classroom activities. This emerged as particularly appropriate given the large proportion of EAL pupils in the class.

Within such a multimodal approach, each mode was used to do largely different tasks, though the written or spoken word was still employed to draw salience to key points in a pictorial or physical

representation. Although communication may be multimodal therefore, and although language may not be the most appropriate tool for every communicative act, in the context of my data I argue that language was used to draw together the information within each mode to form a composite meaning unit. In this case language was used to contextualise the visual or physical representation, which thus underscores the role of language, specialised in the form of topic discourse, as at the heart of communication of subject domains. Other modes may however prove crucial in the conceptual development and further refinement of such discursive understanding.

Whilst there were clear benefits to this multimodal approach it seems that confusion can also occur in this co-ordination of material across modes, and so it is the success or otherwise of this process of co-ordination that was critical in forming links between physical activities, visual resources and conceptual issues. Indeed I would argue that it was this mixing of the abstract notion of fire movement with physical movement as a representation of the fire, that offered both an innovative teaching-and-learning approach as well as a potential source of confusion of discourse, between language and experience. From my data such activity appeared to support conceptual understanding but not always an 'appropriate' topic discourse for expression.

In many cases therefore the topic discourse framed the topic content, but the movement discourse framed the physical representation activity. The teacher and dance specialist may not have been aware of their tendency to divide their terms of reference in this way, and the pupils may not have appreciated the distinction if they were linking ideas between movement and topic content as the teacher intended. This is a potentially significant educational challenge, in exposing the construction of meaning from the variety of meaning potentials particularly where discourses are seemingly merged.

The picture emerging from my analysis however is certainly not entirely negative. Whilst at times there may have been some confusion regarding how to refer to movement of the fire in a topic

appropriate discourse, at other points the pupils emerged as proficient in appropriating their understanding within the history domain, effectively drawing on and interpreting the sources of evidence they had encountered in the eight topic lessons.

5.5 Chapter summary

Within this chapter I outlined how important aspects of history discourse and practices, around the issues of time and evidence, can be addressed within multimodal teaching-and-learning experiences and meaning-making activities. I addressed an innovative approach to this endeavour, utilising a variety of technological and non-technological resources and non-traditional activities, in conjunction with more 'regular' classroom routines. I showed use of a range of resources, and how in the context of such orchestration we need to consider the issue: to what extent an array of resources is positive, or a difficult management issue for both teacher and pupils.

Specifically I showed how use of a consistent resource across learning experiences and environments offered familiarity and stability in an unfamiliar topic domain. As a contribution of my work and extension of Wells' concept, I argue that the evolving use of the same resource base provided scope to build a *technology-mediated improvable object*, in this case of the IWB timeline slide, which enabled the teacher both to support and evidence development of shared meaning around the concept of time, using it as a prompt for and consolidation point of dialogue. Thus the ongoing revision of this resource facilitated the progression (and observation) of meaning making within and across modes of communication, and within and across lessons. I also showed how use of the specific digital tool of the IWB, as part of the 'digital toolkit' and in the context of teacher and pupil talk, supported the teacher in monitoring the balance between working through planned content and responsive improvisation of resources. My framing of the technology-mediated improvable object therefore extends and adds new relevance to Wells' original concept in the context of the contemporary classroom. By addressing this concept within a temporal

analysis I demonstrated how a learning object can influence activity that is not directly mediated by its presence.

In analysing my data I highlighted an important distinction between a wider subject discourse and a more specific topic discourse. Specifically with this distinction in mind I identified how physical movement activity, in forming representations of historical content, can mediate, support but also potentially hinder appropriation of topic discourse. Through my analysis I illustrated the potential power of this multimodal teaching-and-learning approach, with all modes suited to different communicative aims but with talk still central in communicative activity, to bring coherence to meanings made across modes and in the formation of composite meaning units. I showed how pupils' questions and comments, whilst possibly exposing error or uncertainty, can be used as connection points to negotiate contrasting meaning potentials and re-construct key lesson concepts and resources in a cumulative re-framing, along a trajectory of meaning-making (extending Baldry & Thibault's concept of the meaning-making trajectory). Thus we can potentially think of both talk and physical representation as 'social modes of thinking' (drawing on Mercer's (1997) conceptualisation of talk). This identifies a significant point whereby pupils themselves can be resources for each others' learning: in this combination of communicative modes, and in the pupils actively involving themselves in the subject practices and topic discourse as they develop as historians, there is scope for the cumulative co-construction of meanings.

It became evident however that such a multimodal approach can have its disadvantages, in the 'rich points' or 'frame clashes' as different discourses were brought into contact: such as in the discourse of movement of fire and of movement in general within my data. This use of physical movement to represent historical concepts offered both an insightful teaching-and-learning experience but also a potential source of confusion. I would suggest that the multimodal approach more successfully supported development of conceptual understanding, but not always the consistent development of a verbal means of expressing this in topic appropriate terms. I

argue therefore that to take full advantage of the benefits of such a multimodal approach, practitioners need to monitor the complementarity but also potential conflict between discourses in use, and how they present use of these discourses to their pupils.

Within this focus on developing and appropriating discourses, I would claim that meaning has to be actively made, reinforcing the importance of participation. This in turn emphasises the need for both teachers and researchers to attend to physical and discursive participation and interaction over time, as pupils negotiate their meaning-making trajectories. Thus what is meaningful is determined by ongoing interaction and the orientation of those involved in interaction.

In orchestrating meaning-making activity, I argue that there are some interesting findings around the management of promoted meanings. As teachers engage with their pupils during small group or individual work, and in checking pupils' work, I suggest that such preparatory and one-to-one reading interactions act as a mutual risk management strategy. In this sense, pupils' fear of public exposure when reading their work to their peers is reduced by having had it previously approved by the teacher. Equally, teachers' concerns over offering a model of incorrect topic understanding are lessened by knowing the contribution they invite is 'appropriate'. Teachers can thus adopt a more interactive approach in covering subject information, in the relative pedagogic safety of having pre-checked contributions. This is perhaps an interesting fusion of an 'authoritative dialogue', in using alternative sources to present the accepted evidence.

By utilising both quantitative and qualitative elements of SCDA, I was able to show that different levels of analysis can be fruitfully combined to examine patterns of talk as they develop and change across lessons, and uncover some unexpected findings. In the following two analysis chapters I extend the lines of argument presented here to address: how multimodal improvable objects emerged as part of the shared meaning making, for which I will draw on a more

multimodal transcription and analysis method; and how different meaning potentials were exposed as pupils' instantiated meaning-making trajectories did not always follow the same path as the teacher's intended meaning-making trajectory. I identify how valuable teaching-and-learning opportunities were evident in both planned and unexpected scenarios, and across multiple modes. These are particularly pertinent concerns when adopting such a multimodal teaching-and-learning approach, and also identify the significance of the temporal approach and combination of sociocultural and multimodal elements in my analysis.

5.5.1 Key points

- Through this chapter I illustrated how new kinds of learning objects were being configured and used in the co-construction, continuity and cumulation of knowledge-building activity – harnessing the pedagogic benefits of technological and non-technological tools.
- I showed how a technology-mediated improvable object was used as a prompt for dialogue around the issues of time as sequential, segmented and setting. On this basis I argue that it was in the interplay of the two media, in using the technology-mediated improvable object as an instantiation of a shared, developing meaning-making trajectory, that learning was resourced.
- My adoption of a temporal approach to analysis enabled me to present a view of how resources can influence later activity not mediated by their direct presence, to consider the lasting effects of mediating resources, in a flexible view of meaning-making trajectories as intended and instantiated.
- I showed how a multimodal approach to a topic which includes physical representation of concepts can be considered in the sense of embodied matched resources. This can facilitate appreciation of evidence in the sense of re-creating a composite meaning unit.

- I highlighted the value of both slowing and speeding up lesson pace, through taking and showing photographs of pupils' physical activity, in creating and interpreting sources of evidence.
- I highlighted the potential benefits but also potential conflict of using physical activity to support topic learning, where it was possible that the pupils were improving their conceptual understanding, but not necessarily transferring this to expressive understanding within the approved topic discourse.
- Drawing on examples presented of the teacher asking pupils to read out their work to the class, having already checked it through, I suggested that this potentially demonstrated an interesting fusion of an 'authoritative dialogue', in using alternative sources to present the accepted 'facts', or evidence.

Chapter 6

The multimodal improvable object: A multimodal consideration of the use of movement as a re-worked object, alongside other modes, in cumulative knowledge building

6.1 Introduction

The data for this analysis concerns the same class and series of topic lessons as chapter 5. As I explore here, the explicit multimodality of these teaching-and-learning experiences deserves direct attention as the teacher and dance specialist utilised numerous resources in different modes to support pupils' learning of subject content. In particular I address the observed use of movement activity with regard to the theoretical concepts of improvable objects and meaning-making trajectories. In this chapter I adopt a different approach to my first research question:

How are talk, digital technologies and other meaning-making resources utilised to resource and make visible meaning-making trajectories within and across lessons, and to scaffold the development of improvable objects as progressive and historical representations of developing understanding?

I approach this with regard to the multimodal resourcing of an improvable object. Still with talk as the central mode of communication, I explore the capacity for both teacher and researcher to utilise this multimodal and evolving activity in the rendering visible and ongoing negotiation of meaning-making trajectories.

As in chapter 5 I provide examples to illustrate and comment on broad patterns in the data, of how movement and other modes were orchestrated in the formation of meaning-making trajectories. I explore how teaching-and-learning experiences were orchestrated multimodally, across the two learning environments and eight lessons. I illustrate how this multimodal orchestration supported the complex co-construction of conceptual understanding, as ideas were

re-worked within and across modes. Thus through use of new technologies that are becoming increasingly popular and present in educational settings (building on the findings presented in chapter 5), and particularly alongside the use of movement that formed a substantial part of the observed topic lessons, we see the importance of incorporating a multimodal approach within analysis of teaching-and-learning experiences.

I frame my multimodal analysis within my overall sociocultural framework, and so consideration of all modes in use is grounded in a view that language is central in meaning-making activity (Mercer, 2004). This alignment of transcription and analysis techniques has enabled me to build a rich picture of the multimodality of teaching-and-learning activities: where visibility of form rendered activities and resources more open for explicit development by the teacher, dance specialist and pupils, as meanings were collaboratively negotiated across modes. Thus in my analysis I was able to observe any complementarity or contradiction between developing conceptual and verbally-expressed understanding, as a particular benefit of this combined approach.

As I address how conceptual understanding was constructed and resourced across the series of topic lessons, Mercer's (2008) comments on the need to consider communicative interaction over time, although focusing on talk, are appropriate here and can be applied more broadly across modes:

Methodologically, we need better ways of analyzing classroom talk as a continuing, social mode of thinking, ways that reveal how the joint construction of knowledge is achieved over time... A key problem for researchers concerned with explaining how talk is used for the joint construction of knowledge... is understanding of how speakers build contextual foundations for their talk. We can only do this in a partial, limited fashion, by sampling their discourse over time and by drawing in our analysis on any resources of common knowledge we share with the speakers. (p. 55)

A key feature of my analytic approach and as an extension of existing techniques is that I focus on how talk and other modes – such as movement, visual resources including those displayed, recorded and interacted with on digital technologies, painting and writing activity – were implicated in this ‘joint construction of knowledge’ over a series of lessons. I consider how activities and resources were employed both in creating the ‘contextual foundations for their talk’ and also in embedding the conceptual understanding as it was explored across different modes, and across the eight topic lessons. Thus in my data collection I aimed to be present as some of the intertextual links were formed – in the building of these contextual foundations – in the resourcing and development of meaning-making trajectories (drawing on Baldry & Thibault, 2006) as interactionally realised.

As well as the meaning-making trajectory, I offer a further extension of the ‘improvable object’ (Wells, 1999) to that presented in chapter 5. In his description of improvable objects, Wells argued how the transience of human speech, and any understandings negotiated through speech, can be made more permanent and opened for revision through written text. In this sense the text itself evidences and becomes a resource for the ongoing, ‘progressive discourse’ (drawing on Bereiter, 1994). In this chapter I present a development of a concept that is useful in addressing resource use (the improvable object), as extended and relevant within the context of contemporary, and multilingual teaching-and-learning situations. In this analysis I extend this view of how ‘objects’ were ‘improved’ to address these ‘improvements’ within *and across* modes to support construction of knowledge, in the creation of a *multimodal improvable object*.

As in chapter 5, the notion of ‘improvement’ is arguably subjective, and so I consider an object to be improved where any alterations are used in efforts to further understanding, as expressed through movement, visual images and/or verbally. I illustrate where both movement and talk could be considered transient forms, or objects, and written as well as photographic or video texts their more permanent equivalents. I utilise multimodal transcription of extracts to illustrate

findings, as outlined in chapter 4. Whilst not focusing on the technology, I show the role assigned to the digital technologies employed (of the IWB and PSP) in supporting this complementarity of provisional and permanent forms in the object improvements. I draw on Betcher and Lee's (2009) notion of the IWB as a potential 'digital hub', and Lee's (2010) extension to describe the 'digital toolkit' around this hub – such as in linking the PSP, and physical interaction with resources on the IWB. How these digital technologies and other tools were integrated in the lessons is addressed in my analysis, as part of the teacher's and dance specialist's wider 'mediational toolkit' (drawing on Wertsch, 1991), as multimodal improvable objects were refined through interaction.

My analytic consideration is in line with a recommendation by the Qualifications and Curriculum Authority (2004), that children should have access to and be literate in using texts in a variety of modes and media, and that classroom learning experiences should reflect this. They suggested that 'looking only at the words (i.e. children's written texts) runs the risk of missing a lot of what children know' (p. 5). Furthermore as a new Government entered office in 2010, a white paper was offered by the newly-formed Department for Education (2010) which whilst critical of the residing National Curriculum's 'prescriptiveness' reiterated this point in stating:

At over 200 pages, the guidance on the National Curriculum is weighing teachers down and squeezing out room for innovation, creativity, deep learning and intellectual exploration. The National Curriculum should set out only the essential knowledge and understanding that all children should acquire and leave teachers to decide how to teach this most effectively. (p. 40)

Therefore my consideration of the movement activities that were used alongside technologies and classroom talk evidences a further mode (relative to traditional practices) through which pupils could explore and display their understanding, whilst still maintaining the central role of language, as an innovative and creative approach to curricular content. Minogue and Jones (2006) also added weight to this argument, stating that physical activity and interactivity with lesson material 'may afford students the opportunity to become more fully immersed in this process of

meaning-making, by taking advantage of tactile, kinaesthetic, experiential, and embodied knowledge in new ways' (p. 340-341). This is particularly appropriate in schools such as the one from which data is presented here, where English is an Additional Language (EAL) for a large proportion of pupils. Particularly within this context, as I illustrate, the potential value of the multimodal improvable object as an instantiation of cumulative knowledge building comes to the fore.

In order to address these issues, it is important to distinguish between continuity and cumulation of learning experiences. Continuity can be considered in terms of adding to and extending concepts, usually driven by the teacher, in a linear sense. Cumulation refers to the progressive nature of this continuity (Alexander, 2008a), engaging pupils as well as the teacher in constructing and negotiating knowledge, whereby discussion and activity around a concept may follow many paths before re-aligning, or not, with the teacher's intended view (see chapter 2 for more detail on this distinction). Although continuity of learning experiences is also important, through this distinction there is a need to engage more critically in education as a cumulative process rather than simply an experience extended over time, where cumulation is a complex pedagogic achievement that cannot be assumed but has to be purposefully pursued (Alexander, 2008a; Mercer 2008; Mercer & Littleton, 2007). Wells' improvable object is a valuable concept in this regard, as such an object is used to explore and demonstrate both the extended and progressive nature of contested and shared, accumulated knowledge. The notion of the multimodal improvable object offers an important development of Wells' original concept in considering how the process of knowledge construction can be resourced across multiple modes, and over time.

In addressing this multimodal activity, I employ the term 'embodiment' (as alluded to above) still within my overall sociocultural framework and so where movement and physical representation are used with talk. This is in contrast to Roth's (2002) use of the term, where movement or gesture is considered to be a precursor to linguistic communication, even for participants who

have a general grasp of spoken language. I would argue however that classroom experience cannot 'embody' all aspects of the curriculum, whereby spoken language as an ability specific to humans enables us to refer to abstract concepts and to events beyond the here and now. Thus we are returned to the central role of language: even where phenomena can be experienced physically or directly, or perhaps 'embodied' or represented in abstract form, it is usually through language that links are formed or emphasised between experiences separated by time or space, as I show within this chapter. I will now outline the rationale behind my incorporation of multimodal analysis.

6.2 A multimodal approach to analysis

It is important to note that whilst I have a stated focus overall on dialogue and language within my multimodal approach, I acknowledge that the aim of the programme was to address how movement and interactive technologies can be used to support the discursive work already happening in established teaching-and-learning practices. In chapters 5 and 7 I largely focus on the discursive side of this, but in this chapter I look in more detail across modes. This combination of teaching-and-learning activities together with more traditional activities adds a potentially new element within my data and analysis, through explicit attention to the integration of movement activity and technology in teaching history. To bring these practices (talk, dance/movement and technology use) together, I consider the lessons in this chapter in terms of how teaching-and-learning activities were explored multimodally, where different tools and modes were used as rich resources for meaning making, connection building and progressive discourse, and language employed as the central tool to work with and orchestrate all other modal resources. For this reason, I incorporate multimodal analysis alongside my sociocultural discourse analysis presented in chapters 5 and 7 (following the transcription conventions described in chapter 4), and I now introduce the influences on my multimodal approach to analysis.

Kress and van Leeuwen's (2001) approach to multimodal communication suggests that image and language (and all other) modes are potentially equal in their significance to communicating via a multimodal text. A sociocultural perspective would argue that language is central and therefore the means of highlighting information conveyed through other modes (Twiner, et al., 2010). Language may well not be the most appropriate tool for every communicative act, but I would argue that it remains essential in drawing salience to particular features within aspects of the display or activity from other modes. As we can see in the statement from Baldry (2010): 'The children's meaning-making process is characterised by a constant interplay between resources such as voice quality, gesture, gaze, movement and of course, language' (n.p.). Although language is last in the list, the precursor 'of course' highlights its importance when considering anything as multimodal. This is one way in which my interpretation of multimodal communication aligns with Baldry's, and differs from that of Kress and van Leeuwen. This is why I incorporated SCDA and multimodal analysis, to allow closer analysis of modes in use, but still with my socioculturally-framed interest in the centrality of language.

Ivarsson, et al. (2011) also adopted a sociocultural approach to multimodal analysis within their research addressing short interactions of children playing a computer game, with transcribed extracts including written descriptions of verbal and non-verbal activity. Where my work differs from that of Ivarsson and colleagues is that I adopted a sociocultural framework to multimodal transcription and analysis over a *prolonged trajectory* of meaning-making experiences, by addressing the multimodal and cumulative nature of activities over a series of eight lessons. I also utilised a more multimodal approach to the transcription process itself, with more modes identified and aligned than just speech, and with substantial use of frozen frames from the video of ongoing activity (whereby non-verbal information is not just re-presented through written description). In contrast to many approaches to multimodal transcription however, but in keeping with my sociocultural framework, I used the layout of the transcript to highlight the mediating nature of talk by placing this in the first main column of the transcribed extracts. Due to the large

amount of detail in the transcribed extracts therefore, it has only been possible to present a relatively small amount of the lesson data and from a small proportion of the pupils. On this basis however I offer detailed and contextualised commentary on the creation of multimodal improvable objects as experienced by some pupils, as they negotiated their meaning-making trajectories, to support the wider coverage of lesson data within chapters 5 and 7.

I now describe how my theoretical approach to this multimodal analysis informed my selection of data to present in this chapter.

6.2.1 Outline of the data to be presented

I focus in this analysis mainly on how movement activities were used and re-worked in exploring topic concepts, and how this was used to support the development of verbal means of communication particularly regarding reasons for why the Great Fire of London spread and how it was stopped. To do this, I address the movement activities, and representations of these activities as recorded on the PSP and displayed back to the class on the small PSP screen itself and large IWB screen. I selected extracts to present in this chapter to illustrate points of development of ideas and concepts, and cumulative knowledge building, through the evolution of a multimodal improvable object. I use multimodal transcription conventions as outlined in chapter 4 to present extracts. In terms of figures I include some commentary of frozen frames from my lesson recordings to highlight key points, as well as presenting some images for illustrative purposes. I also include extracts from the interviews where they address similar issues as the extracts of and commentary on the lesson data, and to illustrate some of the broad themes from the thematic analysis of the interviews (see thematic map presented in chapter 4). I therefore selected extracts to offer detailed observations of how the teacher and dance specialist used and re-used movement and recorded movement activities to explore and develop pupils' verbal reasoning, particularly around the issue of why the Great Fire spread and how it was stopped, in the creation of a multimodal improvable object, which I now present.

6.3 Physical demonstration orchestrated to illustrate history topic concepts.

Commentary to multimodal transcribed extract 1: Using physical demonstration to explore the concept of firebreaks

The first main movement exploration of the history topic concern about why the fire spread so quickly and how it was stopped, was around the concept of 'firebreaks' (week 5, class lesson, starting at 19.30 – see multimodal transcribed extract 1). The movement activity was prefaced by teacher talk to introduce the concept. As the teacher explained verbally, firebreaks were used as a means to stop the spread of the fire, by pulling down the wooden houses and thus removing the fuel that had allowed the fire to continue to spread. As well as his verbal explanation (rows 1-4), the teacher had prepared an IWB slide with written and pictorial information on how the fire was stopped. Even during this verbal explanation, prompted by information prepared for display on the IWB slide, we see the role of movement in being used to reinforce some of the ideas, such as in the actions to represent pulling down houses (row 1), and fetching and throwing buckets of water onto the fire (row 3). The teacher then more explicitly drew on movement and involved the pupils in reconstructing the role of firebreaks, perhaps in thinking he could more clearly articulate the concept in a manner the pupils could relate to, through the combination of modes and pupils' physical participation.

To do this, he invited some pupils to help him demonstrate the concept (row 5). As I also explore in chapter 7, inviting contribution to ongoing talk or activity was used as a means to encourage and maintain acceptable classroom behaviour (row 7: as he stated that he would select 'somebody who's been listening really nicely'), as well as to gather answers and contributions. On this basis, four pupils were called to the front to stand in a line – representing the houses in a street in London in 1666 (rows 10-11). One pupil was chosen to stand behind them, as the fire, and instructed to move gradually along the line depicting spread of the fire from house to house (explained from row 14-25). The teacher therefore explained how the physical representation 'worked', by identifying the pupils in the line as 'houses' (row 11), a further pupil as the 'fire' (row

14), and what it meant if the 'fire' pupil moved along the row of 'houses' (e.g. row 15: 'if she's standing behind someone, that means that this house is on fire'). Thus the teacher's verbal description narrated and explained the physical activity. As well as movement then, within this representation bodily relations and stasis were also important, in terms of the static row of 'buildings' next to each other, and significance of the 'fire' pupil 'standing behind someone'.

Having established the rules, and identified the concepts the pupils were to 'embody', the teacher then reset the demonstration (row 25: 'can you go back to the beginning?') in order to extend the progressive topic discourse being built around the physical reconstruction. The teacher then introduced the concept of the 'firebreak' physically before verbally labelling it as such, by one of the 'house' pupils being told to fall to the ground (row 27), and so preventing the means by which the 'fire' pupil could travel any further along the line. In this multimodal interaction we can see how the teacher built up with the pupils a visual and physical context in which to locate the new term, which he then identified verbally in row 30, 'this is called a firebreak'. The 'fire' pupil's follow up contribution of 'and then there's a gap' (row 34) illustrates how she was verbally making meaning and building connections between the historical content and the physical demonstration they had just made – that the fire could not spread further due to the gap made by knocking down a house. The teacher pursued this uninvited and unanticipated thread, as an interactive opportunity to encourage all pupils to repeat the key term four times (rows 34-36), which he then consolidated one last time himself (row 37). This identifies the teacher's communicative approach at this point as interactive (Mortimer & Scott, 2003) in both verbal and physical modes. Solomon and Black (2008) reinforced the importance of pupils participating in the discourse of the subject they are learning about: In the context of the data presented above we can consider their participation in constructing understanding as mediated through talk, movement and digital display. Within the multimodal transcribed extract, we can see how the teacher organised and narrated the acting out of the spreading and stopping of the fire, involving

five pupils in physically recreating the historical event, and the rest of the class in interpreting this evidence – identified as an important feature of history discourse in chapter 5.

In such instances we can consider the term ‘embodiment’ with regard to where movement activities were used as a complementary mode of communication and exploration to other modes in use at the time, including talk and information presented on the IWB slide. I have found this a useful concept to explore how movement was used in the creation of a multimodal improvable object – on this occasion as the demonstration was enacted twice to build conceptual complexity, and on other occasions (as presented in the multimodal transcribed extracts below) where movement activities were embedded and recorded in photographic form – as a bridging representation (Savinainen, Scott & Viiri, 2005) between conceptual understanding and verbally-expressed understanding, and so as a prompt for dialogue. This linking of movement and talk was a key aim of the teacher, as he explained in his post-interview, particularly regarding the capacity of such an approach to be used to support pupils with EAL.

Interview extract 6.1: Multimodally resourcing conceptual understanding

Teacher’s post-interview, 24.25-25.01 and 25.15-25.23

The extract represents the themes: pupil participation, and interpreting concepts across modes.

1. They’re not, they’re not necessarily, not all of them, even though a lot of them have
2. English as an Additional Language, they don’t, that doesn’t necessarily mean that they
3. don’t have erm, the, you know the knowledge or the capacity for understanding. That’s
4. an issue with a lot of our children, especially in this school, where all, they’ve all got a
5. really good understanding, mostly, but they, they fail to express themselves. They fail to
6. erm, express their understanding through you know, just standard English. They find that
7. really difficult... And this gives them an opportunity to, you know to, just erm have a go.

In the lessons overall and as illustrated in analysis of the above lesson extract, movement was used as one of many modes, offering scope to explore an issue:

- between different modes of communication,
- between concrete and abstract representations of concepts,
- and in the development of verbal means of communicating about a topic.

Thus we see it is the orchestrated interplay between the modes of communication, within situated activity, that potentially supports the unfolding of a more coherent understanding – of a composite meaning unit.

The physical representation, or ‘embodiment’, of the firebreak concept was re-used and re-worked a number of times through the eight topic lessons. It was employed as a ‘multimodal anchor’ (Ametller, 2010; Gillen, et al., 2007), both in the form of a demonstration to the class, and in evolving physical explorations of why the fire spread and how it was stopped. In the sense of being a multimodal anchor or memorable event, it could be built on in re-constructing the represented concept, in increasing the complexity of meaning around the common knowledge (Edwards & Mercer, 1987) they had developed through its first use, and so bridging from the concrete and physical to the abstract and verbal. Whilst I would argue that *all* communication can be considered multimodal (Gillen, et al., 2007; Johnson & Kress, 2003), and not just specific anchoring moments or representations, I agree with Ametller’s assertion that more explicitly drawing on certain modes at key points can offer variety to the teaching-and-learning experience, utilise affordances of different modes where they add value to the pedagogic and practical aim, and make certain aspects potentially more memorable and available for de- and re-construction in other modes. This was certainly the case with the firebreaks enactment, which utilised a physical demonstration in the more restricted space of the classroom environment where such activity might normally be quite rare, as well as the more expansive hall.

What my analysis adds to this concept is a consideration of a multimodal anchor as re-worked across experiences in time, and across learning environments, to offer a continuous view of the progression of topic discourse and making of meaning in the context of the development of multimodal improvable objects. The firebreaks demonstration was for instance used in front of the same IWB slide in the week 5 hall lesson (the second topic lesson), and again in this unevolved, demonstration form in the week 6 class lesson, as a way into the further physical exploration they would be doing about factors central to the spread and stopping of the Great Fire. Also in the week 5 hall lesson, pupils were reminded by the teacher (Anwar) and dance specialist (Karla) that streets in London in 1666 were narrow and houses close together (as mentioned by the teacher in row 4 of multimodal transcribed extract 2, explored below), as a reason for the ease with which the fire spread between wooden buildings. Thus in this respect we can see how the firebreaks multimodal anchor was used as a base the pupils could relate to and remember, and as a multimodal improvable object around which to cumulatively build further knowledge. The importance of the multimodality of this teaching-and-learning activity was emphasised by the teacher in his post-interview:

Interview extract 6.2: Multimodally resourcing use of the topic discourse

Teacher's post-interview, 20.11-20.35

The extract represents the themes: interpreting concepts across modes, connection building, and using the topic discourse.

1. T: I think it was really useful having the dance there. I'm not sure how much they would
2. have remembered if they only had the classroom side of it
3. Interviewer: OK
4. T: which is really interesting for me because, erm, you know with regards to things like
5. firebreaks and, erm, the other key vocabulary that we, we were using at the time, they,
6. I don't feel like they were getting it as much as when erm, as much as after we'd done
7. a dance session on it as well.

Thus whilst the remembering and verbal expression of conceptual understanding was identified as the goal, and the teacher mentioned in his pre-interview that he was concerned that the history content was not lost amongst the movement activity (interview extract 5.2), he acknowledged here the crucial role that the non-linguistic elements of the activity played in resourcing this aim. This building together of conceptual knowledge will now be addressed in terms of how it was portrayed in the first hall lesson on the topic.

6.4 Developing and re-versioning a physical demonstration across modes.

Commentary to multimodal transcribed extract 2: Embodying and emphasising concepts

As in the firebreaks demonstration, representation of the buildings from London at the time of the Great Fire through pupils making shapes with their bodies was one idea that was used in a number of lessons. This occurred both in physical form, where pupils made shapes with their bodies, and in displaying photographs of pupils making the shapes. This identifies a form of 'matched resources' (Hennessy & Deaney, 2006), as well as offering a means for pupils to view their own work, as the concept of a building was re-worked across different modes. Such embodied representation was used in the warm up activity of the week 5 hall lesson (see multimodal transcribed extract 2), predominantly to emphasise that streets at the time were narrow, and the buildings close together, as reasons why the fire spread so quickly. For the warm up, the teacher selected some pupils to make an archway (see figure 6.1 below), saying 'It was all very narrow and close together' (row 4). He also adopted a similar classroom management strategy in selecting pupils to be involved in the demonstration of the warm up as identified in the analysis above, stating that he would select 'somebody who's sitting nicely' (row 7). He reinforced his commitment to this in identifying pupils he would not select on this basis.



Figure 6.1: Warm up activity making arch for 'fire' pupils to run through, week 5, hall lesson, 08.23

The rest of the class were to represent the fire, moving through the arch of buildings, in the movements suggested by the teacher. The different movements were called out, and written on word cards: 'if I show you this word card [which said 'jump'], you need to pretend you're the fire, jumping from house to house' (row 10). This introduction to the physical warm up and historical content therefore was mediated by:

- the teacher's verbal explanation,
- which was interspersed with physical movement (e.g. row 4: squeezing his hands together to indicate streets being narrow and houses close together; and row 10: jumping motion by raising and lowering the 'jump' word card in his hands when saying 'jump'),
- as well as the paper-based word cards,
- and pupils reading out the word cards (as invited in row 9 through the 'sounding out' technique also mentioned in chapter 5).

This identified it as a multimodal introduction to both the physical warm up they were about to do, and the historical concepts they were representing through their physical activity. Such a combination of modes is of potential significance in efforts to support pupils in seeing salience between written and spoken word and the physical action the words corresponded to, as well as between physical activity and the curricular concepts represented through this activity. This level

of connection building is a challenge for all educators but becomes particularly complex within a multilingual classroom, and so illustrates the innovative approach taken by this teacher to meet his pupils' needs, as well as the capacity of this analytic approach to identify such practices.

Although this was a warm up, it fed into further movement activity of making different shapes to represent buildings and ways to move as the fire, and these physical representations were photographed for re-presentation in the same and subsequent lessons. This cycle of representation through movement and recorded movement will now be exemplified.

6.5 Increasing conceptual and movement complexity of the multimodal representation, as enacted and recorded.

Commentary to multimodal transcribed extract 3: Annotating images to reinforce key concepts, and using key concepts to introduce physical activity

Having finished the warm up orchestrated by the teacher, the dance specialist used images prepared on an IWB slide to compare street scenes from the past, in 1666, and from the present day (see multimodal transcribed extract 3). She used these images to annotate directly onto them the key points she wanted to raise. Through her annotations (rows 1 and 6) she emphasised verbally and visually/digitally, as well as in movement that the buildings were close together in the past, as a reason for why the fire spread (in pushing her arms close to her sides (row 2), and squeezing her hands towards each other (row 4), to indicate closeness of houses in the past; and in referring to the closeness of pupils representing buildings in the warm up (row 3)). The dance specialist commented in her VSRD session that she had not planned to annotate the slides at this point, but felt in the moment that this action would help to reinforce the features of the images she was trying to draw attention to:

Interview extract 6.3: Reflecting on benefits of improvisation and annotation onto the IWB to resource understanding

Dance specialist's VSRD session, 03.05-03.16

The extract represents the themes: IWB use, and improvisation from the plan.

1. DS: we could draw on it, very, very helpful, which I wouldn't have been able to do without
2. having the whiteboard.
3. Interviewer: Had you planned to do that?
4. DS: I hadn't planned to do that no, but it was to help them understand.

Whilst not planned therefore, the annotations onto the images (rows 1 and 6 of the lesson extract) – with past and present images juxtaposed to draw salience to the annotated differences – physical movements to accompany verbal descriptions (rows 2-5), and linking back to the warm up activity (row 3), all offered resources for the pupils to use to contextualise the historical content, and provided reasoning for the further physical activity they were about to do. The VSRD session enabled me to explore the dance specialist's interpretation and reflection on this part of the lesson, as I would not otherwise have known whether she had planned to annotate the slide. This therefore illustrates Karla's flexibility to respond to the pupils' needs, and the capacity of the VSRD research tool to be used to uncover this improvisation.

Equally, whilst the movement activity to follow offered a means for pupils to explore the historical content, the teacher's and dance specialist's talk around the activity was crucial in keeping it related to the history topic. The dance specialist asserted the link between movement activity and historical content in stating, 'we're going to pretend that we're from the past, and we're going to see if we can build, a street that is from the past with our bodies' (row 8). In this we see how the historical topic content was built cumulatively across modes, as she simultaneously brought attention to the relationship of the houses to the spread of the fire through movement, talk and

reference to the IWB slide, whilst reinforcing the important notion of time (in this instance of past and present) within history discourse (identified as salient in chapter 5).

After introducing the concepts they were to represent, the dance specialist introduced (verbally and by holding it up) the tool they were going to use to record pupils' 'buildings' – the PSP (row 14) – that they would then view back on the IWB. Thus we see the part of the digital toolkit in being used to mediate the gathering and viewing of lesson resources. The teacher was in control of using the PSP to take photographs, just as the pupils were in control of the material they provided for him to photograph, which then resourced the ongoing construction of knowledge around the displayed photographs. We can see this re-versioning in multimodal transcribed extract 4 (explored below), as the pupils made 'building' shapes (illustrated in row 1), the teacher took photographs of their shapes (row 2), and photographs were selected by the dance specialist to display on the IWB (from row 3).

6.5.1 Commentary to multimodal transcribed extract 4: Creating and using images of pupils' work

From multimodal transcribed extract 4 we can see how the physical activity encouraged an embodied consideration of buildings at different levels, for each pupil as individuals, and how this was re-versioned in a whole-class consideration of the images. The concept of different levels was made explicitly clear by showing different images and identifying the levels being enacted (e.g. rows 5-6), and explaining why a shape could be interpreted as a particular level (row 7), again identifying the importance of reasoning around evidence in general. The dance specialist used the images to offer a visual context for the concepts she was describing, such as the 'curving' shape (row 11). The pupil's comment at the end of the extract, 'I wanna see me' (row 13), illustrates that the pupils were keen to participate physically and in photographed form in the creation of lesson resources. Thus again we see the importance of allowing for pupil participation in meaning making as a multimodal endeavour.

6.5.2 Commentary to multimodal transcribed extract 5: Continuing interaction around images of pupils' work to explore concepts

Following this interaction other photographs of the activity were displayed, which the dance specialist used to invite consideration of how they could move about the pupils' photographed shapes – in creating a context to think about how the fire spread about the buildings (see multimodal transcribed extract 5). At this point she found that for some reason she was unable to use the IWB pen to annotate the images, which she presumed was because they were image files that had not been embedded into an IWB file (rows 5-15). After trying a few options and the teacher making some suggestions, she used the experience as a means of showing pupils that it is acceptable to make mistakes (row 15: 'Sorry I'm still learning about this Year 2 so, I make mistakes too and that's how I learn'), literally holding her hands out as she addressed the unexpected. With the pupils having sat patiently for 40 seconds as she tried to resolve the issue, she decided 'we're just gonna look at the pictures' (row 16). Whereas earlier we saw how she had spontaneously decided and been able to annotate images therefore, here we are made aware that she had to be equally flexible in not being able to annotate onto the screen as she had intended.

Unable to draw directly onto the image slide, the dance specialist identified pupils to point onto the image how they would move over, under, around or through the pupil's projected shape (e.g. row 21), and then to indicate a movement they could make to travel over, under, around or through by imagining the pupil in front of them (e.g. row 23). Thus the backdrop of the IWB slide as a static visual image of a posed embodied representation was not used as planned. It was however used flexibly to good pedagogic effect to encourage pupil participation in using the visual and digital resource, and creating movement, to demonstrate their conceptual understanding of the movement terms. We can consider this multimodal activity in the context of an improvable object: in reviewing and reflecting on the recorded and projected images in the whole-class forum, suggestions of how shapes could be improved, strengthened, moved over, under, around and through were articulated verbally and through movement. Thus we see how the concept was

explored physically, digitally and pictorially, and verbally. This physical exploration of making shapes in pretending to be buildings, photographing and viewing images of these shapes, led into an activity to explore movement of the fire, which I now describe.

6.6 Accumulating knowledge by extension and progression of movement activity.

Commentary to multimodal transcribed extract 6: Linking concepts, movement and words

Throughout the topic lessons, pupils learnt the terms (and actions to represent) over, under, around and through (from 26.45, week 5, hall lesson), which the teacher and dance specialist related to the ways in which the fire moved about the city of London (as in row 1 of multimodal transcribed extract 5). In building this concept of movement within the history topic, pupils practised in pairs, one making shapes of different heights, and the other moving over, under, around or through them (as introduced in multimodal transcribed extract 5 – rows 1-4 – and as enacted in multimodal transcribed extract 6). The dance specialist verbally identified the concepts the pupils were to represent (multimodal transcribed extract 6, row 1: ‘If I tap you on the shoulder you’re going to be the building first. So you’re going to make a lovely shape’; and row 4: ‘the other person, you’re going to be the fire. And you’re going to move under this shape’), to be explicit about the physical activity they were to do, and the historical concept they were embodying through this activity (see figures 6.2 and 6.3).



Figure 6.2: Making a shape and moving
'under' it, week 5, hall lesson, 32.50

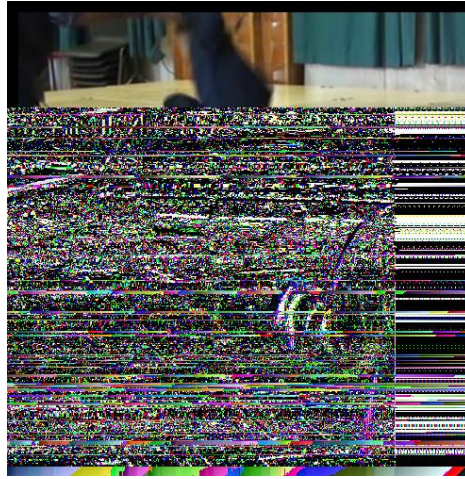


Figure 6.3: Making a shape and moving 'over' it,
week 5, hall lesson, 33.30

The teacher and dance specialist reminded pupils to say 'over', 'under', 'around' and 'through' as they did the moves (e.g. rows 7-8 and 10-11) – highlighting the purposeful integration of movement and verbal modes. Thus we can see how the multimodal improvable object of the relationship between the fire and the buildings was growing in complexity – both in terms of the accumulation of meaning, and the multiple, juxtaposed and simultaneous modes through which concepts were explored.

6.7 Re-working concepts across modes: Commentary to frozen frames, figures 6.4 and 6.5-6.7

Some photographs from this movement activity were used as a re-entry into the topic concepts in the following week's class lesson (week 6, and again in week 7). The teacher had prepared an IWB slide in which he had embedded photographs of the pupils' building shapes, at different levels. These photographs were above an image of a painting of London in the past (see figure 6.4).



Moving photograph of pupil's low shape

Figure 6.4: IWB slide with line of photographs of pupils making shapes of buildings at different heights, above a painting of London in the past. One photograph of a pupil's shape is below the painting, week 6, class lesson, 09.58

The teacher moved one of the photographs of a pupil making a low shape, to sit against a part of the painting which depicted buildings at a low level (roughly where the teacher's finger is on the above figure). This re-use of the images served to emphasise the point that buildings at the time of the Great Fire were at different levels, and also that what they did in the hall lesson the week before was relevant to their current classroom-based activity. As mentioned in chapter 5, the teacher had commented in his pre-interview that he was concerned for his pupils to see the link between content covered in the class and hall lessons, and so linking resources across both locations was one means of responding to this concern. He used the slide to highlight the relevance of what they were doing in the hall lessons (represented here by the photographs) to the historical concepts and time period they were learning about (represented by the painting). Thus in re-framing and juxtaposing the different types of image, he reinforced a further point he was making about historical sources of information - broadly speaking of the use of paintings in the past, and photographs in the present – and thus reinforcing the importance of sources of evidence within history discourse as explored in chapter 5.

In further making connections, the teacher re-called on pupils to help him demonstrate the concept of firebreaks, as they had done in their physical representation in the week 5 lessons.

This was now the third time this concept had been explicitly demonstrated in this way. Some pupils remembered that it was called a firebreak, drawing on their memory of the ‘multimodal anchor’ to utilise the terms from the history topic discourse. This demonstration and explanation was set against a new IWB slide, again depicting the key reasons for the fire *spreading* (wood and wind, through image and words), but with use of a block–reveal aspect covering the ways in which the fire was *stopped* (see figure 6.5 below). Once the pupils had identified the term ‘firebreaks’ in this regard, the teacher moved part of the block on the slide to show the text ‘fire breaks were used’ (figure 6.6). Ensuing talk enabled him to remove the rest of the text under the block, ‘wind changed direction’. He gesturally linked the revealed written phrase (‘wind changed direction’) and his reading it out, by pointing to the top right picture on the slide (figure 6.7), of the fire depicted as moving in one direction on the painting due to the wind blowing it – thus the opposite, by the wind changing direction, was one way in which the fire was stopped. This highlighted coherence between the elements of the slide, revealed through verbal narration and pointing to link the pictorial and written cues, as well as the reasons for the fire spreading and stopping. Thus in a socioculturally-framed multimodal analytic approach, talk was used to draw salience to aspects of the image and written text on the slide, in presenting an integrated interpretation of the multimodal evidence.

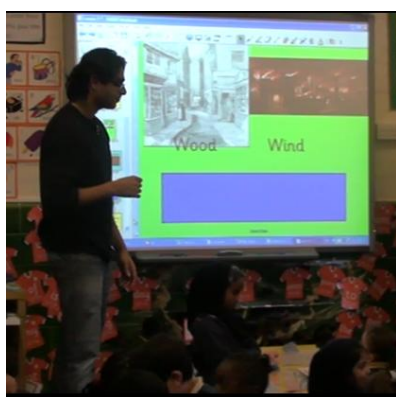


Figure 6.5:
Prepared slide
week 6, class lesson, 14.07

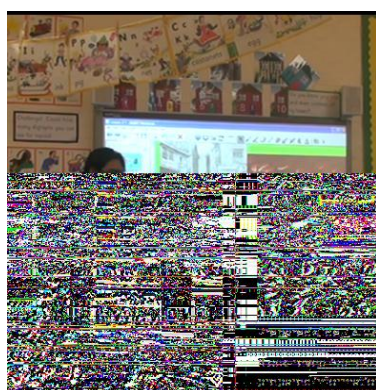


Figure 6.6:
First option revealed
week 6, class lesson, 16.49

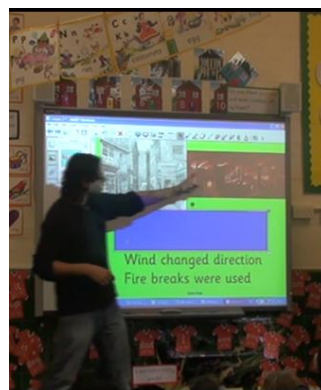


Figure 6.7:
Integrating the text
week 6, class lesson, 17.24

Block-reveal is a relatively common technique in organising IWB slides to allow different levels of prepared information to be shown, rather than having everything displayed at once, and thus offering flexibility on when to show each hidden aspect (e.g. Gillen, et al., 2007). Such a technique however, whilst offering flexibility of when to reveal the hidden information, can have some potential negative effects. For instance, it can suggest there are answers for pupils to 'guess'. As the answers are pre-written the teacher has little scope to vary from them in terms of what could be considered acceptable. This could be interpreted as a concrete realisation of a critique that much use of teacher questions is not genuinely trying to explore what pupils know but just to see if they can respond to cues and say the 'right' words (e.g. Wood, 1992), thus in an interactive but relatively authoritative communicative approach (Mortimer & Scott, 2003), and so illustrating a reincarnation with use of the relatively new IWB of a long-standing educational challenge. Equally, a block-reveal strategy often locks the teacher into an order of revealing items, which may or may not correspond with the order in which pupils offer suggestions. The teacher then has to choose whether to search more in pupils' answers to reveal each item in the order they have been pre-written, or whether they have sufficient memory of where each item is located to reveal them as they are suggested.

In the observed teacher's use illustrated in figures 6.5-6.7 above, two options were hidden, but they were both hidden under the same block – one above the other. In fact although the 'firebreaks' text was pre-written at the bottom of the two items, it was the first to be revealed in accordance with the ongoing dialogue and physical demonstration. The teacher was thus sufficiently flexible in his knowledge of his planned slide and spontaneous use of it to be responsive to pupils' contributions, and reveal the options out of his planned order. Within this interaction therefore he utilised the 'technical interactivity' of the IWB – to move objects in order to reveal hidden, pre-written options on his slide at a point of his choosing – and 'dialogic interactivity' with his pupils – to invite, address and validate their contributions at the point at which they were offered (Mercer, et al., 2010). This offers some response to the critique outlined

above, where seemingly closed questions and options can be answered and then taken up in a relatively more interactive manner.

To return to the revisiting of the firebreaks concept, the dance specialist used a different physical means to explore this in the week 6 hall lesson (the fourth of the eight lessons). In this use, the notion of the firebreak was embedded into a movement activity predominantly thinking about how the fire moved. The pupils were to be the fire as they moved across the room, following the direction indicated by a large arrow on the IWB. There were four prepared IWB slides each with an arrow pointing in a different direction, which the dance specialist switched between through the activity. The arrows were used as a representation of the wind blowing them, directing the fire to move in one way. The firebreak became one element within this activity: the pupils were told that if the teacher fell to the floor (representing a firebreak) when they were travelling towards him, they (the fire) had to stop, until the IWB arrow (wind) was changed forcing them to move in a different direction. This embedding of concepts also showed that the teacher and dance specialist were covering concepts that were related (the fire was spread by the wind, it was stopped by firebreaks), and so it was appropriate to link them through the composite movement activity. This extension of fire movement activity was complemented by further exploration of information about the buildings in London in 1666, as will now be shown.

6.8 Embedding concepts across modes: Commentary to frozen frame, figure 6.8

Also in the week 6 hall lesson, in a similar way to the teacher as illustrated above, the dance specialist showed and referred to her IWB slide with photographs taken on the PSP in the previous hall lesson of the pupils being buildings at different levels.



Figure 6.8: IWB slide of photographs of pupils and painting of the Great Fire, week 6, hall lesson, 14.40

In this as in the teacher's placing of similar photographs on his slide on the previous day (in the week 6 class lesson), the positioning of the photographs was intentional and informative in itself. The photographs of the pupils making their building shapes (taken in the week 5 hall lesson) had been placed close together in a line, with pupils depicting buildings at different heights, like a street scene from London in 1666 (as depicted in the painting below the photographs).

This cycle of physical representation of concepts connected with the Great Fire, recorded and then re-presented as embedded photographs on the IWB, continued to evolve throughout the series of lessons, and both physical and recorded elements were used in most hall and classroom-based lessons, illustrating the development of a multimodal improvable object. This identifies the salience of temporality and meaning making over time, as key concepts in a consideration of a multimodal improvable object. To follow the discussion around these photographs, the pupils were again asked to get into groups and to make a street scene 'from the past', with buildings close together and of different heights: whereby the discourse around time as discussed in chapter 5 was integrated within verbal and physical activity around factors affecting the spread of the fire. One pupil in each group was to be the fire, moving over, under, around and through the buildings. At this point, there appeared to be little extension of the task, but the activity served to re-introduce the pupils to the movement exploration of the historical features. Furthermore, as

identified by Maybin (2006), repetition has an important part to play in supporting pupils' appropriation of concepts.

To this point, most provision of supporting resources and recording of activity had been for the pupils representing *buildings*. This shifted, as the teacher and dance specialist used the PSPs to record video of the activity, enabling them to record movement of the *fire* pupil, as well as the static forms of the building pupils. The teacher had also prepared an IWB slide for reference during this activity, which offered a written label and pictorial representation for the terms 'around' (dynamic simulation of roundabout with moving cars), 'under' (image of someone moving under a fence), 'over' (image of person climbing over a wall) and 'through' (image of someone running through a tunnel: see figure 6.9). Thus written and pictorial (digital), verbal and physical modes were in play during this activity.

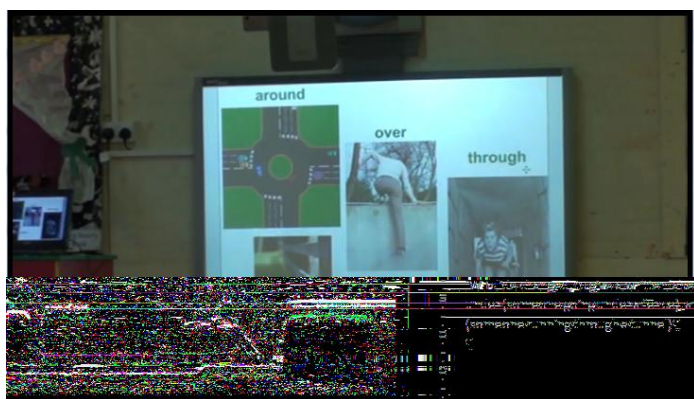


Figure 6.9: IWB slide to support 'over', 'under', 'around' and 'through', week 6, hall lesson, 29.50

This slide remained on IWB display throughout the activity. As the groups worked through their building shapes (using high, medium and low levels but always close together) and fire movements (travelling over, under, around and through the building shapes), the teacher and dance specialist also interacted with the pupils to offer support and suggestion, as well as recording images and video. For instance, we can see this in one group and one fire's thinking

about moving 'over', as shown in figures 6.10 and 6.11 below where the 'fire' pupil was considering how to get 'over' the buildings.



Figure 6.10: Fire pupil with group
week 6, hall lesson, 30.55



Figure 6.11: Dance specialist offers physical suggestion
week 6, hall lesson, 31.05

Throughout these continued physical activities to consider what may appear to be the same concepts, central issues were covered and re-covered, recorded and re-presented across verbal, gestural, pictorial and physical movement modes – as a 'multimodal ensemble' (Bezemer & Jewitt, 2009; Jewitt, 2009). Each time they were considered, concepts were linked, emphasised and developed, in an evolving exploration of factors influencing why the fire spread and how it was stopped. This activity and the same IWB resource was again used in the week 7 hall lesson. We should also remember that these pupils were 6-7 years old, and as Alexander (2008a) argued, repetition has its place as one of the interactive techniques employed by teachers to develop pupils' conceptual understanding. Such development can arguably be said to have been supported, as illustrated in this chained recap session early on in the week 7 hall lesson (see lesson extract 6.1 below). To present this extract I use transcription conventions from the qualitative element of my SCDA rather than a multimodal transcription, as the points I wish to make are concerned with the verbal exchange.



Figure 6.12: IWB recap of key concepts, week 7, hall lesson, 03.20

6.8.1 Lesson extract 6.1: Inviting, connecting and reformulating pupils' contributions

Week 7, hall lesson, 03.28-03.48

The teacher was standing in front of the IWB slide shown in figure 6.12, but it was not referred to in the following exchange. He had asked pupils to suggest reasons for how the fire was stopped, at which point he addressed the apparent confusion between 'blowing houses up', and 'pulling houses down'.

1. T: They were blowing houses down?
2. Ps: No
3. T: They were blowing, they were blowing houses up, I see what you mean. What was that
4. called when you blow a house up?
5. (Few Ps raise hands)
6. Nina: A firebreak
7. T: It's a firebreak, fantastic. Any other way that they stopped it? What else helped? What
8. else helped?
9. Cath: Erm, everyone erm (pause) everyone erm (pause) worked together to [put it out
10. T: [Everyone worked together.

6.8.2 Commentary to lesson extract 6.1

At this point we can see that the conceptual understanding of key ideas was largely available to the pupils who contributed, although at times the ‘appropriate’ verbal means of expressing this was not so clear, such as where pupils had potentially linked but not appreciated the distinction between previous references to pulling houses down (as mentioned earlier – row 1 of multimodal transcribed extract 1), and blowing houses up. The teacher did not directly identify this view as wrong, that the people at the time were ‘blowing houses down’, but instead acknowledged the general idea as correct and re-phrased it more appropriately (line 3). We can consider this as a ‘reformulation’ (to draw on a technique identified by Mercer, 1995, to work with pupils’ ideas) where the teacher used pupil input to pull out key points aligned to the intended meanings, but also fit within the flow of classroom discourse – and so how the teacher used talk to guide construction of knowledge. The teacher emphasised the importance of pupils having opportunities to express their understanding in his post-interview:

Interview extract 6.4: Offering opportunities for pupils to express understanding

Teacher’s post-interview, 23.00-23.19 and 23.29-24.18

The extract represents the themes: role of the teacher, using visual resources, interpreting concepts across modes, pupil participation, and PSP use.

1. T: my main aim is to get, get the middles and lowers with limited language to really use
2. the visuals as an opportunity to explain themselves. To, you know have a go at, you
3. know speaking and listening basically. They need as many opportunities as
4. possible...Even if they’re not coming up with exactly the right idea, the fact that they’re
5. speaking, they’re listening, they’re engaging is, you know is a big deal for us. We really
6. want them to, er try. You know, and, if there’s an adult there they can help them with
7. their language as well as with the learning, you know.
8. Interviewer: Yeah
9. T: It’s just, the learning just becomes a, you know a context for them to do the talking

10. within. Erm, and when they do see themselves on, er, a video or a picture you know
11. they, they're always in the mood to talk about it. They're always, you know, they
12. always have the smile on their faces. They always want to, and if I ask them then, you
13. know 'what are you doing in this picture?', I still have to prompt them quite a bit I
14. think. You know the lowers especially.

From this we can see how the teacher valued and aimed to use talk and other modes with his pupils to encourage their verbal participation in constructing knowledge, and to demonstrate that exploratory discussions were as highly regarded as being able to offer a 'correct' answer.

Providing opportunities for pupils to talk about topic concepts, mediated through visual and physical modes that were enjoyed by the pupils, was therefore considered as important as their ability to appropriate and express topic understanding. Such verbal interactions as illustrated in lesson extract 6.1 were used by the teacher as a recap of previous work covered across modes, still against the backdrop of his IWB slide depicting in image and written text the importance of the wooden houses and direction of the wind as key reasons behind the spread and stopping of the fire. It also served as a re-introduction for further development of concepts.

As well as doing and repeating the physical movement activities, the recording and showing video and images of these activities achieved a number of things:

- It enabled pupils to see themselves and/or their peers;
- Pupils who at any point were playing the role of buildings may easily have been oblivious to the activity of those being the fire – watching video or seeing images back may have supported them in seeing a more coherent view of how the portrayal of the buildings and fire were related;
- It enabled the concepts covered through physical activity to be quickly re-oriented to, linking the physical and abstract elements, and showing how previous lesson activities

were related and relevant to ongoing lessons as various concepts were integrated into the activity in a cumulative frame of knowledge building;

- By embedding and displaying the photographs back on the IWB, it made available to the practitioner the affordances of the technological tool. Through this they could re-work the images by annotating, moving or re-sizing them as appropriate to the current learning need (though attempts to annotate onto photographs were not always successful).

The variation and combination of modes enabled the teacher and dance specialist to check pupils' understanding, and to allow pupils different means of expression where they might perhaps have struggled in one or other mode of communication on its own, as identified in interview extracts 6.1 and 6.4. This identifies the significance of appreciating the progressive nature of knowledge building around the history topic content as multimodally realised, where dialogic interaction and interpretation but not always topic discourse (as illustrated in chapter 5) played a key role in developing conceptual understanding. The multimodal and temporal nature of my analysis, within a sociocultural framework, enabled me to see and highlight the importance of this integration. The concepts and activities were further developed in the remaining lessons, as I now illustrate.

6.9 Integrating concepts and resources

Following the same exploration in pairs in the week 7 hall lesson, pupils were put into two groups to make a street scene from London in 1666. As previously, pupils were to form a line and make shapes at different heights, close together, as the buildings in a street. One pupil was to be the fire, travelling over, under, around and through the line of pupils, making different moves and using different body parts. When the pupil portraying the fire reached the end of the line, they were to make and hold a shape to become a building at the end. The next pupil at the start of the line then became the fire, and moved along the line of pupils. Pupils in the line were to change building shape every time a different pupil became the fire. Unlike previous uses of similar street scene tasks, every pupil became the fire in relatively quick succession, and all building pupils were encouraged to try out more shapes by having to change shape frequently.

This group activity was used almost as a rehearsal – to reinforce continuity of activity - for the integration of a further dimension about the topic of the Great Fire that the group were learning about – whereby cumulation was supported through progression and integration of concepts into the activity. This further dimension concerned the role of eyewitnesses, and of a particular person called Samuel Pepys who wrote a diary at the time, which the pupils were learning is the source of much of the information we know today about the Great Fire. This reiterates again the importance of evidence. The teacher combined the availability in these hall lessons of the PSP recording device, as a means to record events in the present, and set this against a task the class had done in the previous day's class lesson of painting a scene from the Great Fire, as a means used to record events in the past. This reinforced the emphasis in the history discourse of the use of sources of evidence and the time-bound nature of such sources (in juxtaposing the painting as from the past and video-recording device in the present), and utilised the multimodality of the mediational toolkit available to resource and re-frame the familiar movement activity. Split into two groups, one group were then set to represent the movement activity of the fire pupil moving along the line of pupils as buildings. The other group were cast in the role of 'eyewitnesses', watching as the fire spread throughout the buildings. One pupil in the eyewitness group took photographs of the street scene on the PSP, as 'Samuel from the present'. This was the one occasion during these lessons where a pupil used the PSP. Another eyewitness pupil painted a picture of the street scene, as 'Samuel from the past' (see figure 6.13). The rest of the eyewitness group watched, and were given 'detective sheets' with words to help them think about what they saw (including names of body parts, ways of moving).



Figure 6.13: Teacher showing pupil's painting, week 7, hall lesson, 43.40

At the end of the lesson the teacher showed the painting to the rest of the class and highlighted some of the key points, including that buildings (as represented to the painter by the pupils) were of different heights and close together. The dance specialist then showed the photographs back to the group on the PSP screen (as the card reader was broken and so she was unable to show them on the bigger IWB screen). This exploited the tools of the hall lesson and the classroom lesson, in using the PSP and painting to consolidate the differences between past and present means of recording events, and as aligned to the physical acting out of the fire spreading through the street scene. It also highlights a third occasion where the need for flexibility in how to use technological resources was apparent, which is an issue I return to in chapter 7. Memory of this physical activity and its interpretation in terms of the history topic were still available to the pupils in their focus group two months after the lessons, as the comments below reveal:

Interview extract 6.5: Focus group pupils remembering topic activities and concepts

Focus group, 12.00-12.22

The extract represents the themes: interpreting concepts across modes, connection building, and PSP use.

1. Lior: I remember when someone was pretending to be Samuel Pepys and someone was p,
2. er, and someone was taking a picture. And then Samuel Pepys, who was pretending, he
3. had to draw erm, draw erm the buildings

4. Interviewer: Yeah, they did that didn't they?

5. Lior: Er, two groups were making buildings

In efforts to show cumulation of learning experiences, the focus in this lesson had largely been to develop pupils' knowledge of eyewitnesses and means of recording events in the past and present, and in doing so the teacher effectively re-contextualised the physical representation of the fire spreading as an event which needed recording. We can see from the focus group comments above that these points had been remembered by the pupils in terms of both the physical activity and the historical interpretation. Through this activity the teacher both covered and integrated two of the curricular learning objectives – in building a multimodal improvable object around why the fire spread, and of understanding what an eyewitness is, through the history practice of recording evidence using time-appropriate tools.

6.10 Connecting and revealing accumulated knowledge

The final week's hall lesson (week 8) was used as a development and cumulation of the concepts and movement activities the pupils had been working on for the past three weeks, around why the fire spread and how it was stopped. In structuring a further task where all pupils were to play the role of the fire, the teacher had prepared IWB slides with words and arrows, which he encouraged pupils to say with him alongside the arm movements they had linked to the words during the past few weeks. This introduced a relatively familiar pairs activity, with one pupil making building shapes and the other being the fire moving about it, depending on which slide was showing on the IWB. The fire pupil was to say the word of the action they were doing, as displayed on the IWB, as they moved about their partner.

As the pairs swapped so that the fire pupil became the one to make building shapes, the teacher showed other IWB slides to remind them to use different levels for the buildings, as high, medium, or low. Thus in this final lesson a further support had been offered for thinking about

how to move as the fire, and for thinking about different ways to make shapes of buildings. Each slide for the different heights had the word written in large font, and a picture of one of the pupils making such a shape from previous lessons, as shown in figure 6.14. As well as a re-orientation to the topic concepts, this also offered support for developing pupils' linguistic skills and their ability to verbally express their developing conceptual understanding, in recognising correspondence between the written and spoken words, alongside pictures and arrows to support them in making meaning around the words.



Figure 6.14: Buildings can be high, medium or low, week 8, hall lesson, 18.20

All these preparations then funnelled into a whole-class 'final outcome', which the teacher fed into with a photograph on the IWB from a street scene they had made in the previous hall lesson.

The teacher used the photograph on the slide to raise the key points:

- Building pupils were at different levels;
- A child as the fire went (using arm movements, and encouraging pupils to say the words and use the arm movements) under, over, around and through the line of pupils.

From this reminder of the previous lesson, the teacher told the pupils that they would be making a new street scene. This incorporated familiar and developments of familiar points from their previous street scenes, which I illustrate and explore below, whereby:

Familiar - Pupils as buildings were to be at different levels;

Familiar - Pupils as buildings were to be close together, and in a winding line;

Familiar - The pupil as the fire was to travel under, over, around and through the line of building pupils;

Familiar – The activity would be recorded in painting and on the PSP, to represent past and present means of recording evidence;

Development - When the teacher shouted ‘firebreak’, the building pupil at the end of the line was to collapse, and the fire pupil had to change direction to go back where they came from;

Development – More than one pupil would be the fire at any given time, to show rapid spread of the fire;

Development – More pupils would become firebreaks, so that ultimately there would be no building pupils left for the fire pupils to spread.

These latter points were distinct extensions of previous incarnations of street scene enactments – emphasising continuity - whilst integrating movement and more traditional classroom-based explorations around the firebreak concept – emphasising cumulation of activity and concept.

As the whole class were involved in this single street scene enactment of the conditions for the fire spreading and means by which it was stopped, the dance specialist took on the eyewitness role of ‘Samuel from the present’, recording the scene in video on the PSP. The teacher painted the scene, posing as ‘Samuel from the past’. It was a much smaller class that day due to it being a religious festival, for which children were given leave to be at home. Therefore all pupils, as well as the TA, were involved in the physical activity rather than recording it. Figure 6.15 below shows the enactment of the points above (see multimodal transcribed extract 7).

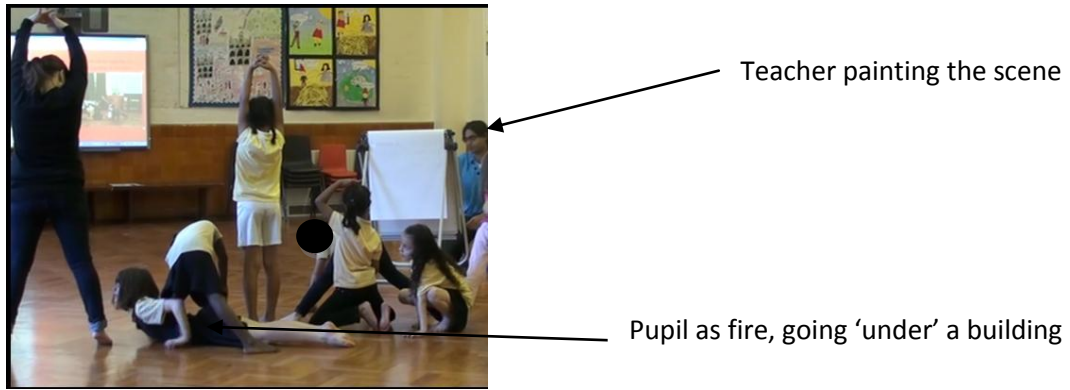


Figure 6.15: Embodying the spreading and stopping of the fire, week 8, hall lesson, 24.55

6.10.1 Commentary to multimodal transcribed extract 7: Cumulative exploration of buildings, fire and firebreaks

As the first pupil was told to travel over, under, around and through the line of pupils, the dance specialist reminded the pupils of her role to record the event on the PSP (row 3 of multimodal transcribed extract 7), which also served to remind the teacher and for him to state that he was going to paint the scene (row 4). The playing of music supported the ongoing activity as within a movement or dance frame (row 4). Equally the pupil's labelling of her movements as over, under, around and through (rows 5 and 7) maintained the link between the movement activity and the historical content of movement of the fire, although the link was not made explicit at this point. Furthermore, the dance specialist's and teacher's media and reference to their media of recording the activity framed and reiterated the importance of evidence within the history discourse, and the difference between past and present media for creating these sources of evidence.

This movement phrase was further developed, as the order 'firebreak' (row 12) meant there was one less person for the 'fire' pupil to move about. At this point the teacher invited the 'fire' pupil to explain the significance of the firebreak within the context of the movement re-enactment (rows 13-14), to which she replied 'go back the other way', thus linking the movement activity and historical topic content. Before increasing the complexity the teacher reset the scene, as in the original firebreak demonstration, by swapping the 'fire' pupil (after row 19), and as the TA who had been the 'firebreak' stood up as a building again (shown in row 20). The teacher then paused

his painting to move from the side to the front and so more directly orchestrate the unfolding scene, for instance as a new pupil was selected to be a 'firebreak', and fall to the floor (row 20: 'And firebreak'). The teacher increased the complexity of the representation and integration of concepts by asking the TA to join the pupil to represent the fire. Within the following minute all the pupils became either a fire or a firebreak, with the addition of a third pupil to represent the fire (row 23) to illustrate the fire spreading more quickly, and more pupils as firebreaks to mean that the fire had nothing left to burn and so nowhere else to go as no buildings were left standing.

The terms of reference by the teacher became increasingly more related to narrating an embodied representation of the fire, such as in the phrases 'OK Lior you're a fire now as well' (row 23); 'another firebreak so collapse as well' (row 25); 'Firebreak, you need to have collapsed completely' (row 26); and finally 'all of the rest of the buildings collapse completely' (row 28). This was relative to statements made by the teacher a little earlier in the interaction that were focused more on movement qualities: 'get ready to go under, over, around and through' (row 2), and early comments by the dance specialist including to the 'fire' pupil to 'try some different actions, you could jump over, or roll under' (row 10). Explicit movement instructions were however integrated within the conceptual instruction and narration to ensure the smooth unfolding of the representation: including comments to 'hold your shapes' (row 9) by the teacher, as the 'fire' pupil was struggling to move about a 'building' pupil who was shifting her shape; and to 'spread out a little bit' (row 24) to allow the 'fire' pupils to travel across the scene without treading on the 'building' pupils. Thus the movement and topic discourses were to some extent interlinked in directing and narrating the scene, as was identified in chapter 5, just as the physical movement activity offered a transparent, embodied representation of the issue of concern: of why the fire spread and how it was stopped.

After the activity, the teacher addressed why he had told more than one pupil to be the fire and firebreaks, allowing him to summarise the embodied representation of the historical concepts, in

stating 'There was more fire than people pulling down houses. That's why I got more and more of you to become the fire, and more and more of the buildings to collapse'. In this frame, although the evolving movement activity had been slowly developed over the four weeks, the final speeding up and poetic 'ending' of the activity was used to allow the children to effectively discover for themselves how and why the fire spread and how it was finally stopped. This multimodal improvable object of the physical and recorded physical exploration of why the fire spread and how it was stopped, followed a trajectory of enacting, re-viewing, refining and integrating the various concepts relevant to the learning objectives. The modes in play were again re-configured, as the pupils were then shown their acted out street scene in the forms of the teacher's painting and the dance specialist's video (shown this time on the IWB).

In his consideration of improvable objects, Wells (1999, 2009) also acknowledged the multimodality of communication, but did not explicitly explore the creation of improvable objects across modes. In my data, subject and topic discourses (as explored in chapter 5) and topic concepts were mediated through a number of tasks and objects in different modes, each used to build understanding around the re-worked object. This was observed through use of painting, writing and moving, as well as recording, viewing and re-working (improving) still images and video of the activity about the progressing topic content, as depicted through the ephemeral mode of movement. In this the transient activity (movement) was recorded and made permanent (visual image or video shown to whole class) to highlight key points pertinent to the ongoing knowledge-building activity (in speech aligned to the image or video of the shared movement experience). It seems appropriate to close this commentary with the words of the teacher from his pre-interview, as he identified how his multimodal resourcing of teaching-and-learning activities was driven by a desire to best support his pupils' learning:

Interview extract 6.6: Teaching as providing multimodal opportunities for learning

Teacher's pre-interview, 24.49-25.34

The extract represents the themes: pupil participation, pupil enjoyment, IWB use, interpreting concepts across modes, and role of the teacher.

1. All these things get them more engaged. It gets them interested in their learning, and
2. that's the main, that's my job really. Get them, you know, make learning as irresistible as
3. possible (laughs), you know. That's a quote I got from (laughs). But erm, it's a really good,
4. it's a really good idea. You know if they're getting involved, physically, as well as you
5. know, just through interaction on a whiteboard or whatever, they're definitely gonna
6. learn more. It's just, you know hands down, beats teaching them, just listening. Erm, I
7. think teaching is changing as well, because we're not, we're no longer just teachers now
8. you know we're, you know, facilitators of learning if you want. So we provide
9. opportunities for them to learn.

6.11 Chapter summary

In chapter 5 I identified how resources as 'improvable objects' can be used to record a moment in the ephemerality of talk. In particular I illustrated how an IWB slide can be annotated with central or identified points, and any annotations saved or removed, and re-edited or added as necessary in subsequent uses. From the data presented in this chapter, I showed how tools can be used in a similar way but to record moments in the ephemerality of *movement*, and indeed in recording moments in the ephemerality of *talk around movement*. I used multimodal analysis, whilst maintaining the centrality of language, to offer a potentially richer notion of improvable objects in a multimodal context, in how an object can be improved within and across modes, and the role such objects can play in supporting and revealing understanding. I therefore argue that within a view of all communication as multimodal, but with talk used to integrate and draw salience to aspects communicated in other modes, analysis of movement and re-working of teaching-and-

learning experiences across modes can offer a richer picture of how knowledge can be built multimodally and over time.

As in the original definition of improvable objects, the focus therefore is not directly on the object *per se*, but on the process of working both with and on the object: such as in working 'with' the physical movement, and 'on' the represented versions of movement. I addressed how an object was used and re-versioned in interaction (around an evolving movement exploration of a street scene in London in 1666), through consideration of the interrelationships of talk, painting, items recorded on the PSP, items displayed on the IWB, and movement, and how they were orchestrated to support reflection, revision and connection building along a meaning-making trajectory. Thus the different means of representing the historical event provided the 'contextual foundations', to paraphrase Mercer (2008), for exploring the topic and developing conceptual understanding across modes. This in turn highlights the important role multimodal improvable objects can play within contemporary teaching-and-learning settings.

Within this analysis I employed the term 'embodiment' to address where movement activities were used in lessons as a complementary mode of communication and exploration to other modes in use at the time, for instance to serve as a multimodal anchor. Embodiment was a useful concept to explore how movement was used as part of a multimodal improvable object, embedded and recorded in photographic, video and painted form to bridge between conceptual understanding and verbally-expressed understanding. From this I argue that use of movement can offer a means to demonstrate conceptual understanding as an observable point of reference: as a prompt and resource for dialogue. This may be particularly important in an EAL context, supporting development of understanding and building connections between concepts *across* modes, which illustrates the innovative approach taken by this teacher and dance specialist to meet their pupils' needs.

I showed how movement activities used to represent a historical event as well as recordings of movement were brought back into the dialogue at later points, to reinforce the story being told through movement representation in a cumulative sense of knowledge building. Introduction and reference to these activities, in shifting between physical explorations and talk, identifies where the conceptual, experiential and visual meet the verbal in representing and re-constructing developing topic understanding, as objects for improvement across multiple modes. I therefore propose that progressive knowledge building as observed here occurred *in the interplay between* the movement activity, representations of movement and talk around them.

Recording such movement, re-versioning and displaying it in video, photograph or painted form, offered a sense of the pupils' own work immediately and directly informing lesson resources and content, enhancing the active participation of pupils in lessons, and offered the teacher, dance specialist and pupils a further object around which to co-construct and check their developing topic understanding. As alluded to in chapter 5, such activity provides an embodied version of 'matched resources', whereby different resources including use of movement, images and painted representations of frozen movement, video of dynamic movement and talk can be brought together in the formation of a multimodal ensemble, or composite meaning unit.

I illustrated a number of occasions where pupils participated in the lessons across modes and to different lengths, the opportunities for participation that were planned for beforehand by the teacher and dance specialist, and those that were created in ongoing interaction. It became evident, such as in pupils' responses to classroom management reminders that pupils would be selected who were behaving appropriately, that pupils were keen to participate in the creation and consideration of lesson resources and issues, across the modes of movement, talk, interaction with the IWB and in being photographed. It also became evident that the teacher and dance specialist welcomed pupils making their own links and voicing their curiosity about the topic, as revealed through their combination of communicative approaches. I would argue that

for this group of pupils this reinforces the importance of allowing for pupil participation in meaning making as a multimodal endeavour, which my multimodal approach to analysis enabled me to identify. In the following chapter I address the issue of teacher flexibility and improvisation in more detail.

Regarding the tools used to record improvised movement activities (notably the PSP and IWB), some uses of these tools as presented in this chapter could be considered innovatory in terms of the teaching-and-learning aims for which they were employed. As I showed, during these lessons photographs of movement activities were:

- Displayed in photograph form on the IWB, usually directly after capture;
- Displayed on the PSP screen directly after capture (in that lesson due to the card reader not working so unable to link and show through the IWB);
- Copied and embedded into IWB slide files, in subsequent lessons;
- Embedded (pre-lesson) and moved (in lesson) in IWB slide files.

Videos of movement activities taken on the PSP were:

- Played back on the IWB by opening as a video file, directly after capture.

With this variety of use in mind, employing the PSP to record frozen images and dynamic videos of movement and show them back to pupils immediately on the PSP screen or IWB, of which images could then be referred to in highlighting key points, represents a particularly innovatory combination of tools and activity to achieve curriculum objectives. This indicates a potentially improvisational orchestration of tools and teaching-and-learning activities and interactions, where practitioners would not know what images they would record in lessons.

In such instances we can see how the teacher and dance specialist were what Lee (2010) would refer to as 'normalising the digital', in drawing regularly on the IWB and PSP tools to pursue pedagogic aims. As mentioned above, Betcher and Lee (2009) identified the IWB as a 'digital hub', which can be used to integrate and work with input from multiple media. Their description of the

'digital hub' reflects some of the practices outlined in this chapter, as orchestrated by the observed teacher and dance specialist in their use of the IWB and PSP, alongside other digital and non-digital tools. The importance in drawing on this term here is not to emphasise the digital over non-digital tools, as the teacher and dance specialist also juxtaposed digital and non-digital tools (such as painting) in the pursuit of pedagogic aims. The importance in referring to the IWB as a digital hub is to emphasise the *integration* of available resources in preparing lesson content and responding to pupils' needs within lesson interactions, whereby it played a crucial part when brought into interaction and alongside activity in other non-technological modes, in the creation of a multimodal improvable object. This again emphasises the significance of incorporating a multimodal approach within my socioculturally-framed analysis.

The technologies therefore were not merely used as add-ons, or for use sake, but where they offered genuine value to the teacher's and dance specialist's pedagogic and practical aims. Such use showed how the teacher and dance specialist utilised the various tools and activities available in forming a continuous and at times cumulative teaching-and-learning experience, around the *intended* meaning-making trajectory of why the Great Fire of London spread so quickly and how it was stopped. I explore this issue in more detail in the following chapter in the sense of the interplay between the teacher's and dance specialist's *intended* and pupils' *instantiated* meaning-making trajectories.

6.11.1 Key points

- Within a view of all communication as multimodal, but with talk used to integrate and draw salience to aspects communicated in other modes, analysis of movement and re-working of teaching-and-learning experiences across modes can offer a rich picture of how knowledge can be built multimodally and over time.
- Consideration of a multimodal improvable object as developed over time allows for a rich analysis of cumulative knowledge building.

- Recording and viewing recordings of pupils' own work, in a sense of embodied matched resources, increases the opportunities for pupil participation in lesson activity and creation of lesson resources.
- A multimodal improvable object to address development of conceptual understanding can offer opportunities for pupils to articulate their understanding where they may struggle if limited to one mode or another, and serve as a prompt for dialogue. It is the orchestration of this interplay between modes of communication, within situated activity, that potentially supports the unfolding of a more coherent understanding – of a composite meaning unit.
- Integration of technological resources, in preparing lesson content and responding to pupils' needs within lesson interactions, played a crucial part when they were brought into interaction and alongside activity in other non-technological modes, in the creation of a multimodal improvable object.
- In acknowledging the increasing presence and use of technologies in classrooms, and alongside other means of explicitly enhancing the multimodality of interactions, the multimodal improvable object is a valuable concept in addressing resource use within contemporary, technology-mediated and often multilingual teaching-and-learning situations.

Chapter 7

Dialogic meaning-making trajectories as interactionally realised

7.1 Introduction

Building on the findings reported in chapters 5 and 6, in this chapter I present analysis addressing my second research question:

How do instances of, and allowance for, improvisation and reciprocity in teaching-and-learning experiences influence the negotiation of meaning-making trajectories?

In chapters 5 and 6 I considered the concept of meaning-making trajectories (extending the concept offered by Baldry & Thibault, 2006) mostly in terms of the activities orchestrated by the teacher and dance specialist: as planned, or intended meaning-making trajectories. As mentioned earlier, I interpret 'intention' through analysis of the teacher's prepared lesson resources and through comments made in the interviews, whilst mindful that this may include a teacher's intention to improvise from his resources as appropriate. I also addressed some instances where pupils expressed ideas or mis/understandings that may not have been anticipated by the teacher, or were not part of the meanings intended by the teacher or dance specialist. In this chapter I look more closely at understandings and meanings made by the pupils, including those made in interaction with the teacher, and how meanings were negotiated and collaboratively constructed in interaction. Thus I address the teacher's *intended* meaning-making trajectory in the context of the meaning-making trajectories that were *instantiated* by the pupils as the lessons unfolded. In this sense I draw on the notion that communicative acts have 'meaning potential', a concept also drawn on in chapter 5, to consider how meaning is made from various possible interpretations. In this analysis chapter I offer teacher and pupil perspectives of meaning-making trajectories as interactionally realised, through the sharing and negotiation of meaning potentials. I argue for the potential value of identifying any differences between intended and instantiated meaning-making trajectories, as valuable teaching-and-learning opportunities for collaboratively constructing and appropriating common topic knowledge.

In terms of the teacher's view, Mercer (2008) argued, 'Good teachers will almost certainly conceptualize a learning trajectory for their students, albeit implicitly, and will know how dialogue can be used to transform this conception into social action' (p. 56). This aligns with my consideration of meaning-making trajectories, and indeed a view of *intended* meaning-making trajectories. In my analysis I combine and contrast this with a view of *instantiated* meaning-making trajectories, as constructed by pupils in the unfolding flow of lessons. I particularly explore these two notions within this analysis, and what happened when the teacher's 'conceptualisation' met pupils' interpretations.

In chapter 6 I illustrated the practitioners' attempts to demonstrate how the Great Fire was stopped by using firebreaks, through a number of modes and activities across the series of eight lessons. This represents the activities that the teacher and dance specialist had planned related to the concept, how these prepared resources and tasks were woven together into an intended meaning-making trajectory of what a firebreak is, and how they were important in the context of how the Great Fire was stopped. Ludvigsen, et al. (2011) argue that teachers' 'instructions' can give a view of a planned trajectory, but that 'instructions need to be transformed in the trajectory of the participation in order to become part of participants' meaning-making' (p. 108). Therefore, by focusing more on pupil responses to some of these demonstrations and instructions, as I do in the analysis that follows, we can gain some insight into how closely the *intended* meaning-making trajectory prepared and supported by the teacher mapped onto the *instantiated* meaning-making trajectories experienced by the pupils. In this I offer a significant development of Baldry and Thibault's (2006) concept of a meaning-making trajectory, to focus on the potential for differences between the planned/intended and the experienced/instantiated meanings as they were made and re-made through dialogue.

A meaning-making trajectory therefore may follow unanticipated routes, whereby the need for teacher improvisation arises. In this I draw on the work of Sawyer (2004) who described teaching

as 'disciplined improvisation', re-working a common metaphor of teaching as performance. I extend this view by showing how the nature of a teacher's response to such unexpected situations, either in attempting to adhere to the plan or in exploring pupils' interpretations, influences the negotiation and appropriation of meanings, and the extent to which an intended and instantiated meaning-making trajectory may ultimately be aligned.

Within this analysis I consider the concept of communicative approach (Mortimer & Scott, 2003) and how this can be applied in the context of collaborative meaning making, in terms of whether or not pupils are invited to interact with lesson resources or ideas (interactive/non-interactive), and whether or not the teacher allows for or acknowledges more than one interpretation or view (dialogic/authoritative). This also entails a consideration of how a teacher 'orchestrates' (Bourne & Jewitt, 2003; Littleton, et al., 2010) such dialogic, technological and physical resources, in supporting the negotiation of meanings. As I focus largely on talk in this chapter, Alexander's (2008a) statement with regard to 'dialogic teaching' is relevant here: 'it is the qualities of extension and cumulation which transform classroom talk from the familiar closed question/answer/feedback routine into purposeful and productive dialogue where questions, answers and feedback progressively build into coherent and expanding chains of enquiry and understanding' (p. 26). In my analysis I focus particularly on how such opportunities for interaction and dialogue were allowed for by the teacher, and how dialogic exchanges initiated by the teacher or pupils were spontaneously worked with in constructing a shared instantiated meaning-making trajectory that aligned with or altered the teacher's intended meaning-making trajectory: how meaning potential was interactionally transformed into cumulative meaning making. Thus I draw on the distinction of learning experiences as continuous – linking to what has gone before and what is yet to come – and cumulative – as progressive integration of events and concepts (Alexander, 2008a; Mercer, 2008). Both continuity and cumulation are significant educational aims, but cumulation is identified as being more important but potentially more

difficult and rare in practice (Alexander, 2008b). I now outline how I selected data to exemplify my analysis in this chapter.

7.2 Outline of the data to be presented

This chapter comprises two main sections where I illustrate the negotiation of intended and instantiated meaning-making trajectories:

- through teacher and pupil questions to build meaning cumulatively around a particular concept,
- and through findings of the concordance analysis to address the teacher's adoption of an interactive and dialogic communicative approach.

In contrast to the multimodal approach of chapter 6, in this chapter I focus more on talk, with attention to any other modes of communication where they were referred to or aligned with that communicated through talk. In this chapter all extracts are taken from the class lessons, and so not involving the dance specialist. This selection of extracts is mainly due to the fact that less pupil talk was audible in the recordings of the hall-based lessons: due to the playing of music; and by pupils being spread out and moving around the large space of the hall thus taking them away from the microphones. Extracts were selected to exemplify the broad patterns in the data identified above, in terms of teacher and pupil use of questions, and adoption of an interactive and dialogic approach as highlighted through concordance analysis. Three extracts presented here were only captured on the teacher's audio microphone, whereby I do not have access to any additional resources drawn on or referred to in other modes. In these cases transcription is restricted to the verbal exchange. I also include extracts from my thematic analysis of the interview data, where they resource understanding of the claims I make around the lesson data. My rationale for use of this analytic tool and transcription conventions were outlined in chapter 4.

For the first analysis section of teacher and pupil questions around the issue of 'firebreaks', I present extracts from the data utilising the transcription conventions as outlined in chapter 4 for

qualitative SCDA. This is because I want to focus on the talk – the questions asked, by whom, and the resulting responses – but also to acknowledge other resources referred to or utilised in other modes in the collaborative meaning-making process.

For the second section I draw on findings from my concordance analysis to evidence strategies in which the teacher adopted an interactive and dialogic approach to topic content, which necessarily involved a commitment to improvise and reciprocally engage with pupils' contributions. The use of concordance analysis was appropriate here in identifying specific and frequent phrases used by the teacher, which I could then analyse in more detail.

In combining the findings of these two sections, I outline how considering in detail the interactional and improvisational nature of meaning making through a sense of intended and instantiated meaning-making trajectories can offer a rich appreciation of how to support cumulative negotiation and construction of knowledge. I use this approach to view the 'reciprocity' of exchanges 'in which ideas are bounced back and forth and on that basis take children's thinking forward' (Alexander, 2008a, p. 24). Such a view enables me to consider how allowance for unknown and unplanned features of classroom discourse can facilitate collaborative and cumulative negotiation of an instantiated meaning-making trajectory.

I now present an *instantiated* meaning-making trajectory, of a pupil's developing interpretation of the firebreak concept the teacher had aimed to convey. The teacher's and dance specialist's multimodal scaffolding of this concept was addressed in chapter 6, but here I offer a more dialogic view to illustrate teacher and pupil input into construction of meaning around the concept.

7.3 Meaning making around the concept of firebreaks

The focus in chapter 6 was on use of movement in exploring how the fire spread and was stopped. In this section of chapter 7 I focus on where a pupil (Lior) demonstrated her understanding, which in this case was largely through her verbal interactions with peers or the teacher, as well as in her written work. I particularly focused on Lior as she made a number of comments related to this concept during the course of the topic lessons. These comments identify some of her confused and changing ideas, and her struggle to understand concepts the teacher was introducing. As she made a number of comments, we get a sense that she was motivated to understand the ideas at stake. All but one of the extracts in this section were taken from when pupils were working at their tables to complete individual work. I would argue that unlike in many whole-class periods when teachers largely ask most of the questions and have pre-set ideas of what the answers will be, within one-to-one or small group interactions as presented here the teacher needed to improvise his presentation of content as pupils asked the questions and posed sometimes unexpected interpretations.

7.3.1 Use of IWB slides as a prepared resource for dialogic meaning making

The first extract I present is from the third of the eight lessons (week 6, class lesson), where the teacher had structured an activity to cover some of the key topic concepts. The introductory IWB slides prepared by the teacher offered some information about why the fire spread and how it was stopped. These were complemented in this lesson by the third physical demonstration of what a firebreak is using some pupils at the front of the class (for more detail on the firebreak demonstration see chapter 6).

Following this verbally, technologically and physically-resourced introduction, the teacher introduced a task for pupils to do individually at their tables. This involved forming sentences, by cutting out and placing together sentence starters (three that stated 'The fire spread quickly because...'; and three that stated 'The fire stopped because...') with appropriate sentence endings

(six statements). The teacher had modelled some of these sentences on the IWB, incorporating a form of 'matched resources' (Hennessy & Deaney, 2006) of the large IWB demonstration template with the individual sheet of statements prepared for pupils to work on.

As Lior was joining sentence starters and endings on her sheet at her table, the teacher approached them and asked some of the others on her table to read out and explain their choices. Lior asked her teacher, Anwar, for some help in pairing two options, to which he replied 'read it, read it. See if it makes sense'. Here he was attempting to support both linguistic development as well as grasp of the topic material, by asking her to put the sentence sections together and to read them out to him. Lior held out two of the sentence sections she had cut out and was considering:

7.3.1.1 Lesson extract 7.1: Structuring, working on and supporting a task to contextualise key concepts

Week 6, class lesson, 28.25-29.30

1. Lior: The fire spread because firebreaks were used
2. T: OK. So did it spread quickly because of the firebreaks, or less quickly because of the
3. firebreaks?
4. (Pause, Lior still looking at her sheet)
5. T: Why did they use firebreaks?
6. Lior: (looks up at T) To stop the fire
7. T: Right so, is the fire going to spread quickly or less quickly?
8. Lior: Erm, less
9. T: So that wouldn't make sense would it?
10. (Lior shakes head)
11. T: So try another one that would make sense.

7.3.1.2 Commentary to lesson extract 7.1

In this we can see that the teacher was trying to help Lior work out appropriate reasons for the fire spreading and stopping, without directly telling her the answer. When she appeared to struggle he de-constructed the conceptual grounding of the sentence ending she had selected about firebreaks, to ask why they were used (line 5), trying to encourage Lior to build connections (Gee & Green 1998) between the terms and how to use them in sentences – toward a contextualised understanding. Once Lior had articulated why they were used (line 6), she appeared able to make the link between understanding why they were used, and perceiving this as a reason for how the fire was stopped (lines 8 and 10). This interaction could be considered as a ‘rich point’ (Agar, 1994), or ‘frame clash’ (Green, et al., 2008) – through the rendering visible in talk of competing interpretations. This was evident in exposing Lior’s current understanding, and as the teacher used her comments to improvise his response and so match her current need. As such, it indicates some progression in Lior’s instantiated meaning-making trajectory, regarding what firebreaks are and why they are important to the topic. It is through such ‘rich points’ or ‘frame clashes’ that make moments of meaning making evident to the teacher and researcher through verbal interaction, that the negotiation of such trajectories can be observed.

The teacher commented in his pre-interview on the importance of the balance between presenting content to the pupils, and allowing them opportunities to work with it themselves:

Interview extract 7.1: Allowing opportunities for pupils’ independent work

Teacher’s pre-interview, 28.35-29.04

The extract represents the themes: role of the teacher, and pupil participation.

1. I do think that you need an initial, an initial part of the lesson or a part of a unit where I
2. am doing most of the teaching and I am doing most of the talking... you start them off and
3. then, you, you know you see what they can do by themselves. The main thing is their
4. independent work and their independent thinking and speech. Cos that gives you a far

5. more clear idea of what they can really do than anything they do with me.

Although the teacher therefore emphasised the need at times for an initially authoritative approach, he saw the work then done by the pupils as significant in the instantiation of their own meaning-making trajectories, and in revealing their understanding to him, as illustrated in lesson extract 7.1. I now consider how the conceptual knowledge around 'firebreaks' was further explored across the lessons.

7.3.1.3 Introduction to lesson extracts 7.2 and 7.3

Lior's continuing meaning making around the term 'firebreaks' was observable in the week 8 class lesson, as pupils learned about the information from Samuel Pepys' diary of the Great Fire. Particularly I refer again here to where class talk covered the role of firebreaks in stopping the Great Fire, to follow the meaning making around this concept as outlined in lesson extract 7.1. As the teacher read out facts from his re-presentation of the diary on his prepared IWB slides, he stated that the diary reported how the King had commanded all houses to be pulled down (as firebreaks) to stop the fire. To this, Lior asked: 'where could they live?' and then 'why couldn't they just pull down about five houses?'. The teacher responded to these questions, to adopt an interactive and dialogic communicative approach, in using his prepared extracts on the IWB to show how pulling down just a few houses had not worked. He was able to acknowledge Lior's question, using his slides to quote from the authoritative text of Samuel Pepys' diary reporting the Mayor of London at the time saying 'I have been pulling down houses but the fire overtakes us faster than we can do it'. We see from this that Lior was thinking one step ahead, or aside, of the teacher's and perhaps history's factual depiction of how firebreaks were used to stop the spread of the fire, through the diary of Samuel Pepys. (It was not made clear in the lessons whether Samuel Pepys' house was pulled down.) Lior's *instantiated* meaning-making trajectory had taken a diversion onto the emotional and practical consequences of this action. This exchange identifies the importance of attending to the social and emotional aspects of pupils' reasoning, as suggested

by Vass and Littleton (2010), which may not have been anticipated by the curriculum-driven setting of learning objectives. The interaction evidences that for pupils this can be an important facet of their meaning making, in understanding abstract concepts from the distant past.

The teacher demonstrated his knowledge of the event and his responsiveness to his pupils in addressing Lior's question, and attempting to show her why the course of action taken was the only viable one given the severity of the situation. In doing this he also reinforced the importance in history discourse of sources of evidence (as illustrated in chapter 5) by invoking Samuel Pepys' diary, and in referring to his own prepared IWB resource, within his spontaneous answer. He was able to be flexible in his immediate response within his overall aim to stabilise meanings (Ludvigsen, et al., 2011; Roth & Duit, 2003), in deviating from his planned coverage of the issue and use of his slides. He adopted an 'improvisational' approach in responding directly to the pupil's questions through secure knowledge of the topic, and dynamic as well as multimodal orchestration of the prepared visual resources alongside his verbal explanation. Through this he responded to Lior's unexpected query and supported her in collaboratively negotiating a shared, instantiated meaning-making trajectory that aligned with the historical evidence.

Using the diary of Samuel Pepys as an example and starting point, pupils were asked in this lesson to write their own diaries as if they were Samuel Pepys, as eyewitnesses at the time of the fire. Some prompt questions had been prepared on an IWB slide for pupils to write answers to in their diaries. One such question stated 'why are firebreaks taking so long?'. The following short lesson extract occurred as pupils at Lior's table were working on writing their diaries, and identifies how pupils applied their own reasoning in attempts to interpret the historical 'facts':

7.3.1.4 Lesson extract 7.2: Pupils querying and re-constructing historical events

Week 8, class lesson, 36.55-37.25

1. Lior (looks up at Cath, who she is sitting next to; Mia also leans in): Can I ask you a

2. question? Why are firebreaks (looks up to IWB) why are firebreaks taking so long?'
3. (Cath looks back at Lior but does not speak)
4. Lior (leans over to Ibtihal on the other side of the table): Ibtihal do you know why
5. firebreaks are taking so long?
6. Cath: Cos wood is so heavy
7. Ibtihal: Because the houses are so heavy?
8. (Cath and Ibtihal look down at their sheets, Lior stands up and walks to the teacher who is
9. at another table)

This was followed by Lior joining the table where the teacher was working through the diary activity with other pupils.

7.3.1.5 Lesson extract 7.3: Exploring explanations of historical events

Week 8, class lesson, 37.37-38.05 and 38.10-38.20 (teacher's microphone)

10. T: The fire was too quick, that's why it took so long to pull the houses down
11. Lior (to T): because erm, because erm, my friends told me
12. T: What did they think?
13. Lior: Cath thought, because the houses were so heavy
14. T: Mmm
15. Lior: That's what Ibtihal thought. And I thought it was erm, cos the fire was going so quick
16. T: Yeah the fire was going really quickly, and erm... So why, so you think because the fire
17. was spreading too quickly. That's exactly what Samuel Pepys said isn't it? He said
18. (pause), the fire is taking over us before we can do it, faster than we can do it.

7.3.1.6 Commentary to lesson extracts 7.2 and 7.3

From these two consecutive extracts, we can see how Lior drew on her classmates as knowledge resources in thinking about why firebreaks were taking so long to stop the fire. Equally we can see

that the suggestions offered by Cath and Ibtihal were logically viable (lines 6 and 7) – that houses made of wood might be heavy and so take a long time to pull down – which indicates again a potential meaning being made that may not have been anticipated by the teacher, and another difference in the intended and instantiated meaning-making trajectories. It appeared however that Lior was not entirely sure of these responses, or preferred to trust a more authoritative source, as she searched for a further opinion by asking her teacher (as she had also done in lesson extract 5.2). This exchange required Lior to interpret and evaluate comments from her peers (lines 13 and 15), followed by the teacher supporting her to work through and evidence reasons (and cite sources of evidence) for why the fire progressed through the city (lines 16-18). We cannot be sure whether Lior heard and copied the suggestion of the teacher (line 10) at the table she had moved to, in giving a similar response to a question for which she was now considering a third answer (line 15), whether she heard and in doing so recognised the appropriateness of the response she heard, or whether there was some other reason for her giving a response other than ‘I don’t know’, or the answers given to her by Cath and Ibtihal. What we can observe however, is that this latter reason was incorporated within the diary Lior wrote, as I now show.

7.3.2 Aligning intended and instantiated meanings through dialogic interaction around resources in other modes

This incorporated reasoning was revealed as the teacher returned to Lior’s table and asked her to read her diary to him (after asking some of the others on her table to do the same). The following lesson extract is taken from when Lior was reading some of her diary to the teacher, as it related to the use of firebreaks:

7.3.2.1 Lesson extract 7.4: Exploring conceptual understanding, as opportunities to reinforce topic discourse

Week 8, class lesson, 43.55-44.35 (teacher’s microphone)

1. Lior: The King has commanded (pause)

2. T: pull
3. Lior: all of the houses to stop the fire (pause) because the fire
4. T: spreading. Instead of going, spreading. (pause) OK
5. Lior: too fast. It is going
6. T: spreading
7. Lior: so quickly because the houses aren't breaking down in time
8. T: Good, fantastic.

7.3.2.2 Commentary to lesson extract 7.4

We see that Lior had used the phrase of the fire 'going' in her written piece (lines 4-5), as she had in talking to the teacher at the other group's table (lesson extract 7.3, line 15). In developing her topic discourse about the Great Fire (as explored in more detail in chapter 5), the teacher suggested and annotated onto her written diary that this would be more appropriately phrased as 'spreading' (lines 4 and 6: her written diary is shown in figure 7.1 below).

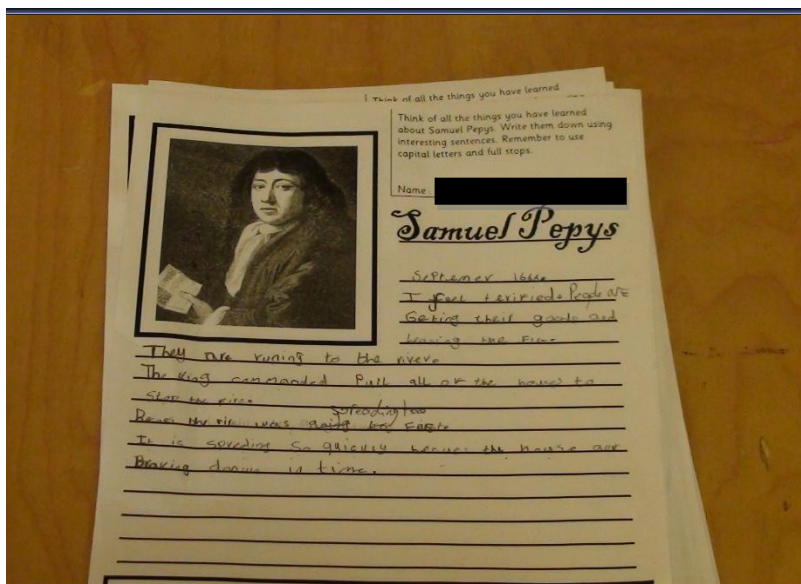


Figure 7.1: Lior's diary of the Great Fire of London

The above interaction was therefore a critical and rich point in Lior's ongoing instantiated meaning-making trajectory, where the discourses of human movement and fire movement were

brought together (in a clash of frames of reference) and the teacher explicitly identified the preferred term. (The teacher had embedded this term in his reformulation of Lior's response at the end of extract 7.3 – line 17 – but had not drawn attention to it as an important term.) Without this reciprocal verbal interaction, mediated by Lior's written diary and the teacher's prepared prompts on the IWB slide, the difference between the intended meanings – around the fire 'spreading' – and the then instantiated meanings – around the fire 'going' – and the role of firebreaks in stopping this spread would not have been brought to light. Therefore the pupil's and teacher's perspectives were aligned with each other and within an appropriate topic discourse through this exchange. With this re-phrasing, it appeared that in this lesson extract Lior's understanding of why firebreaks were used and why they were taking so long to stop the fire matched that of the teacher. He also suggested this was the case in his comment 'good, fantastic' (line 8). This identifies the crucial role of improvisational and reciprocal talk in rendering current understanding visible, and in instantiating shared meaning-making trajectories. I will now show how such meanings made around and with this topic discourse were seen to be embedded in the ongoing flow of the lessons.

7.3.2.3 Introduction to lesson extract 7.5

At the end of the same lesson (week 8, class lesson), the teacher invited a few pupils to read their diaries to the rest of the class. Lior read hers, incorporating this final change from 'going' to 'spreading', as she read from her own work.

7.3.2.4 Lesson extract 7.5: Embedding the topic discourse to evidence conceptual understanding

Week 8, class lesson, 49.19-50.00

1. Lior (standing in front of IWB facing class): September 1666. I feel terrible [written
2. 'terrified']. People are getting their goods and leaving the fire. They are running to the
3. river. The King (pause, to T) I can't remember that one (shows sheet to T and points to
4. it, looks at T)

5. T (leans toward sheet): The King has commanded
6. Lior (turns sheet to face her again and looks at it): commanded pull all of those houses to
7. stop the fire, because the fire (pause)
8. T: can you see from there? Come around here (points to side of IWB closest to him),
9. come around here, out of the light.
10. Lior (moves to side of IWB)
11. T (looks at and points on her sheet): Because the fire was spreading too (pause)
12. Lior: fast. It is spreading so quickly because the houses aren't breaking down in time
13. (looks at T)

7.3.2.5 Commentary to lesson extract 7.5

Most of this development or perhaps re-directing of Lior's instantiated meaning-making trajectory occurred or was visible in one lesson, through her written work and her interactions with her peers and the teacher. Whilst the teacher still supported Lior in reading her written work, in his role as a discourse guide, and in negotiating problems of standing in front of the IWB (lines 8-9), we can see that Lior had incorporated the modelled phrases within her instantiation of events of the Great Fire (line 12).

There is a suggestion that she had arrived at a stable meaning and understanding of the role of firebreaks in stopping the Great Fire, in her response in the week 8 hall lesson the next day. In covering some of the slides from the previous lesson on Samuel Pepys' diary, the teacher read out the section on the Mayor's statement about trying to pull houses down, but that the fire was spreading too quickly for this to have any impact. The teacher asked the pupils why firebreaks were not working, to which Lior offered the reason: 'they were pulling as many houses down as they can but the fire was spreading too quick'. We see in this that Lior had spontaneously drawn on similar language to that modelled by the teacher the previous day, of the Mayor complaining about firebreaks taking too long. In this single statement she had also embedded the term

'spreading' instead of 'going' in terms of the fire's progression. Here we see how the social and individual processes were brought into contact, the inter and intrapersonal, in the creation of common knowledge. The intended and instantiated meanings at this point were aligned, although the trajectory formed in reaching this alignment may not have followed that envisaged by the teacher.

Whilst it may seem that the teacher's intended meaning-making trajectory and Lior's instantiated meaning-making trajectory regarding firebreaks separated at a point, the repeated use of the joint interpretation in Lior's statement above (the teacher's intended interpretation) in the week 8 class lesson indicated that she understood the significance of the teacher's emphasis on the term 'spreading'. Her embedded use of the term in the week 8 hall lesson however suggested that she understood and had 'appropriated' (Bakhtin, 1981, 1986) this view, by linking verbally and for herself the key terms and factors a day after they were reinforced by the teacher. Solomon and Black (2008) argued that participation is critical in learners constructing their own understanding on the intrapersonal level, through verbal interaction and co-construction on the interpersonal level, in their case within the maths classroom and discourse. This identifies in the context of my data presented above how the pupil's questions and interactions with her teacher and peers over the lessons, being an active participant in her own learning and as acted out on the interpersonal level, potentially supported her in building a self-confident, intrapersonal understanding. My analysis of verbal interactions, as mediated by resources in other modes, enabled me to view how intended and instantiated meaning-making trajectories were aligned or differed, and the work done in collaboratively and cumulatively building a shared, instantiated meaning-making trajectory across the lessons.

7.3.3 Section summary

In this section I illustrated how lesson resources were drawn on by teacher and pupils, in building connections between the 'facts' they were learning about, and in collaboratively negotiating

meanings. I focused here predominantly on the transformation of meaning potential into meaning making as realised interactionally through talk, acknowledging also the influence of other modes brought into interaction through and alongside talk. I used this focus to evidence how adoption of a dialogic and interactive approach can allow for dialogic rich points or frame clashes – where potentially alternative views are juxtaposed – to be orchestrated as stepping stones toward building shared understanding, in a collaborative, instantiated meaning-making trajectory. Such rich points evidence for the teacher and researcher critical moments along pupils' meaning-making trajectories, highlighting any emerging deviation from the intended meaning-making trajectory, and thus where further support may be beneficial.

The teacher's willingness and ability to explore pupils' interpretations, in improvising from a lesson plan, will necessarily influence the extent to which pupils feel their contributions or queries have been acknowledged, and the extent to which an intended and instantiated meaning-making trajectory can be aligned over time. This highlights the importance of pupil participation in lesson activity, as active agents in questioning authoritative sources and collaboratively and cumulatively forging an instantiated meaning-making trajectory. It also exemplifies the need for the teacher to feel secure in his/her subject knowledge when being improvisational, to be able to validate and build on pupils' curiosity. Therefore the distinction of intended and instantiated meaning-making trajectory offers a useful conceptual tool for thinking about how meanings are made out of different meaning potentials, and the potential value of their dialogic negotiation by being explicitly brought into interaction.

In the following section I explore further the potential value of a teacher's dialogic and interactive communicative approach, in addressing the teacher's use of certain phrases and pupils' responses to these invitations, drawing on findings from my concordance analysis of lesson transcripts.

7.4 A dialogic, interactive approach

For this section I draw initially on my concordance analysis of lesson transcripts, and extend some of the analysis presented in chapter 5 regarding the teacher's use of the word 'go'. I address particular uses of the word 'go' that were not related to movement of the fire or movement in general (which were addressed in chapter 5). As identified in chapter 5 I labelled this form of use as 'go invite contribution'. Using the term 'go' to invite contributions from pupils, or extensions of contributions, was observed in 32 phases by the teacher (see chapter 5 for description of phases), and once by the dance specialist across the eight lessons, as a means to bring pupils into the meaning-making activity. In this as in the last section the extracts presented here are taken from the class lessons and so did not involve the dance specialist. To close the section I also explore some questions raised by pupils, not directly related to the teacher's use of 'go'. From closer analysis of the transcripts (highlighting the beneficial combination of concordance and qualitative analysis), use of the word 'go' by the teacher to invite contributions often coincided with the teacher adopting an interactive and dialogic communicative approach, and was employed in a number of ways as I now illustrate.

7.4.1 Use of 'go' to invite contribution: To concretise/digitise a suggestion

One such use of 'go' by the teacher to invite a contribution was contained within a recap activity in the very first topic lesson, mediated by prepared statements with blanks to be filled in on the IWB (see figure 7.2). The teacher had just asked when the Great Fire happened, as an interim recap of content covered and in drawing on the timeline activity from a few minutes earlier (as addressed in chapter 5), at which point the correct date was identified and the following exchange occurred.

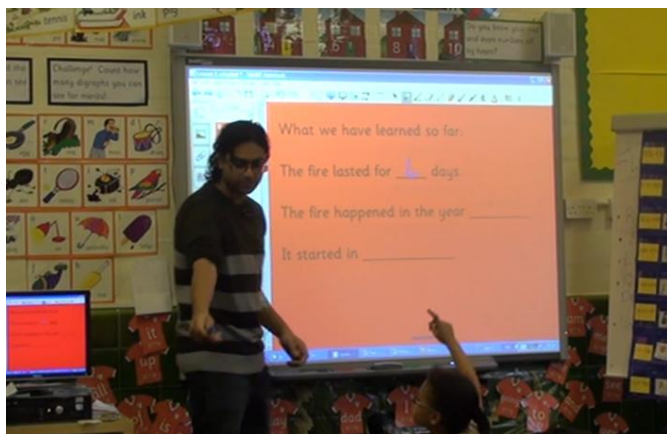


Figure 7.2: 'You said it so you can write it', week 5, class lesson, 24.00

7.4.1.1 Lesson extract 7.6: Inviting contributions and offering opportunities

Week 5, class lesson, 23.56-24.03

1. T: Very good. (T turns to face IWB and raises arm with IWB pen in to write into blank 'The
2. fire happened in the year...') It [happened in the year
3. Lior: (raises hand) [Can I write it please?
4. T: (turns to face Ps) Actually (holds pen out to P) you can write it cos you
5. (Lior lowers hand)
6. T: you said it so you can write it. Here you go.

7.4.1.2 Commentary to lesson extract 7.6

In this instance, the teacher used 'here you go' to offer something to the pupil (line 6) in terms of both a tangible object (the IWB pen, line 4) and an ephemeral opportunity (to write their answer onto the IWB). As in Ametller's (2010) work, this potentially indicates a sharing of the authoritative floor, and encouragement for pupils to take ownership of their work, in allowing them a role in the construction of lesson resources by writing their answer onto the IWB slide. At this point the meanings made around the historical time context of the Great Fire, within the previous timeline activity and here at this recap moment, were instantiated by the verbal responses of the pupil and teacher, and in the written date added by the pupil to the prepared IWB slide. The use of blanks in this prepared slide indicates that this information and

consolidating it in writing was a part of the teacher's intended meaning-making trajectory. The pupils were able to offer this date with ease, whereby at this moment we can consider the intended and instantiated meanings as aligned. This indicates that the effort invested by the teacher in preparing the timeline slide before the lesson, and some minutes earlier in orchestrating talk and annotation around it (see chapter 5), had supported this alignment of intended and instantiated meaning-making trajectory.

Whilst use of the recap slide was planned, the teacher improvised from his plan in allowing a pupil to annotate the IWB slide with the validated answer. The pupil's polite request to write the answer (line 3) indicates that they enjoyed using the IWB tool. The teacher's comment in his VSRD session also confirmed this, as outlined in the following extract:

Interview extract 7.2: Pupils' willingness to participate

Teacher's VSRD session, 10.58-11.16

The extract represents the themes: IWB use, pupil enjoyment, and pupil participation.

1. The good thing is that they're, enthusiastic enough to want to come up to the board, erm
2. and use it. They enjoy using the whiteboard, the interactive whiteboard. And so when
3. they... do get a chance to write something then er, it's nice for them, they enjoy doing it.

The pupil who asked to write the answer, however, was not given the opportunity, but the teacher effectively interpreted this question as a suggestion that pupil annotation onto the IWB could be used as a further learning opportunity, whereby the recognition for giving the correct answer was to concretise it in permanent digital form ('you said it so you can write it': lesson extract 7.6, line 6). As the teacher identified in his pre-interview, this was a common strategy he employed: 'I'll usually ask one child to come up and, if they answer a question correctly I'll ask them to demonstrate their understanding on the whiteboard'. This gathering of 'correct' answers exemplifies that a form of 'presentational talk' (Barnes, 2008) was expected of the pupils, where

the focus is 'on getting it right' (p. 8). Such comments as from the teacher's pre-interview reinforce the points made in chapters 5 and 6 of pupils being willing to participate in lesson interactions and with lesson resources, and how invitation to participate was used by the teacher as a strategy to motivate good behaviour and recognise understanding. It also illustrates a similar practice on the part of the teacher as mentioned in chapter 5, of checking pupils' responses before making further use of them in front of the class, and of using talk in such instances for knowledge display rather than knowledge construction. Although contributions as taken in the extract above were still invited in the presence of the whole class, such a strategy allowed the teacher to check responses before they became literally a more permanent feature of the lesson by being written on the IWB. This does not however have the same security for the pupils, whose verbal responses were offered in the public arena of the whole-class scenario. As motivation to take this risk however they knew through experience that there was the possibility of being able to write their answer onto the IWB, as an incentive that it was worth thinking carefully what a 'right' answer might be.

On viewing this part of the lesson back with the teacher in our VSRD session, he commented:

Interview extract 7.3: Reflecting on intended and instantiated use of a resource

Teacher's VSRD session, 06.52-07.06

The extract represents the themes: pupil participation, improvisation from the plan, and IWB use.

1. T: I should have, I should have, ah, yeah (pause).
2. Interviewer: What do you think you should have done?
3. T: I should have erm, got them to write it in the first place. I don't know, only when they
4. said 'can I write it?' did I think 'oh yeah of course, that's an even better idea, why
5. didn't I think of that?'

In this he identified how he had improvised from his plan in allowing the pupil to write the answer, and that at that point this was a preferable strategy to him writing the answer himself. He also acknowledged that the suggestion for this came from the pupil, and that he was open to improvising from his plan on this basis. Whilst not suggesting that any particular communicative approach is a permanent feature of a teacher's practice, this identifies an interactive and dialogic tendency in the teacher's approach to lesson orchestration. Within his post-interview he also raised some of the reasons for not automatically encouraging general pupil use of the IWB, but the potential benefits that such opportunities can allow:

Interview extract 7.4: Reflecting on pupil use of the IWB

Teacher's post-interview, 05.50-06.39

The extract represents the themes: IWB use, pupil participation, and role of the teacher.

1. T: I think when you first came in I was using the whiteboard a lot more and erm, revealing
2. things and getting them to remember things, erm, moving things about myself. But as
3. time went on then I started to let them move things about as well. Er it's just that
4. sometimes, when they're this young down, it takes a while for them to come up and
5. choose and then, move it and, you know time's always a factor (laughs). So, as long as
6. they get it I don't mind quickly moving it. That was why I was usually doing it but
7. Interviewer: Yeah
8. T: Actually I find like, especially for some of the lowers, you know it really helps them to,
9. stop, think about it, and then move something across themselves. And then assess
10. themselves 'have I got it right?'. And it really helps. Erm, so I would like to incorporate
11. more of that in my teaching.

Thus we see in this the teacher was considering the educational challenge of how best to support learning opportunities for a whole class, through combinations of his own and his pupils' dialogic, physical and technical interaction. We also see the teacher's view that the occasional slowing of

lesson pace, to allow pupil annotation of the IWB, can be a valuable learning experience (as also reported in chapter 5). This is in contrast to the commonly-reported finding that IWB use can support a faster lesson pace (Higgins, et al., 2007), but in alignment with a more recent suggestion that changes in the rhythm of lessons may be more beneficial (Littleton, 2010). In evolving his use of the available tools over time as he tried different things, it is apparent that the pedagogic need was driving the use of the technological tool, and not the other way round. Altogether this identifies the importance of setting the pace of a lesson, and use of resources within a lesson, in accordance with the needs of pupils as they arose, altered and were made evident to the teacher.

As well as working with suggestions given, the teacher also used 'go' within the phrase 'go on' as a means of encouraging suggestions from pupils, as I now show.

7.4.2 Use of 'go' to invite contribution: To encourage pupils to offer a suggestion

Use of 'go on' emerged as a common phrase from the teacher, often in encouraging pupils to add to a statement another pupil had made, or to finish a statement started by the teacher, as in the lesson extract below.

7.4.2.1 Lesson extract 7.7: Offering dialogic opportunities

Week 8, class lesson, 05.02-05.20

1. T: Who was Samuel Pepys then? (pause, holds arms out from elbows)
2. (Few Ps raise hands)
3. T: Why is he so important? (pause)
4. (Few more Ps raise hands)
5. T: (lowers arms) Why am I talking about a guy called Samuel Pepys? (points to P) Go on
6. Lior: Because he was the eyewitness in the Great [Fire of London
7. (Ps lower their hands)
8. T: [He was one of the eyewitnesses in the Great Fire of London. Fantastic (looks at IWB

9. scrolls down IWB slide outline to find next slide)
10. Lior: And he writ it all down in his diary
11. T: That's right. Well done.
12. Lior: And we did paintings
13. T: (looks back to Ps) And you did paintings didn't you, yes.

7.4.2.2 Commentary to lesson extract 7.7

As on this occasion, pupils sometimes interpreted use of this strategy ('go on') as an opportunity for them to engage in dialogue around an issue, not necessarily being confined to just answering the specific question posed by the teacher. The teacher affirmed such 'extra' responses by the pupil in a cumulative frame (lines 11 and 13), also suggesting that this was an appropriate interpretation of the interaction. In adding such 'extra' contributions to those requested by the teacher, and in the teacher maintaining with his pupils an environment in which they felt they could express their understandings and what they felt were related comments, we can see how this pupil in particular was building her own connections between learning experiences and topic content, and adding detail around the meanings they were making. It is also possible that by the teacher not explicitly nominating another pupil to speak (through use of 'go on' or otherwise), Lior was given scope to continue as the teacher organised his lesson resources.

In this regard one of the key tenets of dialogic teaching is the cumulative quality of interactions and experiences, as alluded to in the first section of this chapter and as espoused by Alexander (2008a) and Mercer, Dawes and Kleine Staarman (2009). In lesson extract 7.7 above we can see how the teacher verbally contributed very little information to the exchange, opening it up to pupils with the phrase 'go on' (line 5). We also see how the pupil improvised the common format of this whole-class teaching session to provide *and cumulatively link* the 'facts' she knew related to the historical figure concerned— albeit those already taught to them by the teacher – through her progressive integration of the activities and concepts they had covered in previous topic

lessons. Through her additional contributions she voiced her enthusiasm for the topic, and personal connection building and meaning making across the various resources they had used to learn about the topic and the significance of sources of evidence. This highlights the significance of fostering a climate of interaction and dialogue where pupils feel they can contribute, which in this case identified to the teacher that a meaning-making trajectory was being instantiated that was in line with his intended meaning-making trajectory, rather than simply rote learning of isolated facts. Fostering such a climate was also beneficial in the teacher's use of the phrase 'go on' to more explicitly invite extensions or clarifications for arguments, as detailed below.

7.4.3 Use of 'go' to invite contribution: To invite extensions of contributions

In the final class lesson, the teacher employed 'go on' as a means to encourage pupils to think through and develop a single line of argument, with focus on the key elements in the spread of the Great Fire, in the context of a topic-appropriate discourse through which to relate these events (see lesson extract 7.8 below).



Figure 7.3: IWB slide title: 'I know why the fire spread so quickly and how it was stopped', week 8, class lesson, 03.17

7.4.3.1 Lesson extract 7.8: Inviting extended contributions

Week 8, class lesson, 03.15-03.22 and 03.34-04.04

1. T: And (looks at and points to image of painting on IWB slide: figure 7.3) we were talking
2. (looks at Ps) about why the fire spread (lowers hand) so quickly
3. (Few Ps raise hands)
4. T: Looking at this (looks at and points to slide) picture (looks at Ps and lowers hand), can
5. anybody remember?
6. (Few more Ps raise hands)
7. T: ... (leans back) The wind (pushes arms forward in front of him, palms leading) spread
8. the fire by doing what?
9. Ps: Er
10. T: The wind was (rolls hands away from him and back in, backs of hands leading, three
11. times) fanning the flames and blowing it. Yes (points to Nina) go on then.
12. Nina: Cos the, houses were too close together, and
13. T: (gives 'thumbs up')
14. Nina: the houses were
15. T: (squeezes hands together)
16. Nina: the houses were too, too, together, because, the wind blows the houses down
17. T: (gives 'thumbs up') Well, nearly, nearly
18. (Few Ps raise hands)
19. T: The houses were (squeezes hands together) very close together but (points to P) Lena?
20. Lena: The houses were made out of wood
21. (Ps lower their hands)
22. T: And the houses were made out of wood, that's why everything, (uses slide outline to
23. change IWB slide – see figure 7.4 below) the houses were made out of wood (points to
24. 'wood' on slide), and the wind (points to painting of fire on slide) fanned the flames.



Figure 7.4: 'The houses were made out of wood', week 8, class lesson, 04.00

7.4.3.2 Commentary to lesson extract 7.8

Solomon and Black (2008) highlighted the importance of participation in knowledge construction, claiming that learners adopt different 'ways of engaging with knowledge through their participation and non-participation in classroom discourse' (p. 74). They also highlighted the difference in the nature of classroom talk when a teacher 'replies', rather than 'assesses' a pupil's comment, whereby:

It is the dialogic quality of... interactions – questioning to invite surmise and the reorganisation of ideas, and (most importantly) collaborative discussion which picks up what is said and extends, modifies or even challenges it – that enables genuine construction of knowledge. (p. 75)

In the above lesson extract, the teacher avoided saying a direct 'no' to the pupil's response ('well, nearly, nearly', line 17), searching for extension and progressive linking of ideas rather than offering the information himself. This was perhaps related to it being the final week of the topic lessons, whereby the teacher supported the pupils in re-constructing content rather than telling them facts.

We can particularly see how the pupil's extended but tentative response ('Cos the, houses were too close together, and... the houses were... the houses were too, too, together, because, the

wind blows the houses down': lines 12, 14 and 16) was invited by the teacher's 'go on then' (line 11), and supported by the teacher's gesturing of approval and information in lines 13, 15 and 17. This perhaps represents a multimodal form of a 'spiral IRF' (Wegerif, et al., 1999), as the teacher used his feedback to encourage further contribution. Such gesturing enabled the teacher to validate the pupil's contribution and support its extension, without verbally disrupting the pupil. The teacher's gesturing activity, offered across the gaps in the pupil's speech, may also have served to stop any other pupil from trying to fill the verbal space. This is potentially significant and identifies the importance of fostering *cumulative* knowledge building, where the teacher offered space for the pupil to express and extend her own progressive reasoning and meaning making verbally in front of the class.

The two points at which the teacher offered 'thumbs up' (lines 13 and 17) indicate that the meanings instantiated by the pupil matched those intended by the teacher. However, he backtracked verbally slightly from the second thumbs up ('well, nearly, nearly': line 17). He then verbally (and in his gesture) repeated the contribution from the pupil that was considered appropriate, and called on another pupil to re-phrase the part that was 'nearly' appropriate. At this point we can consider the dialogic nature of the interaction, in the context of Solomon and Black's assertion above, where a statement is modified in extending the common knowledge available. The pupil provided a different but equally accepted reason (line 20), which highlights the significance of the teacher being flexible to work within such a dialogic frame. The teacher changed and referred to his slide (figure 7.4) to consolidate and re-frame the labelled influences on the spread of the fire – that the houses were made out of wood (line 23) and that the wind fanned the flames (line 24, rather than the wind blowing the houses down). We can see here that the pupils were largely able to list the factors related to the spread of the fire (wood, closeness of houses, wind), but that the specific nature and meaning making around why these factors contributed (in this case of the role of the wind) was still not necessarily clear for all pupils, supporting the findings reported in chapter 5. The flexible use of IWB slides and dialogic and

gestural encouragement for pupils to voice their reasoning therefore can be considered as a significant strategy to reveal current and support pupils' ongoing meaning making.

Such use of the IWB, to switch between slides and refer to elements of slides in highlighting key points as they arise in dialogic interaction, was identified as beneficial by the teacher in his pre-interview:

Interview extract 7.5: Using the IWB to offer structure and scope for improvisation

Teacher's pre-interview, 09.53-10.17

The extract represents the themes: IWB use, and improvisation from the plan.

1. the best thing for me is that it [the IWB] helps, helps me to erm, structure the lessons as
2. well as, how I want to teach it. It gives the children a chance as well to erm, to progress,
3. and gives them, you can break, you can stop anywhere, anytime you like, throw out a
4. question. It's not you know, the be all and end all but it's definitely a really good resource
5. to have.

From this we see the teacher's interpretation of the IWB as a supportive tool, used to prepare and present information, but not to restrict lesson content or progression through concepts. The benefits of the tool for this teacher therefore lay in his ability to use and improvise around his prepared resource, in response to his pupils' needs. Thus even in envisaging and setting an intended meaning-making trajectory, it may well have been part of the teacher's intention that he improvise from its structure in allowing space for dialogue: as meaning-making trajectories were instantiated through interaction.

Pupils seemed to appreciate the interactive and at times dialogic approach, in posing unanticipated questions. Thus these contributions were not strictly invited, and so my analysis presented below is not limited to the teacher's use of the word 'go'.

7.4.4 Questioning the intended interpretation

There were moments during the lessons where pupils asked questions that most likely would not have been part of the teacher's intended meaning-making trajectory. In being asked however they highlight the pupils' intrigue about the topic, as well as their apparent fixation with some facts of history they considered to be cruel. With the teacher pausing in his planned lesson trajectory to respond to these issues, the unexpected questions also identified for the teacher some meaning potentials that perhaps needed more collaborative negotiation, as I illustrate in the following two lesson extracts.

During the initial recap in the week 7 class lesson the teacher re-introduced a familiar IWB slide displaying an image of a painting depicting the Great Fire (figure 7.5), at which point the following exchange occurred.

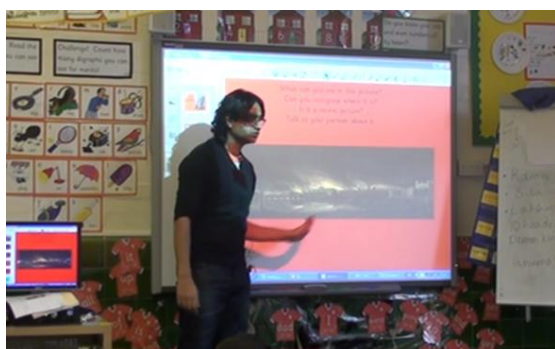


Figure 7.5: Image of painting of the Great Fire, week 7, class lesson, 00.45

7.4.4.1 Lesson extract 7.9: Questioning the historical evidence

Week 7, class lesson, 00.45-01.08

1. T: (moves hand over picture on IWB, looking at Ps) in this picture you're seeing the
2. (pause)
3. Ps: Fire
4. T: (looks at IWB) the Great Fire spread (moves pointing finger from one side of the picture
5. to the other) all across London isn't it?

6. Lior: Did it actually happen?
7. T: (looks at Ps) Absolutely. (holds arms out from elbows) This is what we've been talking
8. about, for the (beats arms into same position) whole last two weeks. This is, (beats
9. arms into same position) actually (moves arms in direction of slide and steps toward
10. IWB) happened. The (lowers right hand and moves left hand over picture on slide)
11. Great Fire, I'm not making it up (holds arms out from elbows and steps to side of IWB),
12. it's not a story
13. P: (inaudible)
14. T: This (points to picture on slide) happened, (lowers hand) it really happened. This
15. happened, it's all real. (looks at and raises hand over slide outline at side)

7.4.4.2 Commentary to lesson extract 7.9

In the context of a history lesson, it is unlikely that the teacher would have anticipated the question: 'did it actually happen?' (line 6). As mentioned in chapter 5 however, the concept of an event happening 400 years ago appeared to be too abstract for some pupils to grasp, and so potentially outside of a sense of 'reality'. In his response he outlined the difference between a 'story' as that which was 'ma[de] up' (lines 11-12) and the historical event of the Great Fire that was 'real' (line 15) and 'actually/really happened' (lines 9-10 and 14). This unanticipated contribution was therefore a potential rich point in the pupils' instantiated meaning-making trajectory, in the clash between frames of history and fantasy. It was *turned into* a rich point as it was taken up improvisationally by the teacher to make this distinction clear.

The exchange further emphasises the importance of evidence within history discourse, as without it there is little way of showing that something 'actually/really happened'. This use of evidence differentiates between the teacher and pupils as budding historians or storytellers. In this sense however, we can juxtapose the historical 'facts' with the 'pretend' activities pupils also did as part of this topic: of the movement activities they engaged in during the hall lessons to 'pretend you're

the fire' (as outlined in chapter 6); and activity they were to do the following week of writing their own diaries to pretend they were eyewitnesses at the time (as outlined in sections 7.3.1.3.-7.3.1.6 and 7.3.2 above). This mixing of the history discourse around evidence and imaginative activities asking them to 'pretend' may perhaps have blurred the distinction between fact and fantasy for some pupils. For most pupils however this distinction appeared to be either clear or unimportant to their learning about the event.

7.4.4.3 Introduction to lesson extract 7.10

During the final class lesson and as the pupils were working to write their diaries, pretending to be eyewitnesses from the past, a similar dialogic opportunity was initiated by Lior, to which the teacher responded flexibly and in accordance with the topic content.

7.4.4.4 Lesson extract 7.10: Attending to emotional aspects of meaning making

Week 8, class lesson, 20.10-20.24 and 20.30-20.42 (teacher's microphone)

1. Lior: Anwar, can I ask you a question?
2. T: Sorry
3. Lior: If erm, if, where does the King live in London in the past?
4. T: Where do you think he would live?
5. Lior: In, a castle.
6. ...
7. T: The King is telling them to pull down houses
8. Lior: But not, why all of them?
9. T: Well all, because the fire's raging everywhere, so he was just saying get rid of, as
10. many houses as you can to stop the fire spreading.

7.4.4.5 Commentary to lesson extract 7.10

Similar to Lior's comment earlier in the same lesson where she voiced a personal and emotional response to the need for firebreaks (as identified in section 7.3.1.3: 'why couldn't they just pull down about five houses?'), we see in the lesson extract above how she was again potentially sympathising with people whose houses were pulled down, in questioning the need for such a drastic response (line 8). Thus for Lior, she was still uneasy in her meaning making of why so many houses needed to be pulled down. This exchange could be considered as an example of 'exploratory talk' (Barnes, 1976, 2008; Mercer, 1995; Mercer & Dawes, 2008), said to be the most productive but also most rare form of classroom talk, where pupils or participants do not just add to the information already given, but question others' opinions and justify their own views in working toward a reasoned argument. Mostly referred to in the context of talk between pupils, we can consider this as exploratory talk as the teacher in the above extract participated in the interaction to encourage Lior to expand on her query, and consider the various sources of evidence available. Thus broadly speaking, Lior was following the intended meaning-making trajectory of houses being destroyed to stop the fire. The teacher may not however have anticipated her curiosity about the events and compassion for the people at the time. This again highlights a need to attend to the social and emotional aspects in how pupils make meaning out of teaching-and-learning experiences (Vass & Littleton, 2010), and therefore the significance of the teacher's choice to build on these comments rather than exclude them as outside the topic of concern. In response to such questions and interactions, the teacher was able to offer context and reasoning for the events, and also to identify where more support was needed to encourage pupils to appropriate the topic discourse.

Within such exchanges, teachers must be confident in their own understanding of the subject content at stake, as pupils work their way toward understanding new concepts. Referring to Sawyer's (2004) conceptualisation of teaching as improvisational, we need to think about teachers and learners playing a part in managing learning as a social activity. In such an

endeavour, for instance responding to pupils' largely unexpected queries and contributions, Sawyer emphasised the skill of teachers to be improvisational, drawing on their 'pedagogic content knowledge', which would not be necessary if teaching were a scripted performance which could be rote learned. Thus it is in such improvisational teaching-and-learning moments that the greatest challenge can be posed both to the authority of the teacher and to any 'accepted' interpretations and meanings. In raising such issues for debate however, substantial rewards can be gained from the co-construction and negotiation of meanings as made in interaction.

7.4.5 Section summary

In attempts to allow pupils to show their understanding verbally and in writing, the teacher used the phrase 'here you go' as a means of offering a physical object (the IWB pen) and ephemeral opportunity (to write the answer onto the IWB that had been given verbally): in recapping lesson content, sharing the authoritative floor and allowing pupils a role in constructing lesson resources. The pupils were able to provide the requested information with ease (date of the Great Fire of London), whereby at this moment we can consider the intended and instantiated meanings as aligned. The activity also supported linking of the written and spoken number (1666), as well as the acts of saying and writing it, which was a significant concern within this school as identified in chapters 5 and 6.

In the teacher's use of the phrase 'go on', to draw pupils into thinking about and justifying their argument in an interactive and dialogic approach, I illustrated how the teacher offered opportunities for pupils to express their developing understandings, in building their own connections between learning experiences and topic content and adding detail around the meanings they were making. This highlights the significance of fostering a climate of interaction and dialogue where pupils feel they can contribute, as such interactions could be used by the teacher to identify whether or not a meaning-making trajectory was being instantiated that was in line with his intended meaning-making trajectory, rather than simply rote learning of isolated

facts. In such extended chains of interaction, I particularly outlined the part that the teacher's *silence* can play – sometimes mediated by gesture – in encouraging pupils to progressively integrate their own cumulative meanings around concepts. This is not to downplay the role of the teacher's talk, but to reinforce the point made earlier of how slowing lesson pace can be used to support valuable teaching-and-learning opportunities, by giving space for pupils to articulate their developing meaning making. Following such interactions the role of the teacher was crucial in orchestrating a reminder of key concepts, as it became clear that whilst most pupils were aware of the key factors at stake, they were not always clear on the exact nature of their influence. In this light I evidenced how the rendering visible of uncertainty served as stepping stones (Alexander, 2008a) for attempts to instantiate acceptable shared meanings, alongside the promotion and maintenance of a safe environment in which to take intellectual risk. Thus the combination of teacher silence and explicit verbal and gestural orchestration served to gather pupils' contributions and re-align them within a shared and approved, instantiated meaning-making trajectory.

I showed how such an interactive and dialogic climate also offered instances where pupils asked their own questions, or made judgements based on the event they were learning about, that the teacher may not have anticipated. Such unexpected questions could be considered as potential rich points, and also illustrated some use of exploratory talk, used as they were improvisationally by the teacher as opportunities to explore, reinforce and link elements of the topic. This offered the genuine reward that the pupils were attempting to use the historical awareness they were developing to forward arguments. Thus whilst repetition has an important part to play in learning (Gillen, et al., 2007; Roth, 2006), at times the content is more beneficially provided by the teacher, and I would argue that at other often unexpected times it is more beneficially explored dialogically by and with the pupils in negotiating an instantiated meaning-making trajectory.

7.5 Chapter summary

Through the extracts presented in this chapter I highlighted the importance of pupils' participation – verbal and physical, and technical interaction with tools – in making meaning of their learning experiences. I predominantly focused on interaction and meaning making through talk within this analysis chapter, in viewing how meanings were instantiated across the course of the lessons, and to offer support but a different angle to the findings presented in chapters 5 and 6. In framing this I offered a significant extension of Baldry and Thibault's (2006) original concept of the meaning-making trajectory within a dialogic and interactional frame, through the distinction between *intended* and *instantiated* meaning-making trajectories. I acknowledged the work of Mercer (2008), that most teachers will envisage a learning path for their pupils, and of Ludvigsen, et al. (2011) whereby aspects of a teacher's intentions can be identified from the instructions they give to their pupils. In presenting my analysis I contrasted this focus on the teacher's intentions through an interactional perspective that addresses the interplay between the teacher's intentions and the pupils' responses, drawing on the concept of meaning potential, where different meanings can be made around the same issue, concept or resource.

I presented evidence of how a teacher could plan uncertainty and reciprocity into his lessons, through use of tools (including technologies) to encourage pupils to explore, query and justify meanings as they were made, as a prompt for dialogue. I illustrated how a teacher's orchestration of such resources in conjunction with dialogic interaction can offer pupils opportunities to directly and dialogically interact with and around the meaning-making resources available.

The fostering of continuity and also cumulation of learning experiences is an important educational aim. This was supported in the observed lessons by use, repetition and extension (continuity) and progressive integration (cumulation) of a number of resources, activities and concepts across the lessons particularly through the promotion of an interactive and dialogic teaching-and-learning environment. This highlighted a two-way process of rendering visible and

developing understanding, as the teacher paused in his authoritative delivery to allow pupil exploration of content. Analysis of discursive tools therefore identified some *breaks* in continuity and cumulation, or rich points in the dialogue, that deviated from intended meaning-making trajectories. I showed that when given the time to explore these breaks, through teacher improvisation and responsiveness to his pupils as well as pupils spontaneously offering their own interpretations, such instances could be used to help build connections between concepts in a way that was meaningful for the pupils: in the collaborative and cumulative construction of knowledge. This illustrates the value of the teacher's improvisational approach, in providing learning opportunities for his pupils rather than dictating meanings to be acquired, and being responsive and secure in his topic knowledge, to engage pupils' curiosity.

Through the beneficial combination of my qualitative and quantitative SCDA, I showed that in the teacher's attempts to consolidate meaning making on the interpersonal level on a one-to-one or whole-class basis, through active participation in lesson activities and dialogue, he aimed to support pupils in appropriating their own intrapersonal understandings of topic concepts that aligned with those he was promoting. Whilst it became evident that most pupils had a fairly clear interpretation of the concepts at stake, not all had fully appropriated the topic discourse to relay these concepts, as also reported in chapter 5. This identifies the importance of the teacher's strategy to explore pupils' understanding through dialogic interaction, in attempts to scaffold such 'appropriate' topic discourse. This suggests the general importance of allowing time for pupil involvement and participation in dialogue and with focal resources, and potential benefits of a slowing of lesson pace, to explore any unexpected interpretations, and in the pursuit of appropriating a curriculum-approved instantiated meaning-making trajectory.

I developed a conceptual framework to illustrate that a teacher's intended meaning-making trajectory and pupils' instantiated meaning-making trajectories may not always match directly onto each other. This does not however mean there is a flaw in the teacher's lesson plan, or in the

pupils' learning, but it does require some improvisation and reciprocity on the part of the teacher. I explored these concepts to evidence that the exposure of any differences between intended and instantiated meanings can provide valuable dialogic opportunities for the further negotiation and instantiation of meaning making as interactionally realised, and offer for the researcher a means to address the ongoing and interactional meaning-making process.

7.5.1 Key points

- Planned uncertainty: Use of tools and technologies can play an important role in encouraging pupils to explore, query and justify meanings as they are made, as a prompt for dialogue, where pupils can directly and dialogically interact with the meaning-making resources available.
- A teacher's intended meaning-making trajectory may not always match pupils' instantiated meaning-making trajectories, as they are constructed and revealed through dialogic interaction. A teacher's acknowledgement of different meaning potentials available, and in identifying any differences between intended and instantiated meaning-making trajectories as they progress, can offer valuable teaching-and-learning opportunities depending on how they are taken up by the teacher in ongoing interaction. This requires a teacher to improvise from his/her plan, or intended meaning-making trajectory, if s/he is to re-align any intended and instantiated meanings.
- A temporal approach is essential to analysis of the issues addressed here, in viewing any differences in intended and instantiated meaning-making trajectories as they are brought into interaction, and as they are negotiated through dialogic interaction.
- The distinction between intended and instantiated meaning-making trajectories offers a significant extension and useful conceptual tool for addressing how meanings are made out of different meaning potentials, and the potential value of their dialogic negotiation by being explicitly brought into interaction.

Chapter 8

Discussion and conclusions

8.1 Introduction

In this chapter I briefly review the theoretical starting point to my research, and how I interpreted this to frame my approach to the educational context in which I collected my data. I summarise the findings and original contributions that I offered through my analysis chapters, in the context of my research questions. I revisit my methods of data collection and analysis, and offer some reflections on my methodology. I close the chapter by highlighting implications of my work for practice and further research, before presenting my overall conclusions. It is appropriate therefore to continue this chapter by returning to the theoretical framework within which I developed my research questions.

8.2 Theoretical background and aims

Within my research I adopted a sociocultural framework, whereby a number of assumptions were inherent in my approach to the data and analysis presented in my thesis. For instance, I adopted the emphasis placed on the mediated nature of human knowledge (Wertsch, et al., 1993), necessitating a focus on the use of tools in supporting educational activities. I drew on the distinction offered by Vygotsky (1962) of psychological tools or signs (such as talk or images), and technical tools (such as physical objects), as well as the greater emphasis and importance placed on the use of talk in mediating and constructing knowledge. This also reinforces the importance of interaction with others in knowledge building, and how various tools are used, re-used and appropriated (Bakhtin, 1981, 1986) across events. Through such a theoretical approach, it is important to attend to both teacher and pupil talk and interaction with other tools and each other. In this regard I wanted to use my data to explore how such exchanges can highlight 'rich points' (Agar, 1994) and 'frame clashes' (Green, et al., 2008), where different views or 'meaning potentials' (Furberg, 2010; Furberg & Ludvigsen, 2008, drawing on Kress, 2003) are brought into

contact through interaction. I wanted to address how such features can serve as useful identifiers along pupils' 'meaning-making trajectories' (extending the concept introduced by Baldry & Thibault, 2006) for both teachers and researchers, as well as the pupils themselves. This requires the teacher to be improvisational in response to his/her pupils (Sawyer, 2004), which potentially challenges the teacher's subject knowledge and classroom management ability.

In addition to the sociocultural emphasis on talk, I identified the need for a multimodal approach within my analysis, in attending to the various communicative modes drawn on as well as talk, in conveying and interpreting meaning making in action. Thus I maintain the central importance of talk in communication, but I view communicative events as integrated accomplishments across different modes, as composite meaning units – in the sense of a 'multiplying effect' (Lemke, 1998) – rather than an additive notion of what communication via each mode offers in isolation. Within a view that all communication is inherently multimodal (Gillen, et al., 2007; Johnson & Kress, 2003) I was particularly keen to address use of learning objects and 'improvable objects' (extending the concept offered by Wells, 1999), to explore how the increasingly present new technologies in contemporary classrooms, and particularly the IWB as a tool now available in the vast majority of primary school classrooms, could be used in the creation of 'improvable objects'.

Through consideration of these theoretical foci I devised an overarching research question:

How is knowledge building pursued and orchestrated as a temporal and cumulative process, by teachers and pupils, through their use of talk, digital technologies and other meaning-making resources?

I then devised two more specific research questions to explore the identified issues in more detail, around which I organised my analysis chapters:

How are talk, digital technologies and other meaning-making resources utilised to resource and make visible meaning-making trajectories within and across lessons, and to

scaffold the development of improvable objects as progressive and historical representations of developing understanding?

How do instances of, and allowance for, improvisation and reciprocity in teaching-and-learning experiences influence the negotiation of meaning-making trajectories?

I address my findings to these questions in section 8.4.

Having outlined the theory and aims behind my research, I now offer a reminder of the context in which I collected my data before presenting my findings.

8.3 Context of data collection

The piloting of a new teaching-and-learning programme provided the stage for my data collection. The programme was driven and supported by a contemporary dance organisation, encouraging use of dance/movement as well as potentially interactive technologies as tools in subject teaching-and-learning. The technologies were an IWB and a small number of PSP mobile devices fitted with integrated cameras, which were used alongside more traditional activities and tools. At the time of data collection, three schools (one class in each school) were involved in the programme and my data collection. Classes generally had two subject lessons per week that were part of the programme, and as part of their coverage of the curriculum: one more 'regular' lesson in the classroom, and one in the hall where there would be more opportunity to resource movement activities. I observed all programme lessons in three schools over an eight week period. The classroom lessons were taught by the class teacher, and the hall lessons were team taught by the class teacher and a dance specialist. I also interviewed the teachers and dance specialists before and after the series of lessons, conducted a Video-Stimulated Reflective Dialogue (VSRD) session with each teacher and dance specialist after the series of lessons, and a focus group with a small group of pupils from each class again after the series of lessons.

8.4 Key findings and contributions

As mentioned above, my analysis chapters were aligned to address my research questions. Thus my findings from my first two analysis chapters relate to the research question:

How are talk, digital technologies and other meaning-making resources utilised to resource and make visible meaning-making trajectories within and across lessons, and to scaffold the development of improvable objects as progressive and historical representations of developing understanding?

8.4.1 Response to research question 1: Use of talk, technologies and movement to resource cumulative knowledge building

All analysis presented in my thesis addressed data collected from a four week, eight lesson history topic on the Great Fire of London with a class of Year 2 pupils (aged 6-7 years). One focus therefore (presented in chapter 5) was to frame my analysis in response to the above research question around issues identified as important within history discourse and practice, namely of time and evidence (Coffin, 2004, 2006a; Deaney, et al., 2009; Derewianka & Coffin, 2008), and how these were addressed within the multimodal teaching-and-learning experiences and meaning-making activities I observed. I now outline how I married this subject approach with a focus on the theoretical concepts I was interested to develop.

8.4.1.1 A technology-mediated improvable object

Addressing the issue of time, I showed how use of a prepared IWB resource of a timeline across learning experiences and environments offered familiarity and stability of resource, in an unfamiliar topic domain. Across the analyses it became clear that time was a difficult concept for the pupils to grasp, whereby this was an important and appropriate educational challenge for the teacher to address. Therefore the evolving use of the same IWB-mediated resource provided scope to build an improvable object, enabling the teacher both to support and evidence development of shared meaning around the timeline as it was used to depict and progressively

annotate when the Great Fire happened relative to the present day. The IWB resource served as a prompt for dialogue, whereby I would argue that it is in the interplay of the two media, in using the technology-mediated improvable object as an instantiation of a shared, developing meaning-making trajectory, that the learning objective could be seen to be addressed. It was also evident how the resource was used to scaffold understanding, as it was gradually relied on less in terms of physical annotation, with the content being added through talk around its prepared structure.

Such a view emphasises the sociocultural stance that knowledge is constructed, and meanings made, through interactions with others and with available objects. In addressing this issue through my analysis I highlighted the importance of the cumulative nature of learning experiences (Alexander, 2008a; Mercer, 2008; Mercer & Littleton, 2007), and explored how pupils were supported in progressively integrating the knowledge they were constructing within and across lessons. Thus a temporal dimension was crucial in my aim to identify how pupils were supported in experiencing teaching-and-learning events as cumulative. This also identifies the importance of managing the interplay between technical and dialogic interactivity (Mercer, et al., 2010), and of using the permanence of the prepared slide to offer both structure and scope for flexibility in how it is used, in making effective use of the resource. Through these explorations I propose a significant extension of Wells' 'improvable object' within the context of the contemporary classroom, whereby the timeline slide was used as a 'technology-mediated improvable object', to support teaching-and-learning of the concept of time and location of the historical event on a timeline as it was re-used and re-versioned over eight lessons.

Alongside this focus on time in my analysis I explored the notion of use and interpretation of evidence, through a consideration of how the appropriation of subject discourse was supported.

8.4.1.2 Supporting the appropriation of subject discourse

Also in my first analysis chapter (chapter 5) I illustrated the development of ways of talking about

historical content, or a history discourse, in terms of use and interpretation of evidence, alongside learning topic content. It was appropriate in analysing my data to distinguish between a wider subject discourse (such as in reference to concepts of time and evidence) and a more specific topic discourse (relating to events of the Great Fire). Specifically with this distinction in mind, I also identified how physical movement activity, in forming representations of the historical content, can mediate, support, but also potentially hinder appropriation of the topic discourse.

Across these analytic themes I emphasised the intricacies of a multimodal teaching-and-learning approach, with modes suited to different communicative aims. In this stance however I maintain the view of talk as central in communicative activity, to bring coherence to meanings made across modes and in the formation of composite meaning units. I evidenced how use of different resources, a teacher's improvisational orchestration across these resources, and range of 'communicative approaches' (Mortimer & Scott, 2003) can facilitate pupils taking control of their learning. In terms of talk I argued that pupils' questions and comments, whilst possibly exposing error or uncertainty, can be used as connection points to re-construct key lesson concepts and resources in a cumulative re-framing, along a meaning-making trajectory. Thus we can frame both talk and physical representation as 'social mode(s) of thinking' (to extend the reference made to talk by Mercer, 1997). This identifies a significant point whereby pupils themselves can be resources for each other's learning: in this combination of modes of communication, and in the pupils actively involving themselves in the subject practices and topic discourse as they assert themselves as developing historians, there is scope for the collaborative and cumulative construction of meanings.

It became evident however that such a multimodal approach was not inherently positive, as discourses from different subjects were brought into contact. The use of physical movement to represent historical concepts offered both an insightful teaching-and-learning experience but also a potential source of confusion. I would argue therefore that to take full advantage of the benefits

of such a multimodal approach, practitioners need to monitor the complementarity but also potential conflict between discourses in use, and how they themselves use these tools with their pupils. In the sense that there can be confusion in the process of developing and appropriating discourses, and as Säljö claimed, 'learning is in the co-ordination between language and experience' (1999, p. 159), I would argue that meaning has to be actively made, whereby what is meaningful is determined by ongoing interaction and the orientation of those involved.

Thus within and across the lessons a mixture of approaches and modes supported cumulative meaning making within the topic discourse, as well as confusion and conflation of topic terms. I suggest that the multimodal approach more successfully supported conceptual knowledge development, but not always the consistent development of a verbal means of expressing this in topic appropriate terms. This could be addressed by considering how content is framed by the activity and discourse in which it is mediated, and being explicit about the links and points of distinction between the two. In this case language is used to contextualise the visual or physical representation, which thus reinforces the role of language, specialised in the form of topic discourse, as at the heart of communication of subject and topic domains. Other modes may however prove crucial in the conceptual development and further refinement of such discursive understanding.

By utilising both quantitative and qualitative elements of Sociocultural Discourse Analysis (SCDA), I was able to show that different levels of analysis could be fruitfully combined to examine patterns of talk as they developed and changed across lessons, which allowed the generation of some unexpected findings. For instance, I had been keen to address how the IWB was used in supporting continuity and cumulation of teaching-and-learning experiences. I had not however anticipated the simultaneous complementarity but also conflict of topic and movement discourses, in supporting appropriation of the history subject discourse, that I was able to explore in detail through my analysis.

Following from this focus on the subject issues of time and evidence, through the theoretical concepts of the technology-mediated improvable object and appropriation of discourse, and given the nature of the data I collected, the creation of ‘multimodal improvable objects’ became an important focus of my analysis.

8.4.1.3 Multimodal improvable objects

Having considered how IWB resources can be used in creating ‘technology-mediated improvable objects’, to record moments in the ephemerality of talk, in chapter 6 I moved to address how tools can be used in a similar way but to record moments in the ephemerality of *movement*, and indeed of the ephemerality of *talk around movement*. It was therefore appropriate to use a socioculturally-framed multimodal analysis to offer a potentially richer notion of improvable objects than their original instantiation, in how an object can be improved and knowledge constructed within and across modes, and the role such objects can play in supporting and exploring understanding.

Thus I was interested in the process of constructing the multimodal object, the improvements made, and where the object was used and re-versioned in interaction. I particularly focused my analysis around an evolving movement exploration of a street scene in London in 1666 (as relevant to the topic of the Great Fire), through consideration of the interrelationships of talk, items displayed on the IWB, items recorded on the PSP, and movement, and how they were orchestrated to support reflection, revision and connection building along a meaning-making trajectory.

Within such a context it was appropriate to employ the term ‘embodiment’ in terms of movement activities used in the lessons as a complementary mode of communication and exploration to other modes in use at the time, for instance to serve as a ‘multimodal anchor’ (Ametller, 2010). Embodiment is a useful concept to explore how movement can be used in the creation of a

multimodal improvable object, embedded and re-presented in photographic, video and painted form to 'bridge' (Rogoff, 1990) between conceptual understanding and verbally-expressed understanding. I therefore argue that movement can be used as a means to demonstrate conceptual understanding and as an observable point of reference, similar to use of the IWB slide referred to in section 8.4.1.1: as a prompt and resource for dialogue. This appeared particularly important when supporting pupils speaking English as an Additional Language, as was the context of my data collection, to support development of understanding and building of connections between concepts *across* modes.

The notion of a multimodal improvable object implies use and re-use, but in the sense of progression as well as continuation of activity and knowledge building. Therefore movement activities used in my data to represent the historical event as well as video and photographs of movement re-entered the dialogue at later points, to add to and offer stimulus for the story being told through movement representation, in a cumulative sense of knowledge building.

Introduction and reference to these activities, in shifting across modes, identified where the conceptual, experiential and visual met the verbal in representing and re-constructing developing topic understanding, as objects for improvement across multiple modes. I therefore propose that progressive knowledge building as observed here occurred *in the interplay between* the movement activity, representations of movement and talk around them.

Orchestrating physical movement activities, in a 'multimodal orchestration' frame (Bourne & Jewitt, 2003; Littleton, et al., 2010) is one way of encouraging pupil participation in lessons. I would also argue that recording such movement, re-versioning and displaying it in video, photograph or painted form, offered a sense of the pupils' own work immediately and directly informing lesson resources and content, enhancing their active participation in lessons in different forms. Such recordings also offered the teacher, dance specialist and pupils further objects around which to co-construct and check developing topic understanding. I propose that this

provided an embodied version of 'matched resources' (extending the concept offered by Hennessy & Deaney, 2006), as different resources including movement, images of frozen movement, video of dynamic movement and talk could be brought together in the formation of a 'multimodal ensemble' (Bezemer & Jewitt, 2009), or composite meaning unit. This identifies an important role for the use of multimodal improvable objects in contemporary educational settings. Such instances also demonstrated a valuable re-contextualisation of the notion of 'pace', as it became apparent that both speeding up and slowing lesson pace could be used to offer significant opportunities, whereby the advantage of controlling pace was not always to be fast.

In such uses of the IWB and PSP to record, display and talk around representations of pupils' movement activities, we can consider how the teacher and dance specialist were 'normalising the digital' (Lee, 2010). In similarly considering the IWB as a 'digital hub' (Betcher & Lee, 2009), we can reflect on how the practitioners orchestrated the IWB and PSP, alongside other digital and non-digital tools. I use these terms here not to emphasise the digital over non-digital tools, but to emphasise the *integration* of available resources in preparing lesson content and responding to pupils' needs within lesson interactions. Thus the IWB and PSP were used to pedagogic effect when brought into interaction and alongside activity in other non-technological modes, in the creation of a multimodal improvable object.

Therefore through use of talk, technologies and alongside other and more traditional educational activities, I outlined the role of learning objects, and of 'improvable objects', in viewing use, revisiting and re-versioning of resources to support progression of conceptual understanding across modes. This is a concept I particularly developed within my analysis, in the sense of a technology-mediated improvable object and a multimodal improvable object, in highlighting how users orchestrate objects to build connections and bridge between concepts and to support progressive integration of understanding in cumulative knowledge building. I described how talk is used in orchestrating ideas offered across learning objects, and talk as central in negotiating the

'improvements' made to such objects, which reinforced the overall sociocultural framing of my multimodal analysis.

Through these considerations I identified how the teacher and dance specialist utilised various tools and activities in forming a continuous and cumulative teaching-and-learning experience with their pupils, around the *intended* meaning-making trajectory of why the Great Fire of London spread so quickly and how it was stopped. In my third analysis chapter I addressed the interplay between the teacher's *intended* and pupils' *instantiated* meaning-making trajectories in responding to my second research question:

How do instances of, and allowance for, improvisation and reciprocity in teaching-and-learning experiences influence the negotiation of meaning-making trajectories?

I interpret intentionality in terms of the teacher's use of prepared IWB slides and activities and comments made in interview, whilst also mindful that a teacher's plan may include an intention to improvise from prepared material if necessary and in response to pupils' needs. Therefore intention does not automatically mean rigidity, and variation in instantiation – as explored through pupils' responses to planned activities – does not imply that an intended plan was wrong or unsuccessful.

8.4.2 Response to research question 2: The negotiation of intended and instantiated meaning-making trajectories

In chapter 7 I addressed this research question through my distinction between intended and instantiated meaning-making trajectories, using extracts from the analysed data to highlight the importance of pupils' participation – verbal and physical, and technical interaction with tools – in making meaning of teaching-and-learning experiences. In this analysis I predominantly focused on verbal interaction and meaning making, to address how meanings were instantiated dialogically across the topic lessons. Thus the temporal dimension was crucial within this analysis to more fully address meaning making in terms of a trajectory, in viewing any differences in intended and

instantiated meaning-making trajectories as they were brought into interaction, and as they were subsequently negotiated through dialogic interaction.

In terms of a teacher's 'intentions', I addressed the use of planned resources. I also addressed how the teacher could adopt a more 'improvisational' (Sawyer, 2004) approach but in the sense of planning uncertainty and 'reciprocity' (Alexander, 2008a) into his lessons. This was observed through use of tools (including technologies) and signs to encourage pupils to explore, query and justify meanings as they were making them: as a prompt for 'exploratory talk' (Barnes, 1976, 2008; Mercer, 1995; Mercer & Dawes, 2008). I therefore argue that such orchestration of resources by the teacher alongside dialogic interaction can offer opportunities for pupils to directly and dialogically interact with and around the meaning-making resources available.

This necessarily involved consideration of the teacher's 'communicative approach', alongside consideration of the use, repetition and extension (continuity) and progression (cumulation) of resources, activities and concepts. Supporting such continuity and cumulation was particularly evident where the teacher adopted an interactive and dialogic approach, allowing for the mutual exposure and development of understanding as the teacher paused in his authoritative delivery of information to encourage pupil exploration of content. In this sense it became apparent that at times lesson content was more beneficially outlined by the teacher, and at other often unexpected times it was more beneficially explored dialogically by and with the pupils in negotiating an instantiated meaning-making trajectory.

Through analysis of the use of discursive tools in such instances I was able to identify some *breaks* in continuity and cumulation, 'rich points' or 'frame clashes' in the dialogue, that deviated from intended meaning-making trajectories. I identified the value of looking more closely at these breaks, both for the teacher and the researcher. Where the teacher could improvise from his plan and be responsive to his pupils as well as allowing space for pupils to spontaneously offer their

own interpretations, such instances could be used to help build connections between concepts in a meaningful way, in the collaborative construction of cumulative knowledge building: of a shared instantiated meaning-making trajectory. This highlights the general importance of allowing time for pupil involvement and participation in dialogue and with focal resources, to explore any potential unexpected interpretations, and in the pursuit of appropriating a curriculum-approved instantiated meaning-making trajectory.

I illustrated the important point that a teacher's intended meaning-making trajectory and pupils' instantiated meaning-making trajectories may not always match directly onto each other (e.g. where pupils ask questions or interpret terms and events in a way not anticipated by the teacher). This does not however mean there is a flaw in the teacher's lesson plan, or in the pupils' learning, but it does require some improvisation and reciprocity by the teacher if intended and instantiated meanings are to be re-aligned. I explored this issue to evidence that the exposure of any differences between intended and instantiated meanings can themselves provide valuable dialogic opportunities for the further negotiation and instantiation of meaning making as interactionally realised. Thus I argue that the distinction between intended and instantiated meaning-making trajectories offers a useful conceptual tool and original contribution of my work, for thinking about how meanings are instantiated out of different 'meaning potentials', and the potential value of their dialogic negotiation by being explicitly brought into interaction.

Having summarised my findings, it is appropriate to offer some reflections on my methods of data collection and analysis.

8.5 Methodology

In approaching my data I adopted a descriptive case study method to observe and video-record lessons from three classes over eight weeks. As part of this I conducted interviews and VSRD sessions (Moyles, Hargreaves, Merry, Paterson & Esarte-Sarries, 2003) with the teachers and

dance specialists, as well as pupil focus groups. Use of the case study method enabled me as much as possible to observe activities and interactions as they unfolded, in the natural course of the teaching-and-learning experiences. Thus I was able to consider and account for aspects that I thought might occur or be important – for instance using video to capture the movement activities – and also be open to events and occurrences that I had not anticipated – such as the potentially conflicting use of topic and movement discourses outlined above.

My purpose in collecting a number of sources of data was not to reach consensus, but to highlight any similarities or differences across and within participants' interpretations of 'life as told' (Bruner, 1984), and alongside my own analytic interpretations of the recorded events. Despite collecting data from three classes, for my thesis it was appropriate to present a detailed analysis of one case. This enabled me to more fully analyse the intricacies, interlinking and unfolding of events and activities that occurred, and expectations and reflections around them, which could hold wider significance for educational research and practice.

Having reviewed my methods of data collection, as presented in chapter 3, I now review the innovative combination of methods of analysis that I employed to analyse my data.

8.5.1 Data analysis methods

It is important to state that in approaching my data my aim was not to evaluate 'good' or 'bad' teaching/learning/teachers/learners, but to identify where practitioners were trying to provide innovative opportunities for their pupils to build knowledge across lessons. I aimed to problematise and offer understandings of processes, without attributing evaluation against people. I adapted and combined a number of methods of analysis in this pursuit.

I combined the advantages of the focus on talk of the quantitative and qualitative elements of SCDA (Mercer, 2004) with features of multimodal analysis (Jewitt, 2009; Kress & van Leeuwen,

2001), to allow me to interrogate my lesson data at different levels of detail. Through this I was able to maintain the sociocultural emphasis on talk, whilst acknowledging how other modes can be integrated into communicative interactions, not to replace but to support the development and reinforce the importance of talk in meaning making. This has been a strength of my approach, as the findings drawn from the different analyses both informed and were informed by the other methods. This in turn enhances the reliability and validity of analytic claims made, through transparent reporting of data extracts in presenting my findings.

Within my analysis I utilised concepts that enabled me to explore this interplay of modes, such as through a consideration of 'matched resources' (Hennessy & Deaney, 2006), 'common knowledge' (Edwards & Mercer, 1987) as multimodally resourced, and extending Wells' 'improvable object' to explore the development of both a 'technology-mediated improvable object' and a 'multimodal improvable object'. I also utilised the temporal nature of the analysis to extend Baldry and Thibault's 'meaning-making trajectory' within an interactional frame. Therefore my analytic foci were:

- to address how knowledge building was framed as a cumulative endeavour for both teacher and pupils, whereby educational experiences build on previous ones and in anticipation of future ones, in a 'purposeful educational journey' (Mercer, 2008) and as 'stepping-stones to understanding' (Alexander, 2008a).
- to view how this cumulative knowledge building and meaning making was pursued through the 'multimodal orchestration' (Bourne & Jewitt, 2003; Littleton, et al., 2010) of various resources and activities, requiring a multimodal and temporal approach to my socioculturally-framed analysis.

Regarding the interview data (referring to interviews, VSRD sessions and focus groups as a whole), all of which were transcribed, I employed thematic analysis (Braun & Clarke, 2006) to consider similar issues as I was addressing in my SCDA and multimodal analysis of the lesson data. I used

my thematic analysis to focus on the interview data at the level of theme, presenting extracts of the themed interview data to resource understanding of insights raised in my findings from analysis of the lesson data. This is not to suggest that I was mining the data for agreement or consistent reporting across the data sources, but it was an appropriate use of the thematic analysis tool in supporting a rich description of points of interest within my descriptive case study.

8.5.2 Reflections on my methodology

In considering the combination of analysis methods, my alignment of SCDA and multimodal analysis adds a potentially rich view of the lesson data. It offers a methodological innovation in bringing together two complementary approaches that consider the importance of viewing interaction within the context of its production, to enable a focus on talk alongside a focus on use of other modes that were particularly salient within observed lessons. Through the temporal dimension of my methodology in addressing a series of topic lessons, I was able to access the historical and dynamic ways in which meanings were created and developed, through composite or even conflicting meaning units and their subsequent negotiation, and to gather both teacher and pupil insights and reflections on their experiences. This was particularly important as much existing research tends to prioritise teacher or pupil perspective, and not necessarily the interaction, similarity or difference between the two. My use of thematic analysis of the interview data also supported this endeavour.

A potential downside of my methodology was that it was too labour-intensive to address all my data within my thesis, whereby I focused on one complete case through the Great Fire of London topic. As I was also not able to gain full informed consent from all pupils, this necessarily limited the number of pupils for whom I could present data. In response to this however I provided a detailed analysis of meaning-making activities of a small group of pupils across topic lessons.

The benefits of complex analysis that my approach offers include:

- the ability to address the temporal nature of multimodal meaning making;
- the transparency for viewing real-time teaching-and-learning experiences;
- and a framework for practitioners involved in cross-curricular and team teaching.

My combination of methods of analysis particularly for addressing the lesson data also enabled me to view the role of specific tools and modes, in their place as individual tools amongst many available to the practitioners and pupils, through how they were perceived and appropriated within practitioners' and pupils' ongoing experiences. This would not have been possible without the alignment of SCDA, multimodal analysis and thematic analysis. This allowed generation of some anticipated findings, and some which were unexpected but became significant through the analytic process, such as the potential conflict of discourses explored in chapter 5. An original contribution of my research therefore lies in the strength, comprehensiveness and complementarity of my research design and methodology, to present developing meaning-making trajectories and illustrate the means by which these were resourced and exposed, from practitioner and pupil perspectives in interaction and reflection.

In analysing data for presentation in my thesis from only one topic therefore, it was appropriate to only include interview data in my thematic analysis from the same one class of participants, as the expectations and reflections offered by teachers, dance specialists and pupils were all contextualised with regard to the specific topic/s of lessons they experienced. This therefore offers a substantial body of work that is worthy of further analysis, to address issues as well as points of agreement and contention that may have been raised across the cases. This is something I will pursue further in extending the lines of argument I present here. For the presentation of my thesis however it was more appropriate to employ this focus on one case as one of the 'boundaries' of my approach.

Having outlined my approach to my data and analysis, I now outline the key implications of my work.

8.6 Implications

In terms of practice, through reporting my analysis I have shown that:

- Teacher planning and improvisation can be effectively balanced to support pupils' learning.

I have shown particularly how the IWB can be used in planned and improvised ways, through prepared resources, intended annotation and unexpected exploration, as a prompt for dialogue and as a means to help pupils structure their thoughts. In general terms, the benefits of having planned resources are clear. Equally, a willingness to deviate from a plan in engaging with pupils' unexpected contributions can offer significant insights for teachers into their pupils' current understanding, and a gauge from which to offer further meaningful support.

- There are potential benefits of adopting a multimodal approach to subject teaching-and-learning.

As I illustrated, a multimodal approach to teaching-and-learning, such as through use of talk, movement and technologies, offers valuable and alternative entry points into supporting the development of conceptual understanding, in a sense of providing matched resources and embodied matched resources. Exploring concepts across modes offers multiple and potentially observable points of reference for practitioners and pupils, in facilitating the linking and monitoring between conceptual and verbally-expressed understanding.

There is a flipside to this argument, from which I add a note of caution:

- The potential negative effects of using a multimodal approach to subject teaching-and-learning need to be monitored.

I note from my research that combining approaches to address topics, such as through use of movement in conjunction with more traditional educational activities, can potentially lead to use of conflicting discourses. Practitioners may not be aware of their use of such conflicting terms and phrases, and pupils may not appreciate that there is a distinction between ‘appropriate’ discourses. This potential dilemma of complementarity and conflict of discourses is a significant educational challenge, and should be explicitly addressed and monitored in the use of such an approach.

In terms of theoretical development, as applied to the context of my data collection:

- The extension of Wells’ work that I presented through the concept of the ‘technology-mediated improvable object’ is significant in exploring how new technologies are being configured to resource progressive and historical representations of developing understanding.

Regarding the use of technologies, a technology-mediated improvable object can support great flexibility for manipulation of the object. For instance following an initial introduction and use, later uses of the same object can require *less* physical improvement or annotation, in the sense of using the object to scaffold learning, as improvements are added by *dialogic* interaction around the digital object but are no longer required in more permanent or visible form. Such activity utilises the functionalities of the IWB, in this instance, to permanently represent and provisionally annotate information, as well as its use as a prompt for dialogue. Thus it is in the interplay of the modes and media that the true value of such an approach is to be found.

- The further extension of Wells' work that I contributed in the form of a 'multimodal improvable object' offers a valuable tool to consider how concepts are explored, represented and re-versioned within and across modes.

Similar to the notion of the technology-mediated improvable object, the multimodal improvable object highlights the significance of the interdependence and interplay of different modes in supporting knowledge construction, but spans more widely than activity around technology use. This is particularly valuable in a context where pupils have difficulty expressing themselves through the school language, such as was the context of my data collection where a large proportion of pupils spoke English as an Additional Language. Such an approach offers important opportunities by allowing pupils to demonstrate conceptual understanding through a variety of modes of expression, as well as a means to develop verbally-expressed understanding. The concept is also important in outlining a more detailed means for researchers to analyse such activity.

- The distinction I proposed between intended and instantiated meaning-making trajectories offers a critical extension of Baldry and Thibault's concept, which provides valuable insights for both teachers and researchers in how meaning making and knowledge construction are viewed and resourced as interactional achievements.

In considering the distinction between intended and instantiated meaning-making trajectories, I identified the potential value of a teacher's ability and confidence to improvise from their lesson plan, and of the importance of supporting pupils in progressively integrating concepts across learning experiences. When such an improvisational approach is adopted in encouraging pupils to offer their own interpretations, and thus bringing potentially contrasting instantiated meanings together, such exchanges can be aligned to help build meaningful connections between concepts, in the collaborative and cumulative construction of knowledge.

Drawing on these contributions, and in the context of the current rich digital landscape, I now outline some imperatives for future research in terms of the complex orchestration of teaching-and-learning experiences.

8.6.1 Agenda for future research

In engaging with the debate on the extent to which multiple representations facilitate learning (e.g. Hennessy, 2011), it is pertinent to explore in more detail how different approaches to subjects can be combined, such as dance/movement and more traditional educational activities, so that the benefits of each approach and associated discourses can be utilised, and the potential drawbacks reduced of bringing subjects together. It is important to consider in more detail any complementarity or conflict of activity and discourses in subjects other than history, and the combination of SCDA and multimodal analysis as I utilised in my research would be an appropriate way to address this. Such data was collected during my work, but due to it being more appropriate to focus on one case study in detail for the findings presented in my thesis, there has not been space to direct my attention to the other subjects covered. It will therefore be an important extension of my work to explore the multimodal resourcing of the other subjects that I observed, in terms of how the issues addressed here do or do not apply across the curriculum, for instance to see if there are other subject discourses where there is less significant conflict with a movement discourse, and why this might be so.

Furthermore, as teachers become more accustomed to and adept at using IWBs in daily practice, it will be imperative to explore how the notion of a technology-mediated improvable object evolves as lessons and concepts are structured and explored, planned for and improvised from in the co-construction of knowledge. It will also be critical to address what other tools become available and aligned within the teacher's toolkit, digital or otherwise, in resourcing this endeavour. In addressing these issues I will build on my work presented here and previously, in adopting a user-focused analysis of IWB and other tool use in the sense of a discourse of

orchestration and participation (Twiner, 2010), rather than a more technology-focused discourse of the transformative effects of technologies.

Finally, through my work presented here I showed that it is essential to explore in more detail the opportunities for and value of pupils being involved in creating lesson resources, such as through use of photographs and video taken of and by pupils. As the importance of pupil participation in lessons has been raised by many researchers, and as children are growing up in an increasingly technology-mediated world where they are used to being producers as well as consumers of resources, it is becoming increasingly necessary to explore what a contemporary, multimedia-resourced classroom can add to this educational challenge. A temporal analysis would be crucial here to consider how technologies (or any objects/tools in the classroom) are used in making meaning over time – along an instantiated meaning-making trajectory.

To close this chapter and my thesis overall, I offer some concluding comments on the work reported here.

8.7 Concluding comments

In terms of methodological contribution, in my analysis I maintain the sociocultural emphasis on the central importance of talk in communication, aligned with a notion that communication is ultimately multimodal. I therefore view communicative events as integrated accomplishments across different modes, as composite meaning units, with language used to draw salience to content conveyed in other modes. On this basis, an original and important contribution of my research lies in my combination of SCDA, multimodal analysis and thematic analysis, to explore in different levels of detail the objects and modes used in the progression and resourcing of meaning-making trajectories, from teacher and pupil perspectives in action, interaction and reflection.

In terms of theoretical contribution, I propose two significant extensions of Wells' improvable object in the form of a technology-mediated improvable object and a multimodal improvable object. These concepts offer rich tools to address how knowledge construction is supported through the intricacies and interlinking of activities within and across modes. They are practically and theoretically useful concepts in addressing the creation of new objects for meaning making in the context of contemporary educational practices. This includes use of new media and exploring modes of communication, as well as the increasing opportunities for pupils to create their own content (such as by taking photographs and video), whereby the concepts of the technology-mediated improvable object and the multimodal improvable object have a timeliness given the innovative programme from which my data was collected.

As a further theoretical contribution I present an important extension of Baldry and Thibault's concept of the meaning-making trajectory, from the individual navigating webpages to the practitioner and pupils negotiating the construction of meaning as a collaborative and cumulative process. The distinction I offer between intended and instantiated meaning-making trajectories serves as a valuable conceptual tool for teachers and researchers to use in thinking about and responding to different meaning potentials as they emerge and are transformed into meanings made, through dialogic interaction.

Thus my methodological and theoretical contributions provide significant insights into current practices for both practitioners and researchers, and identify scope for the further extension and exploration of knowledge construction in contemporary, technology-mediated and often multilingual classrooms.

References

- Agar, M. (1994). *Language shock: Understanding the culture of conversation*. New York: Perennial (Harper Collins).
- Alant, E., Bornman, J., & Lloyd, L. (2006). Issues in AAC research: How much do we really understand? *Disability and Rehabilitation*, 28(3), 143-150.
- Alexander, R. (2000). *Culture and pedagogy: International comparisons in Primary Education*. Oxford: Blackwell Publishing.
- Alexander, R. (2004). *Towards dialogic teaching: Rethinking classroom talk* (1st ed.). York: Dialogos.
- Alexander, R. (2008a). *Towards dialogic teaching: Rethinking classroom talk* (4th ed.). York: Dialogos.
- Alexander, R. (2008b). Culture, dialogue and learning: Notes on an emerging pedagogy. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in schools* (pp. 91-114). London: Sage.
- Ametller, J. (2010, July). *Expanding dialogic education in science classrooms through multimodal discourse*. Paper presented at the Multimodality and Learning conference, Institute of Education, London.
- Bakhtin, M. (1981). *The dialogic imagination*. Austin: University of Texas Press.
- Bakhtin, M. (1986). *Speech genres and other essays* (V.W. McGee, Trans.). Austin: University of Texas Press.
- Baldry, A. (2010, July). *Multimodality as a window on children's learning and children's learning as a window on multimodality*. Paper presented at the Multimodality and Learning conference, Institute of Education, London.
- Baldry, A., & Thibault, P. (2006). *Multimodal transcription and text analysis*. London: Equinox.
- Barnes, D. (1976). *From communication to curriculum*. London: Penguin.
- Barnes, D. (2008). Exploratory talk for learning. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in schools* (pp. 1-15). London: Sage.

- Barnes, D., & Todd, F. (1995). *Communication and learning revisited: Making meaning through talk*. Portsmouth, NH: Heinemann.
- Bearne, E. (2009). Multimodality, literacy and texts: Developing a discourse. *Journal of Early Childhood Literacy*, 9(2), 161-193.
- Beauchamp, G., & Kennewell, S. (2008). The influence of ICT on the interactivity of teaching. *Education and Information Technologies*, 13(4), 305-315.
- Beauchamp, G., Kennewell, S., Tanner, H., & Jones, S. (2010). Interactive whiteboards and all that jazz: The contribution of musical metaphors to the analysis of classroom activity with interactive technologies. *Technology, Pedagogy and Education*, 19(2), 143-157.
- Bereiter, C. (1994). Implications of post-modernism for science, or, science as progressive discourse. *Educational Psychologist*, 29(1), 3-12.
- Bernstein, B. (1975). *Class, codes and control. Vol. 3: Towards a theory of educational transmissions*. London: Routledge and Kegan Paul.
- Bernstein, B. (1990). *Class, codes and control. Vol. 4: The structuring of pedagogic discourse*. London: Routledge and Kegan Paul.
- Betcher, C., & Lee, M. (2009). *The interactive whiteboard revolution*. Melbourne, Australia: ACER Press.
- Bezemer, J., & Jewitt, C. (2009). Multimodal analysis: Key issues. In L. Litosseliti (Ed.), *Research methods in linguistics* (pp. 180-197). London and New York: Continuum Books.
- Bezemer, J., Mavers, D., & Sidiropoulou, H. (2007, September). *Reporting multimodal data: A comparison of image-based and script-based representations of classroom data*. Paper presented at the British Association for Applied Linguistics conference, Edinburgh University.
- Bopry, J., & Hedberg, J.G. (2005). Designing encounters for meaningful experience, with lessons from J.K. Rowling. *Educational Media International*, 42(1), 91-105.
- Bourne, J., & Jewitt, C. (2003). Orchestrating debate: A multimodal analysis of classroom interaction. *Reading*, 37(2), 64-72.

- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Brown-Martin, G. (2009). Chairman's foreword. *Handheld Learning 2009 conference programme*. London: Learning Without Frontiers.
- Bruner, E.M. (1984). The opening up of anthropology. In E.M. Bruner (Ed.), *Text, play and story: The construction and reconstruction of self and society* (pp. 1-16). Washington, DC: The American Ethnological Society.
- Bruner, J. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.
- Carlsen, M. (2008). *Appropriating mathematical tools through problem solving in collaborative small group settings*. PhD thesis, University of Agder.
- Cazden, C. (1979). *Peekaboo as an instructional model: Discourse development at home and at school (Papers and reports on child language development No. 17)*. Stanford: Department of Linguistics, Stanford University.
- Cazden, C. (2001). *Classroom discourse: The language of teaching and learning*. Portsmouth, NH: Greenwood.
- Coffin, C. (2004). Learning to write History: The role of causality. *Written Communication*, 21(3), 261-289.
- Coffin, C. (2006a). Reconstructing 'personal time' as 'collective time': Learning the discourse of history. In R. Whittaker, M. O'Donnell & A. McCabe (Eds.), *Language and literacy: Functional approaches* (pp. 207-230). London: Continuum.
- Coffin, C. (2006b). Mapping subject-specific literacies. *NALDIC Quarterly*, 3(3), 1-14.
- Croll, P. (1986). *Systematic classroom observation*. Lewes, Sussex: The Falmer Press.
- Crook, C. (1999). Computers in the community of classrooms. In K. Littleton & P. Light (Eds.), *Learning with computers: Analysing productive interaction* (pp. 102-117). London: Routledge.

- Deaney, R., Chapman, A., & Hennessy, S. (2009). A case-study of one teacher's use of an interactive whiteboard system to support knowledge co-construction in the history classroom. *Curriculum Journal*, 20(4), 365-387.
- Department for Children, Schools and Families (2007). *Multimodal - ICT - digital texts*. London: DCSF.
- Department for Education (2010). *The importance of teaching*. London: DfE.
- Department for Education and Employment (1999). *Talking in class*. London: DfEE.
- Derewianka, B., & Coffin, C. (2008). Time visuals in History textbooks: Some pedagogic issues. In L. Unsworth (Ed.), *Multimodal semiotics: Functional analysis in contexts of education* (pp. 187-200). London: Continuum.
- Edwards, D., & Mercer, N. (1987). *Common knowledge: The development of understanding in the classroom*. London: Routledge.
- Edwards, J. (2001). The transcription of discourse. In D. Schiffrin, D. Tannen & H.E. Hamilton (Eds.), *The handbook of discourse analysis* (pp. 321-348). Oxford: Basil Blackwell.
- Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki, Finland: Orienta-Konsultit.
- Ferguson, R. (2009). *The construction of shared knowledge through asynchronous dialogue*. PhD thesis, The Open University, England.
- Flewitt, R., Hampel, R., Hauck, M., & Lancaster, L. (2011). What are multimodal data and transcription? In C. Jewitt (Ed.), *The Routledge handbook of multimodal analysis* (pp. 40-53). London and New York: Routledge.
- Floriani, A. (1993). Negotiating what counts: Roles and relationships, texts and contexts, content and meaning. *Linguistics and Education*, 5(3-4), 241-274.
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219-245.

- Furberg, A. (2010). *Scientific inquiry in web-based learning environments: Exploring technological, epistemic and institutional aspects of students' meaning making*. PhD thesis, University of Oslo, Norway.
- Furberg, A., & Arnseth, H.C. (2009). Reconsidering conceptual change from a socio-cultural perspective: Analyzing students' meaning making in genetics in collaborative learning activities. *Cultural Studies of Science Education*, 4(1), 157-191.
- Furberg, A., & Ludvigsen, S. (2008). Students' meaning-making of socio-scientific issues in computer mediated settings: Exploring learning through interaction trajectories. *International Journal of Science Education*, 30(13), 1775-1799.
- Futuresource Consulting (2011). *Understanding technology's role in revolutionising the classroom*. Bedfordshire, UK: Futuresource Consulting.
- Gee, J., & Green, J. (1998). Discourse analysis, learning and social practice: A methodological study. *Review of Research in Education*, 23(1), 119-169.
- Gillen, J., Kleine Staarman, J., Littleton, K., Mercer, N., & Twiner, A. (2007). A 'learning revolution'? Investigating pedagogic practice around interactive whiteboards in British primary classrooms. *Learning, Media and Technology*, 32(3), 243-256.
- Gillen, J., Littleton, K., Twiner, A., Kleine Staarman, J., & Mercer, N. (2008). Using the interactive whiteboard to resource continuity and support multimodal teaching in a primary science classroom. *Journal of Computer Assisted Learning*, 24(4), 348-358.
- Glover, D., Miller, D., Averis, D., & Door, V. (2007). The evolution of an effective pedagogy for teachers using the interactive whiteboard in mathematics and modern languages: An empirical analysis from the secondary sector. *Learning, Media and Technology*, 32(1), 5-20.
- Gomm, R., Hammersley, M., & Foster, P. (Eds.) (2000). *Case study method*. London, Thousand Oaks & New Delhi: Sage.
- Goodwin, C. (2007). Participation, stance and affect in the organization of activities. *Discourse & Society*, 18(1), 53-73.

- Green, J., Yeager, B., & Castanheira, M.L. (2008). Talking texts into being: On the social construction of everyday life and academic knowledge in the classroom. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in schools* (pp. 115-130). London: Sage.
- Haldane, M. (2007). Interactivity and the digital whiteboard: Weaving the fabric of learning. *Learning, Media and Technology*, 32(3), 257-270.
- Halliday, M. (1978). *Language as social semiotic: The social interpretation of language and meaning*. Baltimore: University Park Press.
- Hammersley, M. (2010). Reproducing or constructing? Some questions about transcription in social research. *Qualitative Research*, 10(5), 553-569.
- Hancock, R., Gillen, J., & Pinto, G. (2010) Using video technology. In J. Gillen & C.A. Cameron (Eds.), *International perspectives on early childhood research: A Day in the Life* (pp. 35-58). Hampshire, England & New York: Palgrave Macmillan.
- Hardman, F. (2008). Teachers' use of feedback in whole-class and group-based talk. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in schools* (pp. 131-150). London: Sage.
- Harste, J. (1993). Literacy as curricular conversations about knowledge, inquiry and morality. In M.R. Ruddell & R.B. Ruddell (Eds.), *Theoretical models and processes of reading* (4th ed., pp. 1220-1242). Newark, DE: International Reading Association.
- Heidegger, M. (1996). *Being and time: A translation of sein und zeit* (J. Stambaugh, Trans.). Albany, New York: State University of New York Press.
- Hennessy, S. (2011). The role of digital artefacts on the interactive whiteboard in supporting classroom dialogue. *Journal of Computer Assisted Learning*, 27(6), 463-489.
- Hennessy, S., & Deaney, R. (2006, September). *Integrating multiple teacher and researcher perspectives through video analysis of pedagogic approaches to using projection technologies*. Paper presented at the British Educational Research Association Conference, University of Warwick.

- Hennessy, S., Deaney, R., Ruthven, K., & Winterbottom, M. (2007). Pedagogical strategies for using the interactive whiteboard to foster learner participation in school science. *Learning, Media and Technology*, 32(3), 283-301.
- Hennessy, S., Deaney, R., & Tooley, C. (2010). Using the interactive whiteboard to stimulate active learning in school science. In M. Thomas & E. Cutrim Schmid (Eds.), *Interactive whiteboards for education: Theory, research and practice* (pp. 102-117). Hershey, New York: Information Science Reference.
- Higgins, S., Beauchamp, G., & Miller, D. (2007). Reviewing the literature on interactive whiteboards. *Learning, Media and Technology*, 32(3), 213-225.
- Ivarsson, J., Linderöth, J., & Säljö, R. (2011). Representations in practices: A socio-cultural approach to multimodality in reasoning. In C. Jewitt (Ed.), *The Routledge handbook of multimodal analysis* (pp. 201-212). London and New York: Routledge.
- Jewitt, C. (Ed.) (2009). *The Routledge handbook of multimodal analysis*. London: Routledge.
- Jewitt, C., & Kress, G. (Eds.) (2003). *Multimodal literacy*. New York: Peter Lang.
- Johnson, D., & Kress, G. (2003). Globalisation, literacy and society: Redesigning pedagogy and assessment. *Assessment in Education*, 10(1), 5-14.
- Kemmis, S. (1974). *An ecological perspective on innovation*. Urbana: College of Education, University of Illinois.
- Kleine Staarman, J. (2009). *Collaboration and technology: The nature of discourse in primary school computer-supported collaborative learning practices*. PhD thesis, Radboud University, Nijmegen, The Netherlands.
- Kozma, R. (1994). Will media influence learning? Reframing the debate. *Educational Technology, Research and Development*, 42(2), 7-19.
- Krange, I. (2007). Students' conceptual practices in science education - Productive disciplinary interaction in a participation trajectory. *Cultural Studies in Science Education*, 2(1), 171-203.
- Kress, G. (2000). A curriculum for the future. *Cambridge Journal of Education*, 30(1), 133-145.

- Kress, G. (2003). *Literacy in the new media age*. London: Routledge.
- Kress, G., & van Leeuwen, T. (1996). *Reading images: A grammar of visual design*. London: Routledge.
- Kress, G., & van Leeuwen, T. (2001). *Multimodal discourse: The modes and media of contemporary communication*. London: Arnold.
- Lee, M. (2010). Interactive whiteboards and schooling: The context. *Technology, Pedagogy and Education, 19*(2), 133-141.
- Lee, P.J. (2005). Putting principles into practice: Understanding history. In M.S. Donovan & J. Bransford (Eds.), *How students learn: History, mathematics and science in the classroom* (pp. 31-77). Washington, DC: National Academies Press.
- Lemke, J. (1990). *Talking science: Language, learning, and values*. Norwood, NJ: Ablex Publishing.
- Lemke, J. (1995). *Textual politics: Discourse and social dynamics*. London: Taylor & Francis.
- Lemke, J. (1998). Multiplying meaning: Visual and verbal semiotics in scientific text. In J. Martin & R. Veel (Eds.), *Reading science: Critical and functional perspectives on discourses of science* (pp. 87-113). London and New York: Routledge.
- Lemke, J. (1999). Typological and topological meaning in diagnostic discourse. *Discourse Processes, 27*(2), 173-185.
- Lemke, J. (2001a). Articulating communities: Sociocultural perspectives in science education. *Journal of Research in Science Teaching, 38*(3), 296-316.
- Lemke, J. (2001b). The long and the short of it: Comments on multiple timescale studies of human activity. *The Journal of the Learning Sciences, 10*(1&2), 17-26.
- Linell, P. (1998). *Rethinking language, mind and world dialogically: Interactional and contextual theories of human sense-making*. Charlotte, NC: Information Age Publishing Inc.
- Littleton, K. (2010). Research into teaching with whole-class interactive technologies: Emergent themes. *Technology, Pedagogy and Education, 19*(2), 285-292.

- Littleton, K., Twiner, A., & Gillen, J. (2010). Instruction as orchestration: Multimodal connection building with the interactive whiteboard. *Pedagogies: An International Journal*, 5(2), 130-141.
- Ludvigsen, S., Rasmussen, I., Kränge, I., Moen, A., & Middleton, D. (2011). Intersecting trajectories of participation: Temporality and learning. In S. Ludvigsen, A. Lund, I. Rasmussen & R. Säljö (Eds.), *Learning across sites: New tools, infrastructures and practices* (pp. 105-121). Abingdon, Oxon: Routledge.
- Maybin, J. (2006). *Children's voices: Talk, knowledge and identity*. Hampshire: Palgrave Macmillan.
- Maybin, J. (2009). A broader view of language in school: Research from linguistic ethnography. *Children & Society*, 23(1), 70-78.
- Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon, Philadelphia: Multilingual Matters.
- Mercer, N. (1997). Socio-cultural perspectives and the study of classroom discourse. In C. Coll & D. Edwards (Eds.), *Teaching, learning and classroom discourse: Approaches to the study of educational discourse* (pp. 13-21). Madrid, Espana: Fundacion Infancia y Aprendizaje.
- Mercer, N. (2000). *Words and minds: How we use language to think together*. London: Routledge.
- Mercer, N. (2004). Sociocultural discourse analysis: Analysing classroom talk as a social mode of thinking. *Journal of Applied Linguistics*, 1(2), 137-168.
- Mercer, N. (2007). *Interactive whiteboards as pedagogic tools in primary schools: Full research report. ESRC end of award report, RES-000-22-1269*. Swindon: Economic and Social Research Council.
- Mercer, N. (2008). The seeds of time: Why classroom dialogue needs a temporal analysis. *The Journal of the Learning Sciences*, 17(1), 33-59.
- Mercer, N., & Dawes, L. (2008). The value of exploratory talk. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in schools* (pp. 55-71). London: Sage.
- Mercer, N., Dawes, L., & Kleine Staarman, J. (2009). Dialogic teaching in the primary science classroom. *Language and Education*, 23(4), 353-369.

- Mercer, N., Dawes, L., Wegerif, R., & Sams, C. (2004). Reasoning as a scientist: Ways of helping children to use language to learn science. *British Educational Research Journal*, 30(3), 359-377.
- Mercer, N., Hennessy, S., & Warwick, P. (2010). Using interactive whiteboards to orchestrate classroom dialogue. *Technology, Pedagogy and Education*, 19(2), 195-209.
- Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London and New York: Routledge.
- Mercer, N., Littleton, K., & Wegerif, R. (2004). Methods for studying the processes of interaction and collaborative activity in computer-based educational activities. *Technology, Pedagogy and Education*, 13(2), 195-212.
- Merry, R., & Moyles, J. (2003). Scuppering discussion? Interaction in theory and practice. In J. Moyles, L. Hargreaves, R. Merry, F. Paterson & V. Esarte-Sarries (Eds.), *Interactive teaching in the primary school: Digging deeper into meanings* (pp. 15-30). Maidenhead: Open University Press.
- Minogue, J., & Jones, G. (2006). Haptics in education: Exploring an untapped sensory modality. *Review of Educational Research*, 76(3), 317-348.
- Mortimer, E., & Scott, P. (2003). *Meaning making in science classrooms*. Buckingham: Open University Press.
- Moyles, J., Hargreaves, L., & Merry, R. (2003). Interactive teaching: Digging deeper into meanings. In J. Moyles, L. Hargreaves, R. Merry, F. Paterson & V. Esarte-Sarries (Eds.), *Interactive teaching in the primary school: Digging deeper into meanings* (pp. 171-191). Maidenhead: Open University Press.
- Moyles, J., Hargreaves, L., Merry, R., Paterson, F., & Esarte-Sarries, V. (Eds.) (2003). *Interactive teaching in the primary school: Digging deeper into meanings*. Maidenhead: Open University Press.

- Moyles, J., Paterson, F., & Kitson, N. (2003). It wasn't as bad as I thought! Learning from reflective dialogues. In J. Moyles, L. Hargreaves, R. Merry, F. Paterson & V. Esarte-Sarries (Eds.), *Interactive teaching in the primary school: Digging deeper into meanings* (pp. 141-154). Maidenhead: Open University Press.
- Nystrand, M., Gamoran, A., Kachur, R., & Prendergast, C. (1997). *Opening dialogue: Understanding the dynamics of language and learning in the English classroom*. New York: Teachers College Press.
- Ong, W.J. (1982). *Orality and literacy: The technologising of the word*. London: Methuen.
- Piaget, J. (1970). *Genetic epistemology*. New York: Columbia University Press.
- Piaget, J. (1980). *Adaptation and intelligence: Organic selection and phenocopy*. Chicago: University of Chicago Press.
- Pozzer-Ardenghi, L., & Roth, W.M. (2007). On performing concepts during science lectures. *Science Education*, 91(1), 96-114.
- Punch, M. (1986). *The politics and ethics of fieldwork*. Beverly Hills, CA: Sage.
- Qualifications and Curriculum Authority (2004). *More than words: Multimodal texts in the classroom*. London: QCA.
- Rasmussen, I. (2005). *Project work and ICT: Studying learning as participation trajectories*. PhD thesis, University of Oslo, Norway.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.
- Rommetveit, R. (1985). Language acquisition as increasing linguistic structuring of experience and symbolic behaviour control. In J.V. Wertsch (Ed.), *Culture, communication, and cognition: Vygotskian perspectives* (pp. 183-204). Cambridge: Cambridge University Press.
- Rommetveit, R. (1992). Outlines of a dialogically based social-cognitive approach to human cognition and communication. In A. Heen Wold (Ed.), *The dialogical alternative: Towards a theory of language and mind* (pp. 19-44). Oslo, Norway: Scandinavian University Press.
- Rose, J. (2009). *Independent review of the primary curriculum: Final report*. Nottingham: DCSF.

- Roth, W.M. (2002). From action to discourse: The bridging function of gestures. *Cognitive Systems Research, 3*(3), 535-554.
- Roth, W.M. (2006). *Learning science: A singular plural perspective*. Rotterdam, The Netherlands: Sense.
- Roth, W.M. (2007). Toward a dialectical notion and praxis of scientific literacy. *Journal of Curriculum Studies, 39*(4), 377-398.
- Roth, W.M., & Duit, R. (2003). Emergence, flexibility and stabilization of language in a Physics classroom. *Journal of Research in Science Teaching, 40*(9), 869-897.
- Roth, W.M., & Lee, Y. (2004). Interpreting unfamiliar graphs: A generative, activity theoretic model. *Educational Studies in Mathematics, 57*(2), 265-290.
- Roth, W.M., Tobin, K., & Ritchie, S. (2008). Time and temporality as mediators of science learning. *Science Education, 92*(1), 115-140.
- Roy, K. (2005). An untimely intuition: Adding a Bergsonian dimension to experience and education. *Educational Theory, 55*(4), 443-459.
- Säljö, R. (1996). *Learning and discourse: A sociocultural perspective*. Great Britain: The British Psychological Society.
- Säljö, R. (1999). Learning as the use of tools: A sociocultural perspective on the human-technology link. In K. Littleton & P. Light (Eds.), *Learning with computers: Analysing productive interaction* (pp. 144-161). London: Routledge.
- Säljö, R. (2005). *Lärande & kulturella redskap: Om lärprocessor och det kollektiva minnet [Learning and cultural tools: On processes of learning and the collective memory]*. Stockholm: Norstedts Akademiska Förlag.
- Savinainen, A., Scott, P., & Viiri, J. (2005). Using a bridging representation and social interactions to foster conceptual change: Designing and evaluating an instructional sequence for Newton's third law. *Science Education, 89*(2), 175-195.
- Sawyer, R. (2004). Creative teaching: Collaborative discussion as disciplined improvisation. *Educational Researcher, 33*(2), 12-20.

- Schofield, J.W. (2000). Increasing the generalizability of qualitative research. In R. Gomm, M. Hammersley & P. Foster (Eds.), *Case study method* (pp. 69-97). London, Thousand Oaks & New Delhi: Sage.
- Schwartz, D., Lin, X., Brophy, S., & Bransford, J. (1999). Toward the development of flexibly adaptive instructional designs. In C. Reigeluth (Ed.), *Instructional design theories and models: A new paradigm of instructional theory* (Vol. 2, pp. 183-213). Mahwah, NJ: Lawrence Erlbaum.
- Scott, P. (2008). Talking a way to understanding in science classrooms. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in schools* (pp. 17-36). London: Sage.
- Scott, P., Mortimer, E., & Aguiar, O. (2006). The tension between authoritative and dialogic discourse: A fundamental characteristic of meaning making interactions in high school science lessons. *Science Education*, 90(4), 605-631.
- Silverman, D. (2005). *Doing qualitative research* (2nd ed.). London: Sage.
- Sinclair, J., & Coulthard, R. (1975). *Towards an analysis of discourse: The English used by teachers and pupils*. London: Oxford University Press.
- Smith, H.J., Higgins, S., Wall, K., & Miller, J. (2005). Interactive whiteboards: Boon or bandwagon? A critical review of the literature. *Journal of Computer Assisted Learning*, 21(2), 91-101.
- Solomon, Y., & Black, L. (2008). Talking to learn and learning to talk in the mathematics classroom. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in schools* (pp. 73-90). London: Sage.
- Stake, R. (1978). The case study method in social inquiry. *Educational Researcher*, 7(2), 5-8.
- Twiner, A. (2010). Interactive whiteboards and the discourses of transformation, affordance, orchestration and participation. In M. Thomas & E. Cutrim Schmid (Eds.), *Interactive whiteboards for education: Theory, research and practice* (pp. 37-52). Hershey, New York: Information Science Reference.
- Twiner, A., Coffin, C., Littleton, K., & Whitelock, D. (2010). Multimodality, orchestration and participation in the context of classroom use of the interactive whiteboard: A discussion. *Technology, Pedagogy and Education*, 19(2), 211-223.

Twiner, A., Gillen, J., Kleine Staarman, J., Littleton, K., & Mercer, N. (2007, September).

Orchestration with the interactive whiteboard: Provisionality and permanence. Paper presented at the Association of Learning Technologies conference, University of Nottingham.

Vass, E., & Littleton, K. (2010). Peer collaboration and learning in the classroom. In K. Littleton, C. Wood & J. Kleine Staarman (Eds.), *International handbook of psychology in education* (pp. 105-135). Bingley, UK: Emerald Group Publishing.

Von Wright, G.H. (1971). *Explanation and understanding*. London: Routledge & Kegan Paul.

Von Wright, G.H. (2004). *Explanation and understanding* (paperback ed.). Ithaca: Cornell University Press.

Vygotsky, L.S. (1962). *Thought and language* (A. Kozulin, Trans). Cambridge, MA: MIT Press.

Vygotsky, L.S. (1987). *Thinking and speech* (N. Minick, Trans.). New York: Plenum.

Wegerif, R., & Mercer, N. (1997). Using computer-based text analysis to integrate qualitative and quantitative methods in research on collaborative learning. *Language and Education*, 11(4), 271-286.

Wegerif, R., Mercer, N., & Rojas-Drummond, S. (1999). Language for the social construction of knowledge: Classroom talk in Mexican preschools. *Language and Education*, 13(2), 133-150.

Wegerif, R., & Scrimshaw, P. (Eds.) (1997). *Computers and talk in the primary classroom*. Clevedon: Multilingual Matters.

Wells, G. (1993). Re-evaluating the IRF sequence: A proposal for the articulation of theories of activity and discourse for the analysis of teaching and learning in the classroom. *Linguistics and Education*, 5(1), 1-37.

Wells, G. (1999). *Dialogic inquiry: Towards a sociocultural practice and theory of education*. Cambridge, MA: Cambridge University Press.

Wells, G. (2009). *The meaning makers: Learning to talk and talking to learn* (2nd ed.). Bristol, Buffalo and Toronto: Multilingual Matters.

- Wertsch, J.V. (1991). *Voices of the mind: A sociocultural approach to mediated action*. Hemel Hempstead: Harvester Wheatsheaf.
- Wertsch, J.V. (1998). *Mind as action*. Oxford: Oxford University Press.
- Wertsch, J.V., & Tulviste, P. (1992). L.S. Vygotsky and contemporary developmental psychology. *Developmental Psychology*, 28(4), 548-557.
- Wertsch, J.V., Tulviste, P., & Hagstrom, F. (1993). A sociocultural approach to agency. In E. Forman, N. Minick & C. Stone (Eds.), *Contexts for learning: Sociocultural dynamics in children's development* (pp. 336-356). New York: Oxford University Press.
- Westcott, H.L., & Littleton, K. (2005). Exploring meaning in interviews with children. In S. Greene & D. Hogan (Eds.), *Researching children's experience: Approaches and methods* (pp. 141-157). London: Sage.
- Wineburg, S. (2007). Unnatural and essential: The nature of historical thinking. *Teaching History*, 129(Disciplined Minds edition), 6-11.
- Wood, D. (1992). Teaching talk. In K. Norman (Ed.), *Thinking voices: The work of the National Oracy Project* (pp. 203-214). London: Hodder Stoughton for the National Curriculum Council.
- Wood, D. (1998). *How children think and learn* (2nd ed.). Oxford: Blackwell.
- Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem-solving. *Journal of Child Psychology and Child Psychiatry*, 17(2), 89-100.
- Wood, S. (1995). Developing an understanding of time-sequencing issues. *Teaching History*, 79(April), 11-14.
- Yin, R.K. (1981a). The case study as a serious research strategy. *Knowledge: Creation, Diffusion, Utilization*, 3(1), 97-114.
- Yin, R.K. (1981b). The case study crisis: Some answers. *Administrative Science Quarterly*, 26(1), 58-65.
- Yin, R.K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, London & Delhi: Sage.

**Sociocultural understandings of technology-
mediated educational practices:
Improvable objects and meaning-making trajectories
in the ICT-literate classroom**

Appendices

Alison Jane Twiner

Appendices

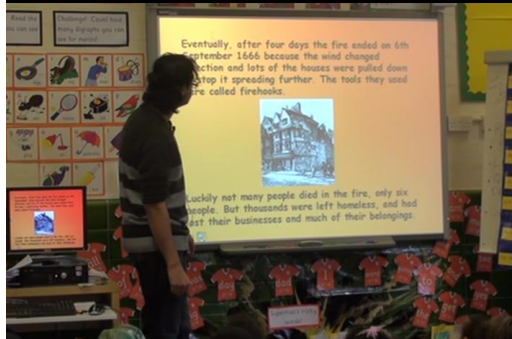
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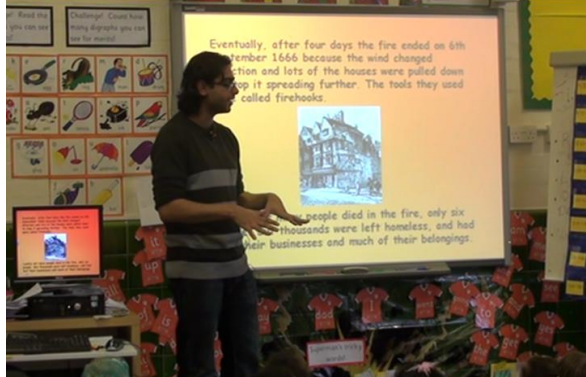
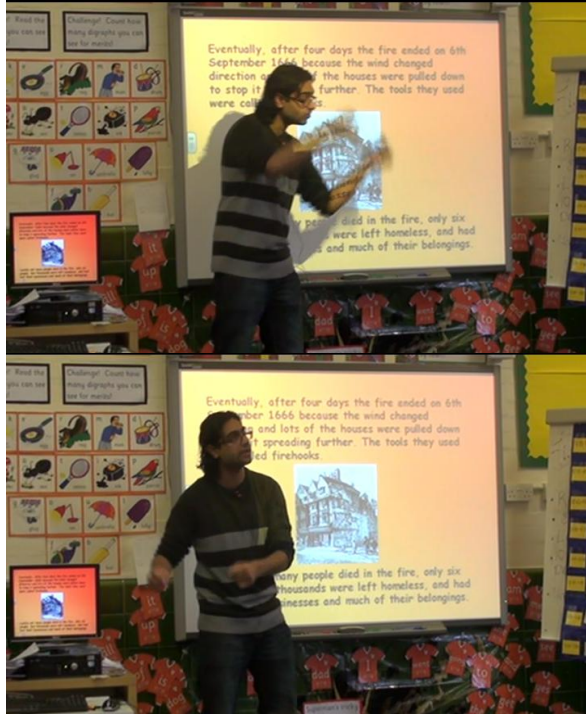
Appendix 1

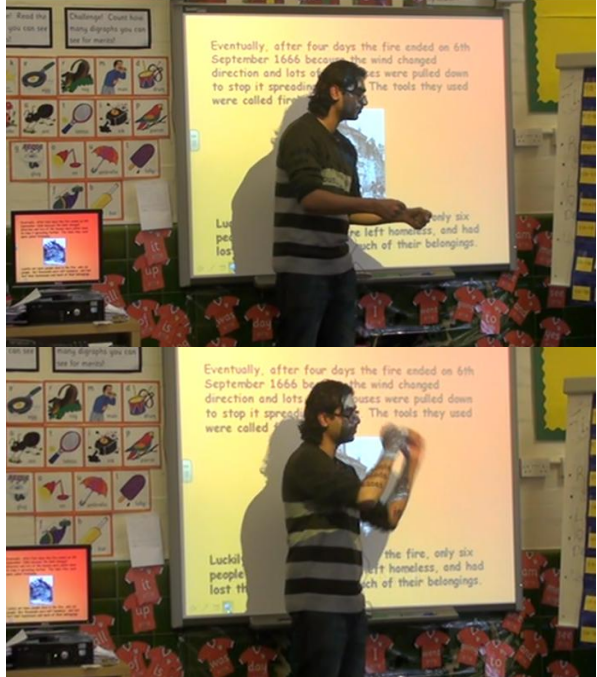
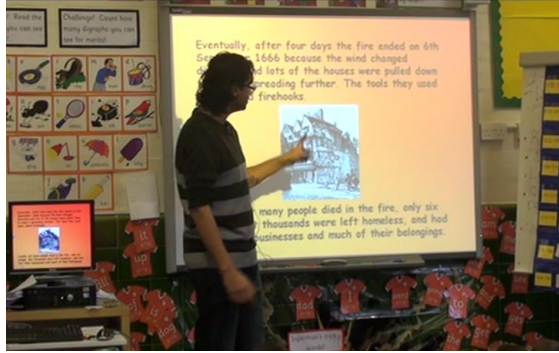
Multimodal transcribed extract 1: Using physical demonstration to explore the concept of firebreaks

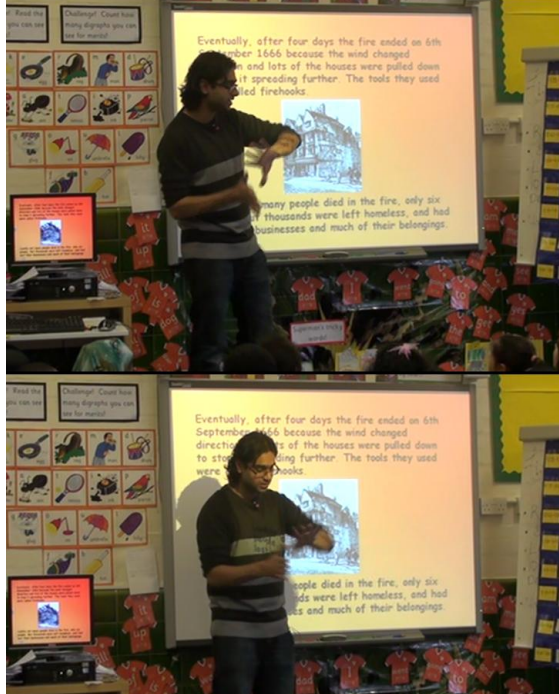
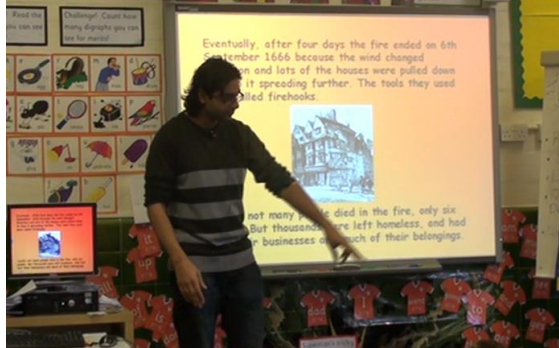
Week 5, class lesson

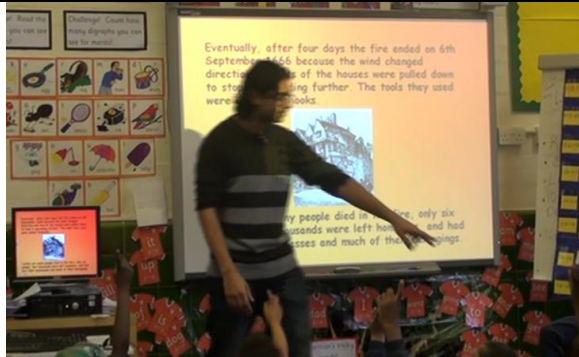
IWB shows written text and image. T standing to side of IWB, Ps sat on carpet facing IWB


Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 19.30	T: Eventually after four days, the fire ended on the 6th September, 1666, because the wind changed direction, and lots of the houses		T looks at IWB as he reads the text	T points to IWB on 'eventually'; follows text on '6 th September' and from 'because... houses'

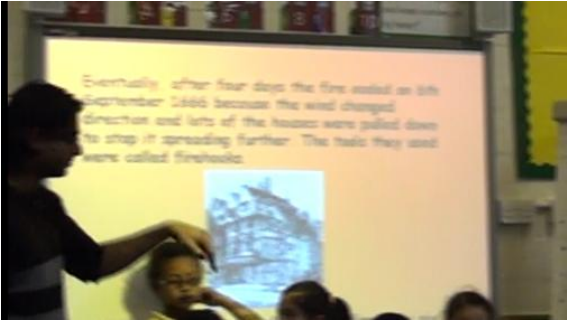
	<p>stopping the fire was ins,</p>		<p>T faces Ps, briefly checking IWB slide on 'ins'</p>	<p>Spreads palms open downwards on 'stopping'</p>
<p>3 19.46</p>	<p>because it took them so long to get to the water and then</p> <p>get</p>			<p>T mimics action of throwing a bucket of water, by bringing arms down to his right side and moving them up to his left side, from 'because... so' then lowers hands to his sides</p> <p>Mimics picking something up on 'get'</p>

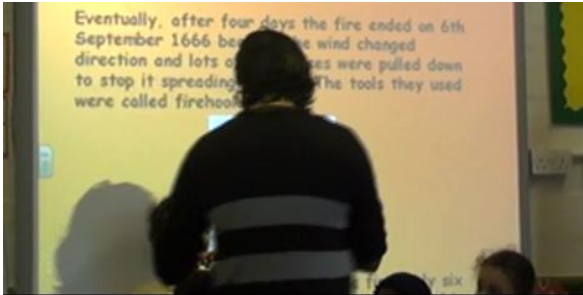
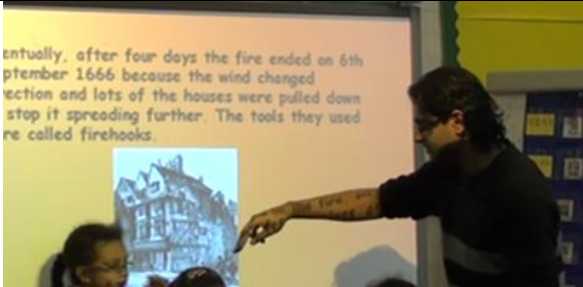
	<p>it all the way up to the place</p> <p>and then (pause) put the fire out like that,</p>			<p>Moves hands across to right side as if carrying something, from 'it... up', then lowers hands on 'place'</p> <p>In pause in speech between 'then put', mimics action of throwing a bucket of water, then lowers hands</p>
<p>4 19.51</p>	<p>they decided,</p>		<p>T looks at slide on 'decided' then looks back to Ps</p>	<p>T points to image on slide on 'decided'</p>

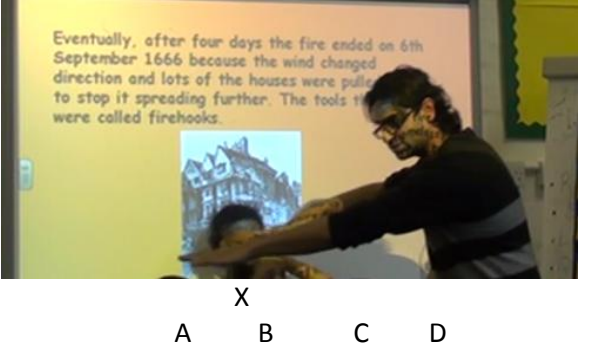
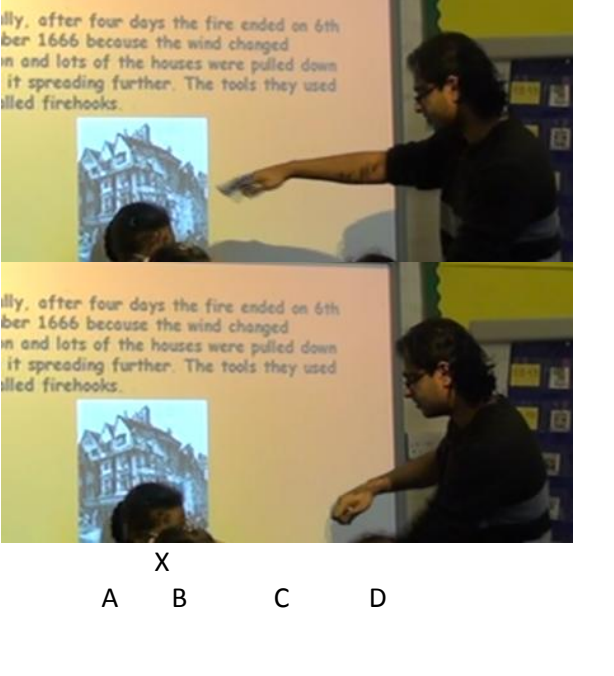
	<p>cos the fire's</p> <p>catching (pause)</p>		<p>Twists hands together on 'cos the fire's'</p> <p>Jumps hands across on 'catching'</p>
<p>5 19.53</p>	<p>can I have a few children as volunteers please?</p>		<p>T points to side of him from 'have... volunteers'</p>

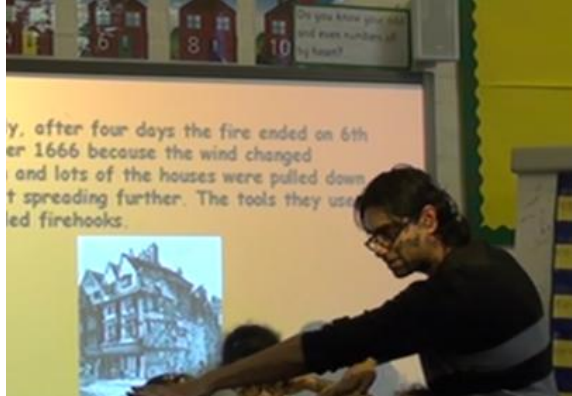
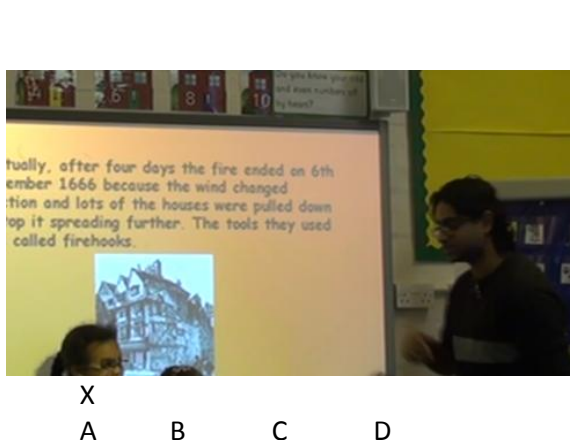
6 19.54	Ps: (intake of breath)			Ps raise hands
7 19.55	T: I'd like erm (pause) somebody who's been listening really nicely (pause)		T looks across Ps	T lowers hands More Ps raise hands
...	T selects three Ps to stand at the front			
8 20.06	This is enough. (pause) And erm (pause)	IWB T A B C (rest of class)	Three Ps (A, B and C) stand in front of IWB, facing class (Cannot show video of A, B and C due to consent)	Three Ps stand up at front
9 20.09	Ps: (intake of breath)			Ps raise hands

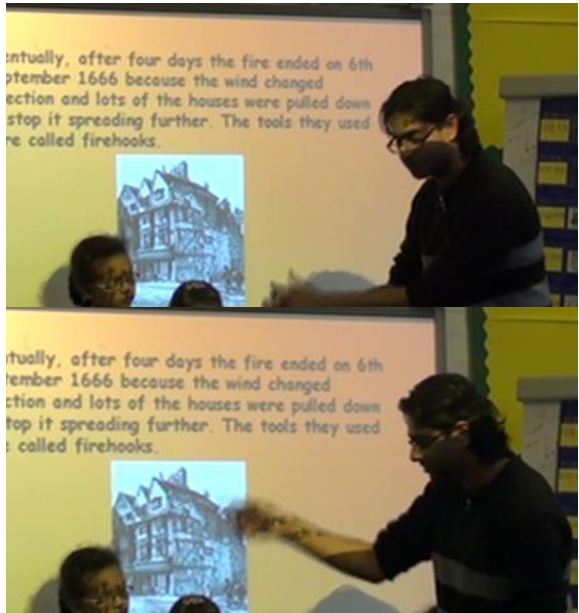
<p>10 20.10</p>	<p>T: We'll have one more Mia then to the front.</p>	<p>IWB</p> <p>T A B C D</p> <p>(rest of class)</p>		<p>T points to P</p> <p>P moves to front of class (D)</p>
<p>11 20.12</p>	<p>So pretend you're (to A) a house yeah? Stand still. You're a house too. OK right next to each other cos the houses were really close together. Right next to each other. Right next to each other. OK.</p>			<p>T stands behind A</p> <p>T taps B on shoulder</p> <p>T moves D in closer to C in line</p>
<p>12 20.23</p>	<p>And er, who wants to be the fire?</p>			
<p>13 20.25</p>	<p>Ps: Me!</p>			<p>Ps raise hands</p>

<p>14 20.26</p>	<p>T: Who's gonna be the fire? (pause) Er right (pause), let's have, come on then Lior you can be the fire. (pause) Stand up. (pause) So you're the fire. Come across, come and stand behind them please. (pause) Stand behind them</p>	<p>IWB</p> <p>T X A B C D</p> <p>(rest of class)</p>	<p>(X = fire pupil)</p>	<p>Lior (X) moves to front and stands behind A</p>
<p>15 20.35</p>	<p>Now (pause) if she's standing behind someone, that means that this house is on fire. So whose, house is on fire right now?</p>	 <p>X A B C D</p>		<p>T points to A on 'this' Moves pointing hand up and down above A on 'right now'</p>
<p>16 20.40</p>	<p>Ps: Salim</p>			<p>T lowers hand</p>

<p>17 20.41</p>	<p>T: Salim's house is on fire right now. So, what they did, once this fire had,</p> <p>so you're on fire yeah?</p>		<p>T facing Ps in front of IWB</p> <p>T looks at A</p>	<p>T moves in front of Ps at front, taps A on head on 'what they did'</p> <p>T moves to side, in front of D, still tapping A on head</p>
<p>18 20.47</p>	<p>And now move across.</p>	 <p>X A B C D</p>	<p>T looks at X</p>	<p>T points to B</p>
<p>19 20.48</p>		<p>IWB</p> <p>X A B C D T</p> <p>(rest of class)</p>		<p>X moves to stand behind B</p>

<p>20 20.49</p>	<p>Now how many houses on fire now?</p>		<p>T looks at rest of class</p>	<p>T puts hands above heads of A and B across the words 'how... now' then lowers them</p>
<p>21 20.50</p>	<p>Ps: Two</p>			
<p>22 20.51</p>	<p>T: Go across.</p>		<p>T looks back at X</p>	<p>T points to B on 'go' and pulls hand towards him on 'across' X moves behind C</p>

<p>23 20.53</p>	<p>How many fires, er, how many houses are on fire now?</p>		<p>T looks at rest of class</p>	<p>T puts hands above heads of B and C across the words 'how... houses' then lowers them</p>
<p>24 20.54</p>	<p>Ps: Three</p>			
<p>25 20.55</p>	<p>T: Three. OK can you go back to the beginning?</p>	 <p>X A B C D</p>	<p>T looks at X</p>	<p>X moves back to stand behind A</p>

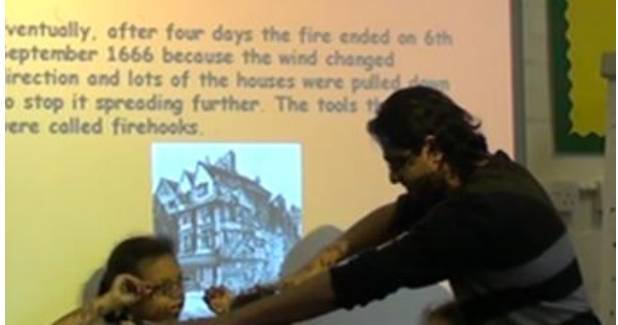
<p>26 20.56</p>	<p>Right this time, what the people decided to do (pause) was instead of trying to get water and putting it out</p> <p>cos the fire was so big (pause) they decided (pause)</p>	 <p>The top photograph shows a teacher pointing at a screen with the text: "ntually, after four days the fire ended on 6th ptember 1666 because the wind changed ction and lots of the houses were pulled down stop it spreading further. The tools they used re called firehooks." Below the text is an image of a large, multi-story house. The bottom photograph shows the same teacher pointing at the same screen, but now pointing specifically at the word "cos" in the text.</p>	<p>T looks at rest of class</p>	<p>T moves toward A, and pushes hands toward him and back twice, as if throwing water, on 'get' and 'putting'</p> <p>Points briefly at X on 'cos'</p> <p>X starts moving arms up and down</p>
<p>27 21.01</p>	<p>to knock down a house, so come down, come down, sit down on the ground.</p>	<p>IWB</p> <p>X A B c D T</p> <p>(rest of class)</p>	<p>T looks at C</p>	<p>T moves hands and bends toward C on 'to'</p> <p>C crouches to floor (c)</p>

28
21.07

They blew up houses, and
then,

so one house is on fire,

now the other one, stand
behind her.



T looks at X on
'and'

T looks at A

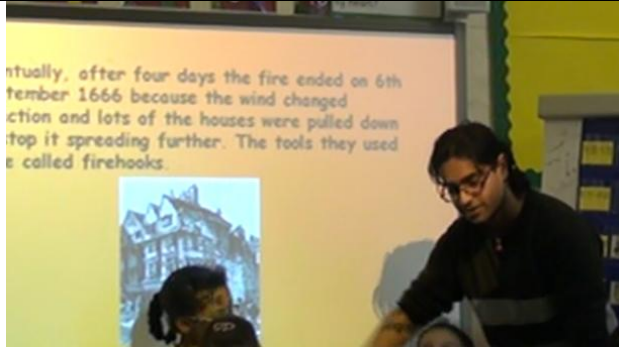
T looks at B


T points at X on 'then'

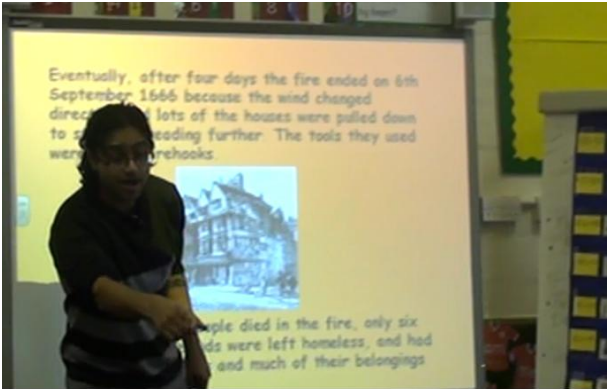
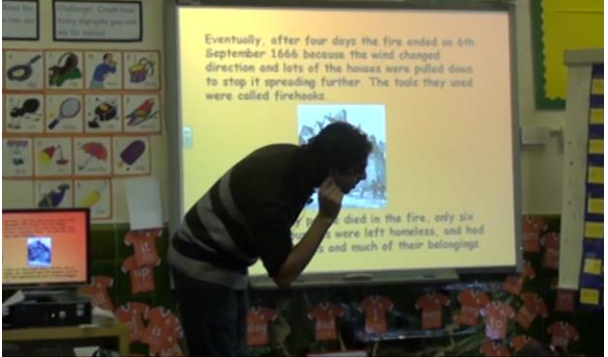
T places hand on A's head on 'one'

T keeps left hand on A's head, and
taps right hand on B's head on 'now'
and 'other'

B starts to crouch down, X moves over
to B

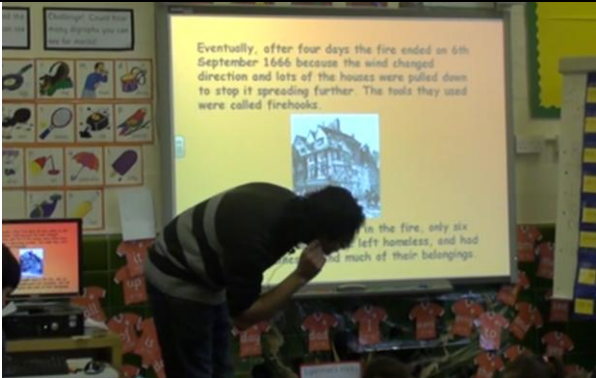
29 21.13	No, no, no, you stay standing. You stand behind	IWB X A B c D T (rest of class)	T looks at B T looks at X	B stands up again
30 21.15	And you over here (pause) so the fire (pause) this is called a firebreak		T looks at rest of class	T holds arm out behind D Moves hand back and forth between B and D, above c crouched down, across the words 'so the fire'
31 21.22	because the fire couldn't reach the next building.			T holds hands by B and pulls them across toward D on 'reach'

<p>32 21.24</p>	<p>So that's why they were trying to blow up</p> <p>the houses.</p>	 <p>B c D</p> <p>B c D</p>		<p>T moves hands above where c is crouching, and pulls them up on 'up'</p> <p>lowers them again and raises them on 'houses'</p>
<p>33 21.28</p>	<p>OK thank you ladies and gents, sit down.</p>			<p>T taps D on shoulders A, B, C and D sit down facing IWB as before</p>

<p>34 21.30</p>	<p>Lior: And then there's a gap</p> <p>T: Then there's a gap then, it's called a f, what's it called? A fire (pause), fire b, b, b</p> <p>Ps: Break T: Fire?</p> <p>Ps: Break</p>	 <p>The image shows a teacher standing in front of a whiteboard. The whiteboard displays text about a fire in 1666 and an illustration of a building. The text on the board reads: "Eventually, after four days the fire ended on 6th September 1666 because the wind changed direction and lots of the houses were pulled down to stop it spreading further. The tools they used were called firehooks." Below this is an illustration of a building. Further down, it says "People died in the fire, only six were left homeless, and had and much of their belongings".</p>	<p>X still standing, facing T T facing X</p> <p>T faces class</p>	<p>T pushes hands apart on 'gap'</p> <p>X sits down, T moves back to other side of IWB</p> <p>T points to P</p>
<p>35 21.35</p>	<p>T: A fire?</p> <p>Ps: Break</p>	 <p>The image shows the same teacher leaning over a table in front of the whiteboard. The whiteboard content is the same as in the previous image.</p>		<p>T leans toward Ps, holding his ear</p>

36
21.37

T: Fire?
Ps: Break



T leans further forward, still holding his ear

37
21.39

T: That's right, it's called a firebreak

T looks at IWB


T stands back up



Appendix 2


Multimodal transcribed extract 2: Embodying and emphasising concepts


Week 5, hall lesson

Ps sat facing IWB at front. Some Ps standing at front

Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 08.07	T: What I'd like you to do (pause) you guys are all houses from the past. Can you please, put your hands up (pause)?		T looking at Ps at front 'House' Ps look at T	T raises hands on 'can'

<p>2 08.16</p>			<p>'House' Ps look at each other</p>	<p>Ps raise their hands</p>
<p>3 08.17</p>	<p>Hold each other's hands, yeah.</p>		<p>'House' Ps look at T</p>	<p>T brings hands together on 'hold'</p> <p>T holds Ps' hands together</p>

<p>4 08.20</p>	<p>So, now this is like a street in London,</p> <p>it was all very</p> <p>narrow and close together.</p>		<p>T looks at rest of class</p> <p>'House' Ps look at each other</p>	<p>T moves to the side of Ps at front</p> <p>Pulls hands up opposite each other from 'it'</p> <p>and squeezes them together and apart quickly five times across the words 'narrow... together', leaning forward</p>
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8 08.34	I can choose you, come on then Sura. Come across here.			T off camera view
9 08.39	<p>If I show you, the word card, er j,</p> <p>who can sound this out for me with the sound buttons? Who can sound this out?</p> <p>Can you sound it out?</p>		<p>'Fire' P standing to T's left (cannot show for consent reasons)</p> <p>'House' Ps look at each other</p>	<p>T picks up card and holds out in front of him</p> <p>T moves card toward Ps sat on floor across the words 'who... out?'</p> <p>Moves card over to show to other Ps on 'can you'</p>
...				

10
08.50


T: J, jump. Good girl.
So,
if I show you this word card,



you need to pretend you're the

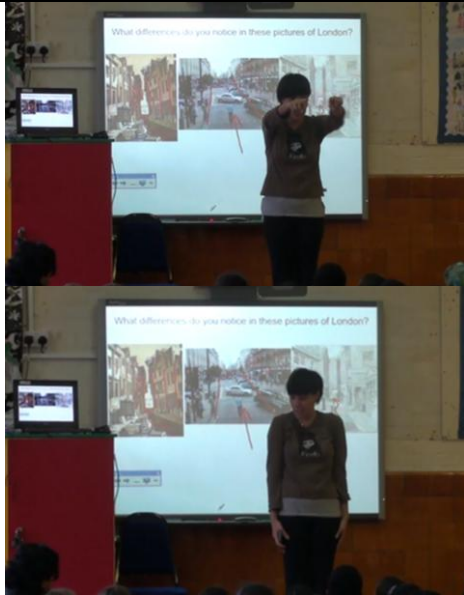





T steps backward and lowers card
on 'so'
lifts card high on 'this word card'


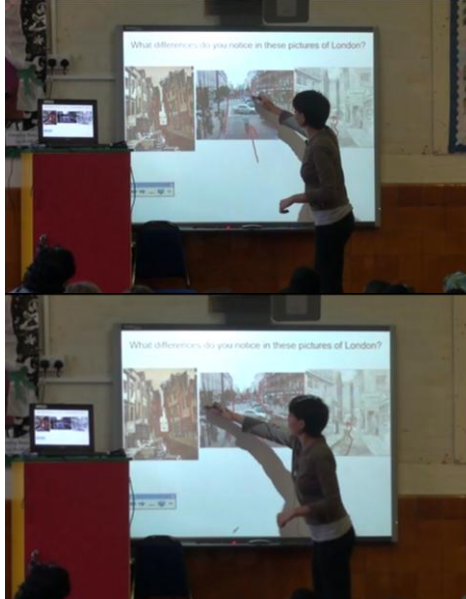
lowers card across the words
'you... the'



	<p>fire,</p> <p>jumping</p> <p>from house to house.</p>		<p>Mimics jump motion, lifting card slightly just before saying 'fire'</p> <p>Lowers card slightly from jumping motion on 'jumping'</p> <p>Repeats jumping motion moving card up on 'from' and down on 'house'</p>
--	---	--	--




<p>2 15.38</p>	<p>Everyone's living (pause) like this.</p>		<p>DS faces class</p>	<p>DS turns to face class, pushes arms close to her sides on 'like this'</p>
<p>3 15.40</p>	<p>When you built your buildings over here</p>			<p>Moves hands to her left side on 'built', and stretches hands apart, stopping on 'buildings'</p>




	<p>and when you made your buildings over there you were</p> <p>standing really close together.</p>		<p>Points to middle of room on 'when', and lowers arms on 'you were'</p> <p>Squeezes arms by her sides across the words 'standing... together'</p>
<p>4 15.45</p>	<p>Because in the olden days, all the houses,</p>		<p>Eases tension in her arms across the words 'because... days' Moves hands out to side on 'houses' and scrunches shoulders up</p>


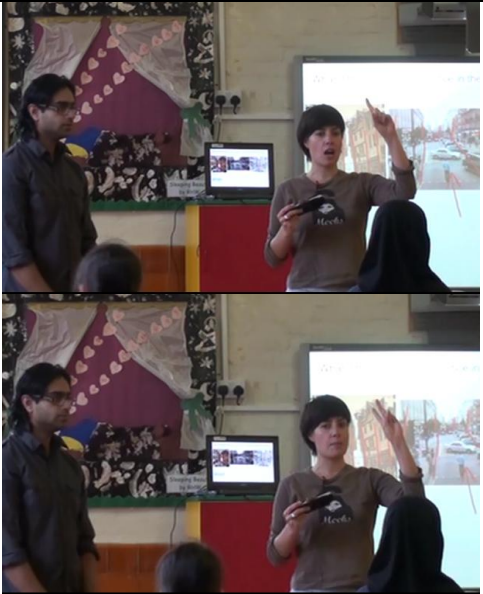
	<p>were close together like that.</p>			<p>Bounces hands in toward her four times across the words 'close together'</p>
<p>5 15.49</p>	<p>Whereas now we have a little bit</p>			<p>Expands arms across the words 'we... bit'</p>


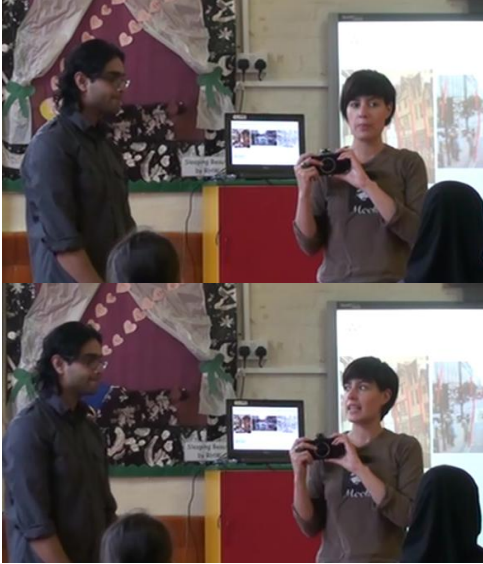
	<p>more space.</p>		<p>DS faces IWB</p>	<p>Lowers arms and turns toward IWB on 'more'</p>
<p>6 15.51</p>	<p>And you can see that the buildings aren't as close together are they anymore?</p>			<p>DS draws five lines onto middle image on IWB to indicate wider spaces between buildings, across the words 'the... anymore'</p>


<p>7 15.57</p>	<p>OK so there are a few things that I've noticed in those pictures.</p>		<p>DS faces class</p>	<p>DS turns to face class on 'there' Crouches down on 'I've'</p>
<p>8 16.01</p>	<p>And what we're going to do today, is we're going to pretend that we're from the past (pause), and we're going to see if we can build, a street (pause) that is</p>		<p>DS faces IWB</p>	<p>Moves arms to her left on 'past' Starts to stand on 'street' Points to right-most image on IWB in pause in speech after 'street'</p>


	<p>from the past (pause) with our bodies (pause)</p>		<p>DS faces class</p>	<p>Points to left-most image in pause after 'past' and holds it there across the words 'with our bodies'</p>
<p>9 16.15</p>	<p>OK? So the first thing we're going to do is practise, making some different shapes.</p>			<p>Lowers arms and moves to side of IWB</p>
<p>10 16.18</p>	<p>So I've already seen some lovely shapes. I saw some of you making shapes like this,</p>			<p>Starts moving arms up and turning side on to class on 'already', and holds them up until 'this'</p>

	and when you were standing there making shapes like this.				Moves to side and stands up straight, arms by side on 'and', and holds it until 'this'
11 16.27	We're gonna look at different shapes that we can make with our bodies.				Moves back to IWB and puts pen down across the words 'we're... bodies'
...					
12 17.11	DS: We can put our bodies on different levels, high (pause)		DS holds PSP in right hand		DS has arm raised until 'high'

	<p>Medium (pause)</p> <p>and low.</p>		<p>Moves arm to medium level during pause</p> <p>Crouches and moves arm to low level during pause (below camera level) T also bends slightly and mouths 'low' at same time as DS</p>
<p>13 17.18</p>	<p>So we're gonna look for different shapes on high (pause)</p> <p>medium (pause)</p>		<p>Raises one finger on 'high'</p> <p>Raises second finger to join first on 'medium'</p>

	<p>and low levels.</p>			<p>Raises third finger to join others on 'low'</p>
<p>14 17.22</p>	<p>And Anwar (pause)</p> <p>when he sees a really clever shape,</p> <p>maybe a shape that he</p>		<p>DS looks at T across saying 'sees... clever' Then looks back at Ps</p>	<p>Brings hand down and raises PSP held in both hands on 'Anwar'</p> <p>Nods head on 'maybe a shape'</p>

	<p>hasn't seen before (pause)</p> <p>he's gonna take a photo (pause)</p> <p>with this PSP.</p>		<p>DS looks briefly at T after 'photo' then back at Ps</p>	<p>Shakes finger side to side twice on 'hasn't seen before'</p> <p>Returns hand to camera on 'he's'</p> <p>Raises PSP on 'with this', then lowers to previous level</p>
--	--	---	--	---


<p>15 17.33</p>	<p>And then (pause) we're going to look</p> <p>at these shapes on the screen.</p>		<p>DS looks at IWB to start pointing</p> <p>then turns body and head to face Ps</p>	<p>DS turns to face IWB points to IWB on 'look' and</p> <p>keeps pointing as she turns body back to face Ps</p>
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Appendix 4

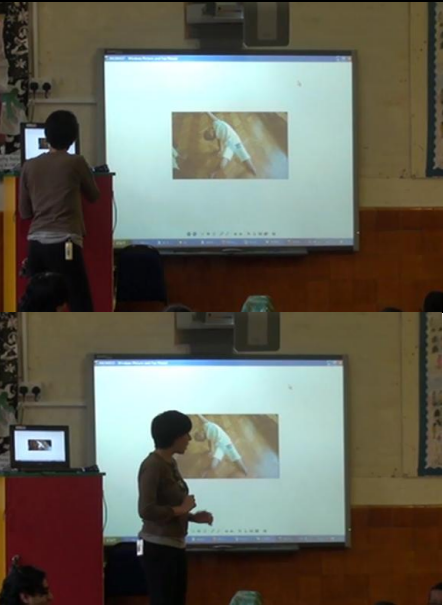

Multimodal transcribed extract 4: Creating and using images of pupils' work


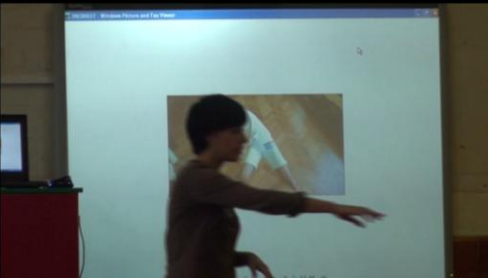
Week 5, hall lesson

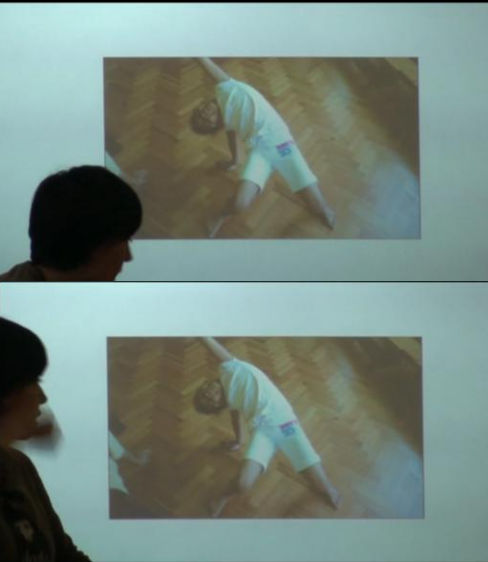

Ps making shapes, T taking photographs on PSP, using photographs displayed back on IWB


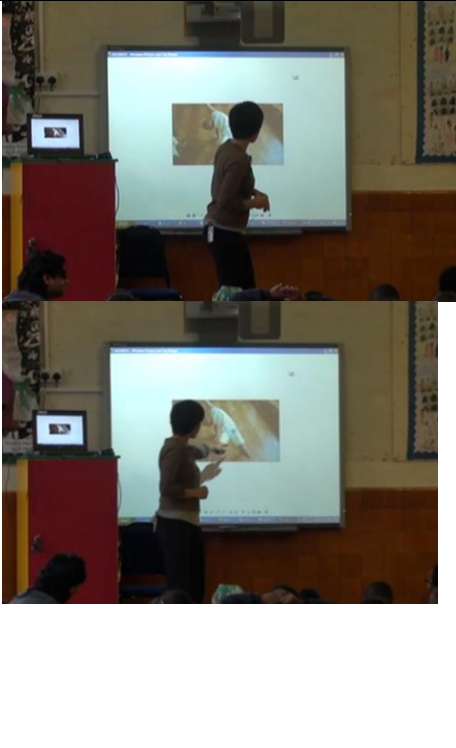
Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 20.00			P's medium level shape	
...				

<p>2 20.13</p>				<p>T photographing P's medium shape on PSP</p>
<p>...</p>				
<p>3 24.43</p>	<p>DS: What else have we got? Some great ones. (pause)</p>		<p>Ps looking at IWB DS looking at PC screen</p>	
<p>4 24.46</p>				<p>DS selects image to open</p>

	<p>Ooh look at that. That's an interesting shape.</p>		<p>DS looks at IWB</p>	<p>which she maximises on the screen</p> <p>DS moves side on to IWB</p>
<p>5 24.51</p>	<p>What level</p>		<p>DS looks across Ps</p>	<p>DS moves hands up</p>

	<p>would you say that shape was on?</p>				<p>and down on 'level'</p> <p>Then brings hands together</p>
<p>6 24.55</p>	<p>P: Er (pause) high Ps: Medium</p>			<p>DS points to P</p>	
<p>7 24.58</p>	<p>DS: It's probably a medium level isn't it?</p>		<p>DS looks at Ps</p>	<p>DS walks back to stand by side of IWB</p>	




	<p>Cos it's, not all the way down to the ground</p> <p>and it's not standing up, so that's probably medium.</p>		<p>Looks at IWB</p>	<p>Bends down on 'all'</p> <p>Stands upright and reaches up straight on 'not'</p>
<p>8 25.03</p>	<p>What can you tell me about this shape? (pause)</p>		<p>Looks at Ps</p>	<p>Gestures hand to IWB on 'this'</p>

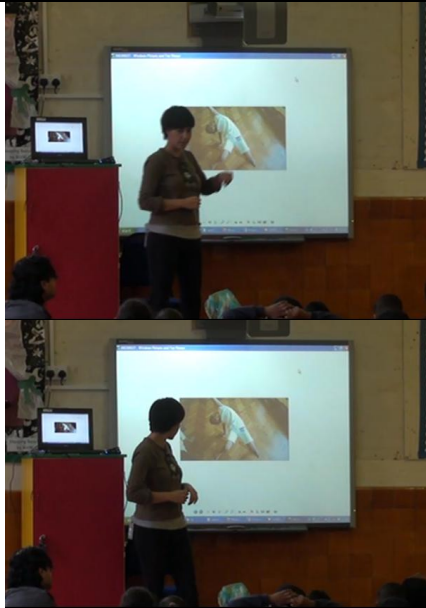

<p>9 25.07</p>	<p>Yes?</p>			<p>Points to P</p>
<p>10</p>	<p>P: She's stretching</p>			
<p>11 25.08</p>	<p>DS: She's stretching, that's right. (pause)</p> <p>But she's also (pause),</p>		<p>DS looks at IWB, then looks at Ps</p> <p>Looks at IWB</p>	<p>Points to IWB in pause in speech after 'also'</p>

if you have a look here



Traces finger over line from knee
to arm on image across the words
'if... here'

	(pause)			Traces finger back in pause in speech after 'here'
	curving		Turns head to turn to look at Ps on 'c' of 'curving'	Continues tracing finger down
			Continues to turn head to face Ps	then back up again on 'urving'

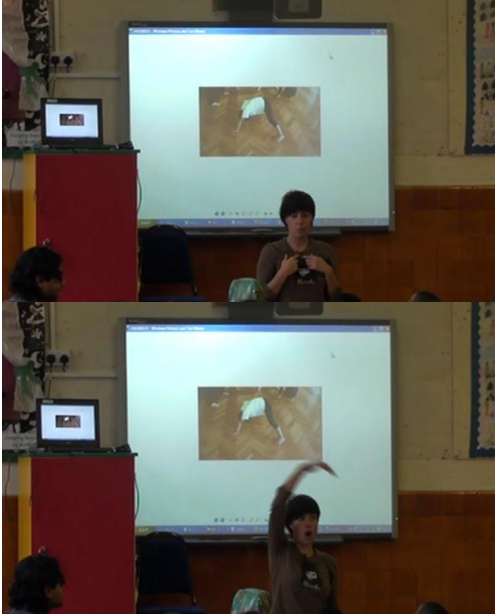
	her body as well.		Looks back at IWB	Brings arm back towards her and leans away from IWB across the words 'her... well'
...	A few more comments are invited and offered by Ps about the photographs			
12 25.56	DS: One more picture.			DS minimises previous picture to show folder of images scrolls down list of images
13 26.00	P: I wanna see me.			

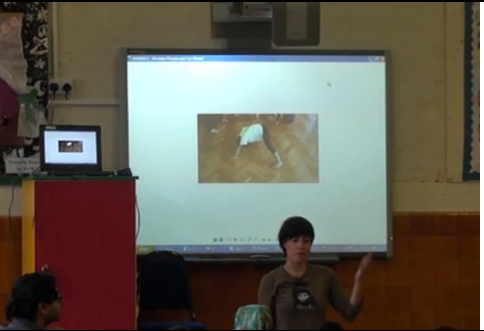

Appendix 5




Multimodal transcribed extract 5: Continuing interaction around images of pupils' work to explore concepts


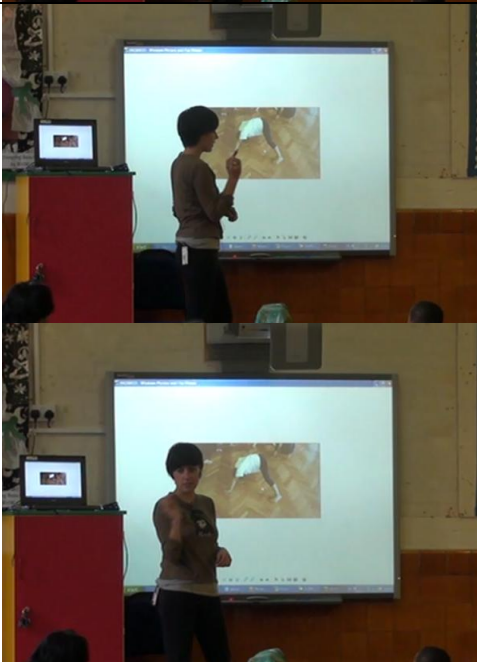
Week 5, hall lesson




IWB shows image of P's shape. DS sat in front of IWB facing class.

Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 27.25	<p>DS: And we're gonna pretend that we're fire (pause)</p> <p>going over</p>		<p>IWB image of P's 'building' shape DS sat in front of IWB facing Ps T and Ps sat facing DS and IWB</p>	<p>DS points to self from 'we're'</p> <p>Raises arm over and back down again on 'over'</p>

<p>2 27.39</p>	<p>OK so we're gonna swap over.</p>			<p>Tilts hands side to side on 'swap over'</p>
<p>3 27.41</p>	<p>So half of us are going to be the different-shaped buildings, and the other half are going to be the fire</p>		<p>DS looks to Ps on her left</p>	<p>Raises hand with finger pointed upwards on 'half' Lowers hand and raises other hand with finger pointed upwards on 'other half'</p>

	going around our partner.		Looks back to Ps in centre	Circles right hand around raised left hand on 'around'
4 27.48	Then we're going to swap over.			Lifts right arm over in semi-circle on 'then we're', to hold both arms out to side from elbows
5 27.51	So, if our partner made a lovely shape like this (pause)		DS looks at IWB	<p>Lowers arms and stands up, walks backwards toward IWB Points to IWB on 'lovely' then drops hand</p> <p>Picks up IWB pen in pause in speech</p>

	<p>we could go (pause) under our partner.</p>			<p>Contacts pen with image in pause in speech, and moves it up toward the P in the image across the words 'under our partner' – it makes no mark</p>
<p>6 27.59</p>	<p>That's not working.</p> <p>Why is that not working? Cos it's not in (pause) Smartboard, is that right?</p>		<p>DS looks at T T leans head round to right</p>	<p>Pulls away from IWB still holding pen up on 'that's not working'</p> <p>Turns to face T across the words 'why... working'. Keeps hand up</p>

<p>7 28.04</p>	<p>T: Er, I don't think so, it should come up.</p>			<p>T raises hand on 'should' then lowers it</p>
<p>8 28.06</p>	<p>DS: Should it?</p>		<p>DS looks at IWB</p>	<p>DS turns to face IWB on 'should it'</p>
<p>9 28.07</p>	<p>T: Put it down and pick it back up.</p>			<p>T points to bottom of IWB on 'down', then lifts hand up slightly on 'pick' then lowers it again</p>

10
28.09




DS: Let's try again.

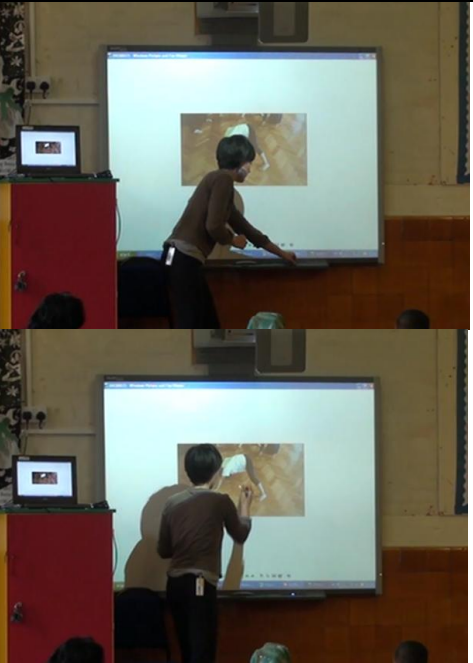



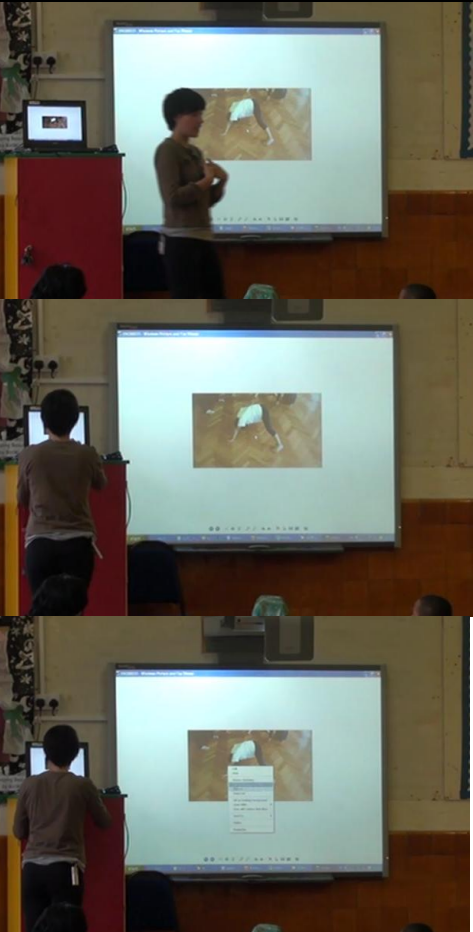
DS puts pen down in slot at
bottom of IWB




leans back from IWB and pulls
arms in


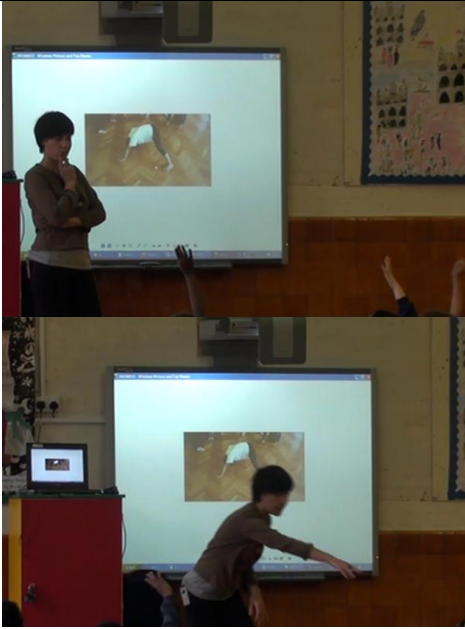
Leans forward to pick up IWB pen
on 'let's try again'



	(pause)		Contacts pen with image in pause in speech, and moves it up toward the P in the image– it makes no mark
11 28.14	T: Any luck?		DS pulls away from IWB
12 28.15	DS: No. (pause)		Replaces pen in slot at bottom of IWB in pause in speech

	<p>Try a different colour.</p>		<p>Picks up another pen on 'colour'</p> <p>Contacts pen with image in pause in speech, and moves it up toward the P in the image– it makes no mark</p>
<p>13 28.21</p>	<p>No, OK.</p>		<p>Replaces pen at bottom of IWB</p>

	<p>I make mistakes too and</p> <p>that's how I learn.</p> <p>Let me have a look.</p> <p>(pause)</p>		<p>DS looks at PC screen</p>	<p>points to self on 'I'</p> <p>then moves to face PC screen</p> <p>Scrolls through menu in pause in speech</p>
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<p>17 28.44</p>				<p>Ps raise hands</p>
<p>18 28.45</p>	<p>and point to how you'd move under this shape.</p>		<p>DS faces IWB</p>	<p>DS points to IWB image from 'point' until 'move' then lowers arm</p> <p>Turns to face Ps on 'under'</p>
<p>19 28.49</p>	<p>Will you come out and show me? How would you move under?</p>		<p>DS looks at P</p>	<p>Steps forward and points to P</p>

				<p>then steps back Most Ps lower hands</p>
<p>...</p>	<p>Ps are selected to come to the front and point on the image, and then demonstrate through movement, how they would move under, over and around the P's shape.</p>			
<p>20 30.20</p>	<p>DS: What are you going to do if I say you've got to go through this shape?</p> <p>What do you think?</p>		<p>DS looks at Ps</p> <p>Looks at P</p>	<p>DS raises finger to chin in 'thinking' pose Few Ps raise their hands</p> <p>DS points to P on 'you', then lowers arm Other Ps lower arms</p> <p>DS steps back to side of IWB Selected P comes forward</p>


<p>21 30.29</p>	<p>P: Through that way.</p>		<p>DS and P look at IWB</p>	<p>P points at back of legs of P on image and moves finger through to front of P on image</p>
<p>22 30.31</p>	<p>DS: OK, through that way. Good, excellent.</p>		<p>DS and P look at each other</p>	<p>P turns to face DS then steps to side of IWB</p>



Appendix 6



Multimodal transcribed extract 6: Linking concepts, movement and words


Week 5, hall lesson



Ps are in pairs: one to represent a building, and the other to represent the fire moving over, under, around and through the building shapes.



Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 31.36	DS: If I tap you on the shoulder you're going to be the building first. So you're going to make a lovely shape, when I tap you on the shoulder		Ps sat in pairs	DS going round Ps, to identify which P in each pair will be the building
...				

<p>2 31.53</p>	<p>DS: Making a lovely shape</p>			<p>DS taps P on shoulder</p>
<p>...</p>				
<p>3 32.19</p>	<p>DS: when you have a shape, I want you to hold it really still please.</p>			<p>P tries a few shapes, then stops on one on 'please'</p>
<p>4 32.25</p>	<p>OK hold it really still. OK the other person, you're going to be the fire. And you're going to move under this shape to start with. OK? Off you go, under.</p>			

5 32.45				'Fire' P crawls under 'building' P
...				
6 32.57	DS: I want you to try over now (pause) over the shape			
...				
7 33.05	T: Say over while you're going over please			'Fire' P moves over 'building' P
...				

<p>8 33.29</p>	<p>T (to 'fire' P): Say over. Mia say over</p> <p>Ready go. Over</p>		<p>T standing next to 'fire' P</p>	<p>T holds 'fire' P's hand as she jumps over 'building' P, as T says 'over'</p> <p>P sits down T lets go of P's hand</p>
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<p>9 33.37</p>	<p>And again, and again, and again.</p>		<p>Ps look at each other</p>	<p>T holds hand out to P P stands up</p>
<p>10 33.40</p>	<p>Say over</p> <p>Mia say over when you go over</p>		<p>'Fire' P looks at 'building' P, 'building' P looks at T</p> <p>'Fire' P looks at T</p>	<p>T starts to walk away whilst talking, rolling hands over each other</p>


<p>11 33.43</p>	<p>Over</p> <p>P: Over</p>		<p>T looks back at 'fire' P</p>	<p>'Fire' P jumps over 'building' P, at which point T says 'over'</p> <p>'Fire' P says 'over' as she lands</p>
<p>12 33.44</p>	<p>T: Good girl</p>		<p>'Fire' P looks at T</p>	<p>'Fire' P turns body round to face 'building' P</p>



Appendix 7




Multimodal transcribed extract 7: Cumulative exploration of buildings, fire and firebreaks



Week 8, hall lesson




Ps and TA in a line, initially to represent buildings.




Row and time specification	Soundtrack	Visual frame	Description of visual frame	Action
1 23.50	T: OK, so the first person going across will be, Cath,		Ps making a line of 'buildings': at different heights and in different shapes. TA also a building (left) T looks across Ps	T points to P on 'Cath'




	<p>you're going across first.</p>			<p>Cath stands up from her building shape</p>
<p>2 23.56</p>	<p>So hold on Cath. Wait, stay there,</p> <p>get ready to go under,</p>		<p>T looks at Cath</p>	<p>Cath bouncing at side T points to Cath on 'stay there', then lowers hand</p> <p>T puts hands together and shifts them side to side on 'under'</p>




	over, around and through.			and 'over'
3 24.00	DS: And I'm going to be recording		DS off camera	
4 24.02	T: Ooh, I gotta get my paints. (Music starts)			T runs to get paints and easel Fire P (Cath) starts moving toward building Ps
5 24.08	Cath: Under			Cath says 'under' as she moves under the first 'building' P


<p>6 24.11</p>	<p>T: Good girl. Bigger voice</p>			<p>T sets up his easel Cath moves onto next P</p>
<p>7 24.17</p>	<p>Cath: Around</p> <p>Around again</p>			<p>Cath moving around P T gets paints</p> <p>Cath circles same P and moves through same gap T returns to easel</p>



<p>9 24.41</p>	<p>Cath: Around T: Hold your shapes</p>			<p>Cath stands up and moves around P</p>
<p>10 24.43</p>	<p>DS: Cath, try some different actions, you could jump over, or roll under. Keep going</p>		<p>Cath looks at DS</p>	
<p>11 24.50</p>	<p>Cath: Through</p>			<p>Cath slides through P's legs</p>

<p>12 24.51</p>	<p>T: And firebreak</p>		<p>T looks up briefly from painting</p>	
<p>13 24.57</p>	<p>So Cath what happens now? What do you need to do now?</p>			<p>TA on end of the line falls to the floor</p>
<p>14 25.00</p>	<p>Cath: Go back the other way</p>			<p>Cath stands up and faces direction she just came from</p>

15 25.04	T: Off you go			
16 25.07	Cath: Under			Cath slides under P
17 25.10	DS: Fantastic Hopping around, well done		T looks up from painting	Cath hops around Ps
18 25.21	Cath: Over			Cath steps over P

<p>19 25.23</p>	<p>T: OK, well done, join the end now Cath.</p>			<p>T points to end of line across the words 'join the end', then lowers hand</p> <p>Cath joins end of line and makes shape</p>
<p>...</p>	<p>They do the same as another P becomes the fire, moving over, under, around and through the building Ps. T stands up and walks to the front.</p>			
<p>20 25.48</p>	<p>T: And firebreak</p>			<p>Cath goes down to the ground</p>
<p>...</p>	<p>T then asks P and TA to be the fire at the same time</p>			
<p>21 26.39</p>	<p>T: Firebreak at this end.</p>		<p>T looks at P on end</p> <p>P on end looks up at T</p>	<p>T points to P on 'firebreak' then lowers hand</p>

	Firebreak at this end.			T raises then pushes hand down to indicate P to go down
...				
22 26.43	T: Firebreak		T looks at P on end T looks at group	T places hands together at side of head P on end goes down

...				
26 27.19	T: Firebreak, you need to have collapsed completely.		Ps on end look at T	T moving towards Ps, raises hands on 'collapsed' Brings hands down on 'completely'
27 27.22	Collapsed completely on your backs. That's it. Collapsed completely.			T opens arms out on 'completely', then lowers them after 'backs' Ps on end go down to floor T walks to front again Fire Ps moving round building Ps

Appendix 8: Pre-interview template

T = questions for teacher; DS = questions for dance specialist

For all interviews, additional prompt or follow up questions were used where needed.

T&DS: What do you hope to get out of the project?

T: How long have you been teaching?

DS: How long have you been teaching dance in schools?

T&DS: How long have you been using an IWB in your teaching, or had one in your classroom?

T&DS: How do you think about the IWB when planning your lessons, in terms of the content to cover, activities you want to do, or features of the IWB you want to use?

T&DS: Is there anything you find particularly useful in using the IWB in class, or in planning?

T&DS: Is there anything you find particularly difficult or unhelpful in using the IWB in class, or in planning lessons?

T&DS: How comfortable do you feel in using the IWB in planning and in lessons?

T&DS: Do you use the IWB to support you in doing any activities that you couldn't do before?

T&DS: Do you use the IWB to support you in doing any activities you used to do before having it?
Has it altered these activities in any way?

T&DS: Do you try to link between lessons and learning concepts?

T&DS: Do you use the IWB alongside other classroom resources?

What sort of other resources do you tend to use in the classroom to convey learning points?

T&DS: Do pupils use the IWB?

T&DS: How comfortable do you feel with pupil use of the IWB?

T&DS: How comfortable do the pupils feel using it?

T&DS: How do you feel pupil use of the IWB enhances or hinders learning and teaching?

T&DS: Are they allowed 'control' of devices?

T&DS: Is the IWB used in group work at all?

T&DS: Have you done team teaching before?

DS: Generally, how do you and the teachers go about planning lessons or activities for the programme?

T&DS: Have you had much training in using the IWB?

T&DS: In the topics I'm going to observe with your class, are there any particular ways you intend to use the IWB?

DS: How do you expect use of the IWB to complement the movement activities, in terms of whole

class, group work and individual pupil activities?

T: I know the dance specialists are hoping to use PSPs in their movement lessons. Do you know if you will have anything similar in the class-based sessions that you do on the topic?

DS: How will you use the PSPs?

T&DS: Are there any other particular resources you'll be using for this topic, in single lessons or over the series of lessons, that you'll revisit?

T: Have you used many movement activities to convey learning points before (alongside or without the IWB)?

T: How do you think the movement lessons with the dance specialist will affect the work you do in class (and vice versa)?

DS: How do you think the class-based sessions on the same topic will affect the work you do in the movement lessons (and vice versa)?

T&DS: I think the aim of the programme is that the teachers will ultimately take over the movement lessons:

T: how do you feel about doing this?

DS: how do you think this can be best supported?

T&DS: There's a lot of talk about interactive teaching. What, if anything, do you know about it?

T&DS: There's also a lot of interest in dialogic teaching. What, if anything, do you know about it and how might you describe or define it?

Appendix 9: Post-interview template

DS: Can you remember what you hoped to get out of being involved in the programme?

T&DS: What were the main good points of doing the programme?

T&DS: What were the main difficulties, or things that could have been improved?

T&DS: Has being involved in the programme changed how you think about using the IWB in your lessons, in terms of content to cover, activities you want to do, or IWB features you want to use?

T&DS: Are there any new IWB activities you've recently started using or hope to use in lessons?

T&DS: Has being involved in the programme altered how you try to link between lessons and learning concepts?

T&DS: Has doing the programme altered how or how much pupils have used the IWB or PSPs?

T&DS: Do you feel any differently about pupil use of the IWB and PSPs than before the programme?

DS: Do you think your pupils feel more or less comfortable, or any differently to using the IWB in lessons?

T&DS: Do you feel pupil use of the IWB within the programme has enhanced or hindered teaching-and-learning?

T&DS: Do you think the pupils were allowed 'control' of devices?

T&DS: How do you feel the team teaching element of the programme went?

T: How do you feel the dance sessions affected your pupils' learning of new subject vocabulary?

DS: How have you found balancing the various elements to get into lessons (subject content, dance, technology...)?

T: How have you found the movement lessons with the dance specialist affected the work you did in class, in terms of content to cover (and vice versa)?

DS: How have you found the class-based lessons with the teacher affected the work you did in lessons, in terms of content to cover (and vice versa)?

T: Do you think the programme has altered how your pupils work with each other, in pairs, small groups, or as a whole class?

T: Did you, or your pupils, use the PSPs in your class-based lessons during the programme?

T: Have you used any or more movement activities to convey learning points in your class lessons during the programme (alongside or without the IWB)?

T&DS: Has being involved in the programme altered how you monitor or assess pupils' understanding at all?

T: In terms of the CPD element, how have you found the take over of the dance-based lessons?

DS: Do you feel that the teacher you worked with is confident to continue using this form of teaching-and-learning activity?

T&DS: Have your teaching-and-learning practices altered during the programme?

Appendix 10: Focus group template

Thinking back over the topic/s of...

What can you remember?

Things you learnt?

Activities you did?

What did you enjoy?

How did you find:

Making up dances/sequences?

Performing your dances?

Talking about your and your friends' dances?

Was there anything you found difficult/didn't enjoy so much?

How did the dance lessons fit in with what you were doing with your teacher in the classroom?

How did you find using the PSPs?

How did you find using the IWB?

Would you like to do more of the type of lessons you had in the hall with the dance teacher?

Appendix 11: VSRD template

Were there any sections you felt went:

particularly well/not very well?

Do you know why?

What can you say in this section about:

Teacher/pupil input?

Who does the talking?

What type of talking: question, answer, discussion, development?

Are pupils' ideas taken forward?

Do you have anything to say in this section about the:

pace; interactions or interactivity; whole class/group work?

How does this section show linking to sections and lessons that have already gone, and ones that were to come?

e.g. through talk; resources; activities

What can you say in this section about use of resources:

e.g. IWB; PSP; Other objects?

How are all available resources used to complement each other, and moved between, as well as for what they can each provide separately?

Does the section show development of any resource/s?

What can you say in this section about use of:

visuals; sounds/music; movement?