Abstract

This study investigates a process of technological innovation in the classroom, and a range of related issues. It discusses the development of a technology-assisted tool, ThinkSpace, combining computer-based concept mapping and a wiki, aimed at facilitating collaborative and critical engagement with complex study material.

The study adopts a design-based research approach in order to develop in tandem the technological implementation of the tool as well as the pedagogical practices for the use of the tool in the classroom. ThinkSpace was introduced into two schools where it was used by A-level history students. In close collaboration with the teachers practical uses for the tool were developed and implemented in the classroom. Data were collected through classroom observation, student and teacher interviews, as well as gathering evidence of students' work with the tool.

The thesis engages with questions of developing pedagogical practice to incorporate technological tools. It provides insights into the processes of working with teachers and students on collaborative innovation projects and the ways in which technology and pedagogy can gradually be aligned to achieve shifts in classroom practice. The project also investigates opportunities for developing productive uses of wikis and concept mapping in the classroom.

The results of this study highlight the gradual and incremental nature of innovation in the classroom. The study concludes that innovation with tools such as ThinkSpace requires changes to deeply-seated learning practices, which are closely linked to student identity. If such practices are to be altered, it is necessary to think more carefully about supporting students through the pedagogical changes that some technological innovations endeavour to put into place. Possible ways of providing support in the processes of innovation were found in the present study through the scrutiny of the ways some students were beginning to appropriate the ThinkSpace tool. This suggested more targeted ways of encouraging conceptualisation and collaboration practices, which were the target of the innovation presented here.

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Part 1 - Situating the study

Chapter 1: Introduction

This study investigates the processes and challenges of innovation with technology in the school classroom. Its aim is to investigate the issue of why technological innovation in schools has proved to be such a difficult task, and to do this through a practical process of development of a technology based tool, designed to support teaching and learning. The study took place in two A-level history classrooms where the researcher worked closely with the teachers to develop uses for the tool and integrate it into daily teaching and learning practice.

The tool this study revolves around was termed 'ThinkSpace', and is a novel combination of computer-based concept mapping and a wiki. It is based on existing tools and technologies, which were combined by the researcher to support in-depth thinking about study material and focusing in on the main concepts of a topic. It is aimed at supporting learners in making sense of both the overall conceptual structure and the underlying detail of their study area. A concept map is used to chart out the main features, concepts or problems of a topic and its purpose is to encourage the students to isolate the most salient features of a topic and to ask difficult questions about their interconnections. The wiki is used as an underlying interlinked 'database' for the topic where the students can record the detailed information about each of the overarching concepts on the map, and 'jump' to any related topics, just as they would in Wikipedia. Any item on the concept map can be hyperlinked to a wiki page exploring it in detail, allowing for easy movement between levels of abstraction and locating the detailed information in the context of the overall topic. In other words, ThinkSpace is designed to help students get to grips with the connections between chapter 2 and chapter 6 in their textbooks, while not losing track of the detail discussed in each of those chapters. The main focus in using ThinkSpace in the classroom, however, is not on giving students an enhanced alternative to Wikipedia, but to challenge them to construct their own representations of the curriculum, constructing their understanding in the process.

This study adopted a design-based research approach in introducing ThinkSpace into the classrooms because of a realisation of the need for a high degree of flexibility in the design. Because the aim was to adapt the tool to existing classroom practice and to explore the challenges of innovation in schools, extensive collaboration with the teacher was seen as the most plausible route to developing ThinkSpace from an abstract idea to a set of practices which take place in the classroom and which include a wiki and a concept map in a way that helps students get to grips with the curriculum.

A-level history classrooms were chosen as a testing ground for ThinkSpace. History was seen as a suitable subject for trying out a 'thinking tool' because of the nature of historical enquiry. Studying

history requires learners to adopt habits of thinking about concepts and factors, of connecting those factors into arguments, generating opinions on the basis of evidence as well as keeping track of large quantities of detailed information. Concepts encountered in history lessons are often ambiguous, requiring definition, and can be 'strung together' in multiple ways to argue one case or another. A-level history in particular was chosen because of a step up (from GCSE) in the level of complexity of the material the students are presented with and the increased need to develop sophisticated analysis and argumentation skills. This ambiguity and 'multi-layeredness' of history, combined with the expectation of relatively complex analysis at A-level were seen as being a suitable field of application for ThinkSpace. The possible application of the tool is however not limited to history learning, but is aimed at any field of enquiry which requires the types of thinking and qualitative analysis outlined here. Thus other subjects in the humanities and social sciences could find application for the tool.

Getting ThinkSpace to work in the classroom proved difficult - perhaps unsurprisingly given the background of previous experience with technological innovation in education. The researcher's ideas about conceptualisation and collaboration practices which the tool could potentially support met with the ideas of teachers and students about how schooling is and should be conducted, and the fit was not comfortable. The tensions which arose in the two development studies, however, do reveal interesting details about the classroom contexts within which the innovation was played out and shed light upon the challenges seemingly endemic to innovation in organisations.

This chapter will provide a background for the development of the ThinkSpace tool and situate the study in a wider context of thinking about innovation in education in order to arrive at the overarching question which will frame the review of the literature in the next chapters.

1.1 Origins of ThinkSpace

My personal engagement with the development of the ThinkSpace tool stems from my own needs for an aid to support my thinking about complex material. When I first began studying for an M.Sc in E-learning in 2005, I came across a wide range of literature, which dealt with complex and unfamiliar topics. Most of the ideas I read about were described in terms I had never come across; the '-isms' were abundant, and separating the finer points of one writer's emphasis from another's proved challenging. To aid myself in making sense of this onslaught of new concepts and ideas I tried out numerous techniques. What I mostly did to make sense of my reading, was taking notes. These notes contained summaries of what I had read, quotes from the text and emerging thoughts about the issues in question. These notes, sufficient in the beginning, quickly became unmanageable. Residing in notebooks they were not well organised and I had no overview of the ideas and concepts covered in them. What I needed was a map charting out the 'conceptual landscape', which would provide me with such an overview.

In solving this organisational conundrum I realised that the issues of order were in fact secondary to the opportunities for learning which I encountered through the struggle to create a coherent picture of my bundle of concepts. The challenge of drawing a conceptual map of all the issues I was encountering on the course proved a formidable one. The ideas could be grouped in various different ways, each of which drew my attention to different similarities and connections in the material. Trying to delineate the ideas into different fields necessitated answering questions about the boundaries between the fields of pedagogy and psychology, or the differences between collaboration and cooperation. The key to producing these questions and setting up opportunities for answers, was to keep the maps and the notes flexible and re-arrangeable, 'copyable' and movable.

Being a technologically minded person and taking pleasure in exploring tools and gadgets, I turned to the wealth of tools available for mapping and note-taking. I discovered that there is a range of concept mapping and mind mapping software available and that a wiki is an excellent tool for keeping notes malleable. Furthermore I found that some software made it possible to link a particular wiki page to a concept on a map allowing for an instant 'dive' from the conceptual overview into the detailed notes. This change of level which allowed for interaction between the breadth and depth of the ideas I was struggling with seemed tremendously useful to me. It prevented me from over-simplifying my thinking when mapping an overview: at any time a click of a mouse would reveal the underlying complexity of a label that I had assigned to a concept and make me question my assumptions. It also helped me to make sense of the detail by putting it in the context of the overview.

The tool drew my attention as a research object. If it was a helpful sense-making tool to me - would it perhaps be useful to others as well? Why did it seem so useful in the first place?

Armed with these questions I took the combination of wiki and concept mapping into a classroom as a research project for my Masters dissertation. Immediately it became clear that working with 'thinking tools' in a classroom presented a range of problems which were very different from working with one myself. However, it seemed that the tool presented some interesting opportunities to the students and that it was worth while studying. The study is based on the questions arising from this first exploration of innovating with ThinkSpace.

1.2 Technological innovation in education

This study takes place at a time where many argue that technology presents a way for education to fall in line with new demands of society. A strong argument for wanting to alter, reform or even fundamentally restructure education today, is that the world around us seems to have changed. Whether education is seen to have a primarily vocational or a primarily liberal purpose (Pring 2004) it is clear that the technological changes in society of the last few decades present formidable challenges as well as opportunities for education. Although the notion of the 'information society' is a

problematic one if used unreflectively (Webster 2002) it is helpful for thinking about the needs of society and the current generation of young learners.

During the last decades there have been shifts in the working practices of large parts of the labour force, the 'knowledge economy' setting a premium of flexibility, willingness to learn, creativity and collaboration (Hargreaves 2003). A job is now rarely for life and workers are expected to re-skill themselves - or be re-skilled - as demand for new competencies arises. Arguably many more working lives now include communication and some degree of collaboration, and much of this takes place over the internet. The re-skilling, communication and collaboration takes place in an informational landscape which is very different from that of the pre-internet era. As Neil Selwyn argues: "Whilst the use of new digital media is certainly not a pre-requisite to a young person surviving in twenty-first century society, it is almost certainly an integral element of thriving in twenty-first century society" (Selwyn 2007:9).

The changes in the workplace are reflected in education policy rhetoric such as that of the (then) DfES 2020 Vision report, which set out as one of the primary goals of education that "all children and young people leave school [...] understanding how to learn, think creatively, take risks and handle change" (DfES 2007:5). Technology is often seen as a means to achieving these ends and therefore this concern has been mirrored by large-scale investments in education technology (Selwyn 2000) as well as the prevalence of ICT concerns throughout the curriculum.

As well as being an important vocational concern, technology plays a perhaps even more important role outside work and education. The social landscape of children and young people has changed and now includes new forms of socializing and tools for communication, which for many policy makers and educators are unfamiliar, strange and even frightening. One very significant wave of change in technology has been the emergence of Web 2.0. The term 'Web 2.0' refers to the prevalence of ways of engaging with the internet, where a large proportion of users create and publish as well as consume web content (Davies, J. and Merchant 2009). Because of the emergence of highly user-friendly software, the technology has become highly transparent, removing the need for special skills for production of web content. Because more people were able to contribute, the web evolved from a one-to-many broadcasting model to a many-to-many 'mass socializing' model (Selwyn and Gouseti 2009). As O'Reilly put it, Web 2.0 could "harness collective intelligence" (2007:22), and with applications such as eBay, Wikipedia, Flickr, Facebook and YouTube it is easy to see the landslide change in web use that Web 2.0 has brought about. Young people have readily taken to the new kind of web with the vast majority of secondary school age children reporting that they use the Internet to chat to friends, use social networking sites, listen to music and watch videos on a weekly basis (Becta 2010). Especially Facebook has become an integral part of many young people's lives - to the point where

some are talking about Facebook addiction (evidenced by online articles such as WikiHow's 'How to quit Facebook' [1]).

To many theorists of technology the shifts in the ways young people communicate and socialize online convey a vision of the new generations as 'digital natives' (Prensky 2001), 'homo zappiens' (Veen and Vrakking 2006) or 'new millennium learners' (Pedró 2007). Within this rhetoric young people are viewed as being intrinsically 'plugged in' to digital technologies in a way that people born before the beginning of the digital age - the 'digital immigrants' - are just not. These younger generations are taken to be incredibly responsive to interactive multimedia experiences and somehow intrinsically capable of orienting themselves in a complex multimodal information universe.

However, as Selwyn (2009) points out, the painting of young people as digital natives is more often than not "rooted in informal observation and anecdote" (:371) rather than research evidence and the picture begins to fade when such evidence is considered. It is true that young people integrate a range of tools such as social networking, gaming and creativity tools into their daily lives, but they do so to various extents, some engaging with them enthusiastically, others less so (Davies, C. , Carter et al. 2008). Working in higher education, Margaryan et al. "found no evidence to support previous claims suggesting that current generation of students adopt radically [new] learning styles, exhibit new forms of literacies, use digital technologies in sophisticated ways, or have novel expectations from higher education" (2010:438). Indeed many children and young people can today be described as 'pragmatists' in terms of their use of technology, and view it as part of the infrastructure of their daily lives and not as something that is intrinsically exciting and fulfilling (Davies, C. 2010). However many are adept at mutually configuring their practices and the tools they use (Boyd 2008) in ways which are often incomprehensible to uninitiated adults and this raises questions about how schools are to react to such changes in students' lives outside school.

Young people's everyday uses of technology have rarely permeated into the curriculum. In fact the general trend of technological innovation in schools has been that of overall disappointment. The rhetoric promising the fundamental impact of the new technology on schools since the popularisation of the personal computer has largely echoed that of earlier technological innovations, such as the radio, television and video (Cohen 1987; Robertson 2003). Mostly the promise has remained unfulfilled (see e.g. Cuban, Larry 2001). The increasing prevalence of Web 2.0 technologies has been echoed with enthusiasm for exploring the opportunities these offered for education. The social, collaborative and creative nature of Web 2.0 has clear parallels to both the contemporary goals for education as well as current theories of learning as being situated, distributed and social. Therefore Web 2.0 tools such as wikis, blogs and social networks are popular targets for technological innovation in schools.

[1] http://www.wikihow.com/Quit-Facebook (accessed 8/10-2010)

However, in line with previous initially promising technologies, integrating Web 2.0 technologies into school environments has proved to be an elusive target. Despite many attempts, such tools remain on the fringes of educational practice and recent research suggests that young people's engagement with Web 2.0 technologies - both in and out of school - is often shallower than first anticipated. Whereas Facebook is unequivocally popular, in their investigation of 11-16 year olds' uses of Web 2.0 technologies, Luckin et al. (2009) found "little evidence of critical enquiry or analytical awareness, few examples of collaborative knowledge construction, and little production or publishing outside social networking sites" (:100). Selwyn (2009) argues that the seemingly collaborative activity can most often be described in terms of co-ordination and co-operation. Indeed there is evidence that young people may lack skills necessary for collaborative production of web content (Luckin, Logan et al. 2008) and even more basic literacy skills necessary for navigating the web confidently (Livingstone 2008). This is reflected in students' adoption of technology in school, where Deaney et al. (2006) found an 'uneven skill base' amongst their students, having initially anticipated a good grounding in ICT. As Livingstone and Bober write:

> Despite young people's enthusiasm for the internet, 'internet literacy' is still developing. Young people admit to aspects of internet use which they find problematic [...] Awareness of the motives behind websites and a critical attitude towards their credibility and trustworthiness appear little developed (Livingstone and Bober 2003).

Therefore a fundamental need remains for educating young people about the complex nature of knowledge on the web, despite their seeming effortlessness in navigating it. 'Knowledge on the web' must of course not be seen in isolation from any other kind of knowledge. Instead the ability to think critically about resources and modes of knowledge production on the web must be taken as part of overall ability to operate with any kind of knowledge. However, the Internet does afford a range of modes of communication and knowledge construction which are different from their non-digital forms. Therefore, arguably, it is worth exploring these new modes of interaction and probing how they can be interwoven with our existing understandings of schooling and knowledge, and potentially expanding the repertoire of practices which are deemed to be formative of educated individuals.

This raises questions about how we are to go about exploring digital forms of interaction in a school context. As Selwyn and Gouseti (2009) argue, much of the current debate about technological innovation in education takes an overly technologically deterministic view in either wanting to completely replace school or else to reinvent school through the use of Web 2.0 technologies and practices. Following these views, the nature of schooling will radically change, driven by the opportunities for online personalised learning, which will replace the mass broadcasting pedagogies of traditional schooling. However, as Cole (2010) argues, there is no cultural change to match the technological changes in society, which would merit such a landslide reorganisation of an institution

which has emerged over centuries to serve the cultural needs of society. Much research aimed at transformation is therefore far removed from the actual realities of the classroom and focuses on the state-of-the-art of technology use, contributing to the 'oversold and underused' (Cuban, Larry 2001) phenomenon. However, as Crook argues, "in the continually reforming world of education, enrichment may be a more attractive model" (Crook, C 2008:55), necessitating detailed study of the state-of-the-actual (Selwyn 2010) technology use.

The present study is aimed at such enrichment rather than radical reorganisation of current classroom practice. During the pilot study conducted as part of this research it appeared likely that the ThinkSpace tool could be useful for thinking about the existing curriculum material and for achieving some of the goals outlined in the current examination guidelines, which point towards critical thinking and analysis. However, it also became very clear that the fit between the assumptions of the tool and what was going on in the classroom was problematic, and that this discrepancy could not be understood in terms of the technology alone. Rather it was a case of trying to 'make it work' in the context of the classroom and through developing classroom practice with the tool "recognise and explore the web of mediating factors that technology comes into contact with once it is placed in educational settings" (Selwyn 2000:99).

This study therefore consists of multiple strands, which all pertain to the study of the 'state-of-the-actual' technology use. The foundation of the study is the practical 'making-it-work' in the classroom. This meant working with a technology-based idea within the confines of classrooms: collaborating with the teachers and students to develop tasks and practices which capitalise on the technological nature of the tool but also are possible to sustain in a real-world classroom. This provided a platform for two aspects of research:

- an investigation of the social realities of working with technological innovation in the classroom and
- thinking about the emerging uses of the ThinkSpace tool and theorising its potential for being used to support teaching and learning in the classroom.

Together the practical implementation work and the two main research foci aim at forming a clearer picture of real-life innovation in classrooms as well as proposing concrete possibilities for innovating with a particular technology. The overall question directing this study is the following:

What processes and challenges are involved in designing and developing a new tool for learning in the context of classroom practice?

1.3 Thesis outline

This thesis is divided into four main sections. The first section, of which this chapter is part, aims at situating the study within the relevant literature and building a theoretical 'lens' for making sense of the data gathered in the course of the study. To this end Chapter 2 will look at literature on technological innovation in schools and the role of technology in organisations more generally. It will develop a theoretical stance on learning and examine challenged of learning history in particular. Chapter 3 will go in more detail with the ThinkSpace tool and with its two technological components: concept mapping and the wiki.

Part two of the thesis will engage with the study methodology and the fieldwork. Chapter 4 will start by operationalising the overarching question into three concrete research questions on the basis of the insights from the literature. It will explicate the study methodology and examine the ethical issues arising in this research project. Chapter 5 will provide a description of the two classroom studies outlining the main events which took place in the two classrooms and seeking to give a flavour of the work in the two classrooms. On the basis of the methodological discussion and the description of the two development studies, the approach to and procedures of data analysis will be discussed.

The third section is dedicated to the analysis of the data and reporting of the findings from the two schools. The three chapters in this section will engage with each their research question in turn. Chapter 6 will look at the teacher's role in shaping the ways ThinkSpace was used in the classrooms, as well as the ways the uses of the tool were negotiated between the teacher and the researcher in each of the two studies. Chapter 7 will engage with the students' views of the tool and the ways they appropriated it (or didn't appropriate it) and shaped its use. Chapter 8 will explore the emerging classroom practices where ThinkSpace was coming to play a productive role in support of teaching and learning.

The fourth and final part is dedicated to a final discussion of the findings. Chapter 9 will thus bring together the thoughts from the previous chapters to reflect upon what can be learned from this study about the processes and challenges of innovating with technology in classrooms.

Chapter 2: Innovation, learning and collaboration

This chapter will take a look at the literature to establish how it can illuminate the potential usefulness of ThinkSpace for learning. Three main areas of writing on education will be examined. Firstly, a review of current understandings of the nature of learning will seek to establish how learning with a tool like ThinkSpace can be conceptualised. This will serve to form a basis for theorising the potential usefulness of the tool for learning purposes. Secondly, drawing on the concepts from the first part of the chapter, research on concept mapping and hypertext writing in wikis will be presented. These are the two technological components of the ThinkSpace tool, and the lessons learned about the use of each of them for learning and instruction will help form a clearer picture of the range of uses ThinkSpace could be put to, and the pitfalls connected with using it. Finally, this chapter will turn to the literature on the ways technological innovations find their way into organisations in general and schools in particular. Thinking about how groups of people appropriate new ways of acting with new tools sheds light on some of the processes that the ThinkSpace tool will be part of on being introduced into a school environment. It will also help us understand the ways the tool is used in the present study.

2.1 Technological innovation in schools

Introducing technology into schools has proved to be fraught with difficulties. Technological innovation seems to follow inevitable cycles of excited investment and disillusion. Radio, television, video, all promised landslide change, but never delivered it (Cohen 1987; Robertson 2003). Despite extensive recent focus on technology for education (such as the Harnessing Technology Strategy), it is questionable whether the ways digital technologies are used in schools merit the extensive government spending. While allowing for low student to computer ratios (currently somewhere in the range of 3.6 (de Waal 2009) to 4.3 (Smith, Rudd et al. 2008) pupils per computer), it seems that technology has far from transformed education: rather it has come to sit, somewhat awkwardly within and beside the existing education structures. While accessing technology has become easier, teachers' confidence in using it seems to have fallen in the last couple of years (BESA 2009). The learners' use of technology in school seems to remain limited and uncreative (Crook, Charles and Harrison 2008), although many are prolific and creative users of technology outside the classroom (Davies, C. , Carter et al. 2008). If we are not to discount this evidence as the clamour of a "vociferous anti-technology lobby" (Underwood, Baguley et al. 2010:10), we need to gain a better understanding into the reasons for the lack of landslide change in education.

Technology is often hailed as a driver of educational change with improved access to ever faster and vaster information and multimedia resources typically given as justification for technology driven

innovation (e.g. DfES 2007). The main body of research into education technology, as Selwyn (2010) argues, follows this highly technologically deterministic view of innovation in seeking to pin down 'impacts' and 'effects' on learning of ideal technology use, while disregarding actual use in real-life classrooms. In this tradition, as Amiel and Reeves (2008) argue, technology is too often treated as value-free, tempting us to see technological innovation as a purely mechanical undertaking. Far from being neutral, technology is "a set of practices glued together by values" (Hodas 1996:199) which in many cases require changes to the way school operates. Therefore to understand how technology functions in the classroom, we need to take a broader view and "look beyond issues of learning, and instead develop 'context-rich' accounts of the often compromised and constrained social realities of technology use 'on the ground' in educational settings" (Selwyn 2010:66).

Schools are organisations (Handy and Aitken 1986), and as any organisation they are resistant to change and interested in self-preservation, which means that "Often, defending an established modus operandi takes precedence over what might appear to outsiders as improved, more efficient or more rational ways of achieving a purpose or responding to new social conditions" (Goodson, Knobel et al. 2002:8). Therefore, even if technologies are taken up in the classroom, it is often a question of nominal or token change (Schön 1971 in Everard and Morris 1985), the overall look-and-feel of schools remains fundamentally unchanged (Hodas 1996) and "technological innovation [gets] reinvented into a benign addition to traditional [...] programs" (Cuban, Larry 2001:65).

In their tracing of the history of the current principles of schooling, Tyack and Tobin coined the phrase 'grammar of schooling' to describe "the regular structures and rules that organize the work of instruction" such as "practices in dividing time and space, classifying students and allocating them to classrooms, and splintering knowledge into "subjects."" (Tyack and Tobin 1994:454). These practices are strongly upheld by the community surrounding the school – parents, teachers, students, all having an idea of what a 'real school' looks like and supporting the practices that confirm this 'script' (Metz 1990). Tyack and Tobin conclude that whereas it is not impossible to reform the fundamental practices of schooling, it is impossible to change 'everything at once' and reform is a much more gradual and long-term process than was recognised by engineers of ambitious, but failed reform attempts.

2.1.1 Role of technology in organisations

For an understanding of the process of institutional change and to enable a discussion of what Zhao et al. (2002) term "issues around the interface between technology and the educational establishment" (: 483) it is useful to turn to the literature in the field of organisation science.

Structuration theory provides a good way to think about the role of technology in organisational structure and change. Giddens (1979, 1984) provides a powerful take on the balance between structure and agency. Instead of a dualism between agency and social structure, he inserts the term 'social

system' between the two (Whittington 1997) and proposes a duality of structure, where individual agency is the very means by which structure is reproduced: "the structural properties of social systems are both medium and outcome of the practices they recursively organize" (Giddens 1984:25). The structures therefore shape people's practices, but are themselves constituted by those practices in a recursive fashion. If all agents engaging in a particular practice as part of their day-to-day 'going on' disappeared, the structure would cease to exist. Giddens insists on the capacity of people to choose their actions deliberately – even though their consequences might not always be the intended ones – in other words, he stresses the possibility for agency.

Picking up on these ideas, and responding to the need to account for the role that ICT plays in organisations, writers like Orlikowski and Barley (Barley 1986, 1988; Orlikowski 1992, 2000; Orlikowski and Barley 2001) have tried to create conceptual frameworks that treat technology as both material and social objects. These authors have questioned both the more deterministic and the excessively socially focused representations of the role of technology in organisational change (Orlikowski 1992; Barrett, Grant et al. 2006).

Following Giddens' thought on agency Barley (1986, 1988) describes institutional change as 'slippages' between the institutional template and the exigencies of life, which are especially prevalent when the institution encounters exogenous shocks, such as the introduction of new technologies. If such slippages cannot be incorporated into existing practices, they give birth to a reconfiguring of institutional structure, by themselves being replicated in people's practice. From this standpoint Barley treats technology as "occasions that trigger social dynamics which, in turn, modify or maintain an organization's contours" (Barley 1986:81).

Orlikowski (2002) in her situated change perspective also argues against the more determinist views of technological structures as presented by for example DeSanctis and Poole. They argue that designers of technology incorporate social structures into it, and as "these structures then are brought into interaction, they are instantiated in social life" (DeSanctis and Poole 1994:125). Orlikowski (2000) argues that a picture of technology as having a fixed, stable and determinate structure, which is always and readily available to users, breaks down in the face of evidence of the fluid reconfiguration of technologies and practices by users in organisations. Furthermore it is not suitable for depicting technologies, which are inherently modifiable, user-programmable and complexly networked, as are the Web 2.0 technologies which were just emerging at the time of Orlikowski's writing in 2000, but which are very widespread today. Rather she depicts change as "a series of ongoing and situated accommodations, adaptations, and alterations (that draw on previous variations and mediate future ones), sufficient modifications may be enacted over time that fundamental changes are achieved" (Orlikowski 2002:5). Instead of structure being embedded in technology, she proposes that this structure is emergent and enacted in practice through the rules and resources instantiated in the use

of technology. Jones et al. (2006) moderate Orlikowski's view in arguing that the distinction between embedded and enacted structures is too strong, because while structures are enacted, the design of the artefact presents the user with certain options and not others, thus also furnishing a certain structure to the action. These embodied meanings do not determine action, but make some options more available than others.

From this perspective, the role technology comes to play in an institution, such as a school, goes through a potentially lengthy process of configuration through the use of this technology in the everyday practices of teaching and learning and eventually, as Bruce and Hogan (1998) argue, disappears entirely from view because it becomes transparent to its users. The technology is here not seen as determined or determining behaviour, but as something that emerges through practice as well as shaping future practice. Accordingly, the role of the designer of the technology, is not that of dictating a narrow scope of pre-determined ways of using the tool, or that of predicting practices. Neither can ways of using the technology be dictated by the 'implementers' of the technology who may, however, try to shape the uses of it from within the organisation (administrators, researchers). Even the individual users of the technology (teachers, students) are not in explicit control of the technology adoption. Instead, the practices of tool use, although suggested by particular features of the technology, emerge in the course of daily use, in a sometimes unpredictable fashion.

2.1.2 Affordances and appropriation - putting technology to use

Although, as discussed above, technology does not carry a set of embedded structures, it does none-the-less 'point towards' particular practices, making it a potential threat to established organisational structures. A way of describing the interplay between the user of a technological tool and the technology's orientation towards particular uses is the concepts of affordances and appropriation. In writing about our visual perception, Gibson (1986) proposed that we do not only see the world around us in terms of shapes and spatial relationships, but also in terms of the possibilities for action that the objects we perceive offer us. The term he used for this was 'affordance' referring not to the properties of an object, but to the relationship between the perceiver and the perceived. Affordances are not contained in the object (an object can afford different things depending on the subject) – nor are they the pure creation of the subject (they are physical properties of an object and do not disappear with the disappearance of the observer) (Bonderup Dohn 2009). Instead this concept bridges the subject-object dichotomy and exists only in the relationship between the two. In this way Gibson reconciles the poles of pure realism and pure constructivism in the determinism/anti-determinism debate (Selwyn 2008).

Affordances are functional in that they both enable and constrain action: they frame, but do not determine the action that can possibly take place with an object (Hutchby 2001). An apt example of enabling and constraining properties of an object, is that of a set of stairs, both enabling movement

between floors, and constraining the way movement can be achieved (for instance by excluding wheel chair users) (Bruce and Hogan 1998).

Affordances are invariant – they do not depend on the changing needs of the subject, and they are part of the environment of all observers of an object (although people may perceive something as having different shapes from different angles, the affordances of the object will be what invariantly is perceived by all) (Reed 1999; Brown, J, Stillman et al. 2004).

At the same time, affordances are culture dependent in that they are dependent on experience (in the sense of the German Erfahrung rather than Erlebnis), so that in order to be able to perceive certain affordances of an object, learning needs to take place (Bonderup Dohn 2009), especially if the object is a designed artefact and its affordances not directly derived from its materiality (Hutchby 2001). In this view a new technology furnishes possibility for action for its users in a way, which is tied to the user's perception of the technology as well as of the situation. What the tool will be used for depends on what the user thinks it could or should be used for in the particular context.

For education this means, as Jones et al. (2006) argue, that the affordances for learning are built into the potential relational situation by the designer - but the students may not perceive them. Thus the designer has indirect control over the students' learning only through the design of the situational affordances. In other words: you cannot design learning, only design for learning. Therefore technological innovation is not merely a question of good software design, or of pupils 'understanding' the potential of a tool, but it is a question of the 'fit' between the proposed technological innovation and the wider social contexts into which it is inserted (Selwyn 2007). The concept of affordances therefore helps us to direct attention to the "empirical question of embodied human practices in real time situated inter- action involving technologies" (Hutchby 2003:582).

A possible consequence of the perceived affordances of a tool is its appropriation by the tool user. Appropriation is a process of taking something external and making it one's own. Wertsch (1998) emphasises the tension between using a cultural tool as one's own and the inherent appropriation of the affordances and constraints associated with the tool. The user's role in the mediated action is to populate the tools with his own intention and meaning in their use, endowing him with the power of agency. Appropriation therefore presupposes some form of tool use - tool use, however, needs not presuppose appropriation. In fact users, while having mastered the tool, may resist using it. If forced they will use it without the feeling of the tool being their own and "their performance is often characterized by clear forms of resistance such as dissimulation" (Wertsch, J. V. 1998:57).

Squire and Barab (2004) describe the appropriation of a game for history education as the students learning not only how to use the tool, but also why to use it. They write about a gradual process of initial rejection, use with resistance and eventual appropriation of the game for a purpose that was

meaningful to them. Gaining familiarity with the tool the students reconfigured their view of its purpose and shaped their uses of it accordingly.

This highlights the gradual nature of making a technological innovation function meaningfully in a particular environment, which is very relevant to the investigation of how ThinkSpace was used in the classroom. A significant part of the analysis in the subsequent chapters will therefore pivot around the concepts of affordances and appropriation in trying to trace the ways students' and teacher' views of the tool developed and what this meant for their uses of the tool and for potential future design processes.

2.1.3 Experiences from CSCW

An area where many of these thoughts have been played out, and which served as an important inspiration for introducing collaborative technologies into the classroom (Lehtinen, Hakkarainen et al. 2001), is the field of Computer Supported Collaborative Work (CSCW). The main conclusions from this area of research are mirrored in work on introducing technologies oriented towards collaboration into learning situations and therefore it is useful to take note of this strand of research.

Many CSCW studies are concerned with 'groupware': "computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment" (Ellis, Gibbs et al. 1991:40). These systems often include shared calendars, communication tools, communal access to file editing etc. and have been notoriously difficult to implement. Adopting a somewhat ironic tone, Grudin argued that most groupware applications share two main characteristics: "A significant investment has been made in their development, and their successes have consistently fallen far short of expectations" (Grudin 1988:85). While promising on paper, as soon as groupware, such as Lotus Notes is taken out of the laboratory environment and implemented in real organisations, forces directed at maintaining the status quo in work processes prove to be powerful obstacles to change (Olesen and Myers 1999).

In line with argument outlined above about the interplay between agent and structure, Orlikowski argues that the adoption of groupware applications is highly dependent on "people's cognitions or mental models about technology and their work, and the structural properties of the organization such as policies, norms, and reward systems." (Orlikowski 1992:362; emphasis in original). Therefore, as Bødker et al. (1988) argue, design of groupware must take into account practices already existing within the institution. To this end innovators must engage in a dynamic design process where prospective users are involved and which in itself leads to development of new possibilities for cooperation. Vandenbosch and Ginzberg (1996) conclude that in order to be able to create such possibilities for collaboration four conditions need to be present:

- a need to collaborate must exist,
- users must understand the technology and how it can be used to support collaboration,
- the organisation must provide sufficient support for the introduction and continued use of the technology and finally,
- the organisational culture must be supportive of collaboration.

The other half of the 'interface' between organisation and technology and an important facet in the discussion of the affordances of technology is the physical design of the technology itself. Technology has been famously difficult for users to operate, seemingly despite much design effort. Ackerman (2000) argued ten years ago that there was a 'social-technical gap' between what we had come to know about the need to support the "highly flexible, nuanced, and contextualized" (:180) human activity and our then existing technological means for supporting it. Ten years on, the problems of providing seamless technological means for human collaboration persist and work continues to better enable computer systems to support awareness, communication and coordination in collaborative systems (see for example Janssen, Erkens et al. 2007; Engelmann, Dehler et al. 2009; Phielix, Prins et al. 2010). In the present study, the design of the technology certainly had an important impact on the ways ThinkSpace could be used in the classroom. It is, however, not a central concern in this thesis, and as a researcher with limited technical resources I had little influence on the technology design.

2.1.4 The classroom ecology

The experiences from CSCW give a good insight into the challenges presented by introducing technologies into organisations. The work done in schools takes forward these findings. As Zhao and others (2002; 2003) argue, an almost exhaustive list of variables affecting the uptake and use of technology in schools has been presented. Among the enumerated factors are: the school's organisational makeup or 'instructional inheritance' (Cohen 1987), the physical and time structure, which directs the movement of students and teachers and the layout of the school day (Tubin, Mioduser et al. 2003), teachers' attitudes towards and experiences with technology and the technology itself (Becker and Ravitz 2001), with its seemingly inherent unreliability (Hennessy, Deaney et al. 2004), contradictory directions for its use and constant evolution into new forms. But all these variables are often treated in isolation, preventing an overview of the complexity of interacting influences (Zhao, Pugh et al. 2002; Zhao and Frank 2003).

In an attempt to focus our attention on interactions, activities, processes, and practices rather than correlations between variables Zhao and Frank (2003) draw on the view of the classroom as a 'learning ecology'. First emphasised by Doyle (1975; 1977) in the context of research on teacher behaviour and efficiency, the 'classroom ecology paradigm' focuses on "mutual relations among environmental demands and human responses in natural classroom settings" (Doyle 1977:176).

Among the variables impacting on the students' learning (or the 'exchange of performance for grades' as he defines the formal task structure of the classroom), Doyle mentions the other students, teachers and resources available in the classroom, the temporal effects of school terms, quality and consistency of communication in the classroom. This complexity within the classroom, is furthermore situated within the array of classrooms that the students meet every day as they move from room to room and within the overall school environment (Fraser 1986). It is argued that by directing our attention to the practices where all these factors are entangled in interaction, rather than by trying to analytically separate them, we can get a better understanding of the inner workings of schools.

Technological tools and innovations can be seen as part of the learning ecology within which students and teachers operate. Bielaczyc (2001; 2006) proposes a subset of factors that must be attended to in the design of technology for learning:

- The software.
- The technical infrastructure and specifications of the hardware.
- The social infrastructure: the social structures that support learning with the tool.
- The ways in which learning with the tool fits in to the curriculum and relates to standards.
- The teacher's knowledge of the functionality of the tool.

Furthermore, Bielaczyc (2006) developed the "Social Infrastructure Framework" which unpacks the dimensions of the social aspect of teaching and learning. Within the social workings of the school, four dimensions need to be taken into consideration in the design and evaluation of technology-based learning activities:

- The cultural beliefs dimension: the mindset that shapes the way of life in the classroom (for example the beliefs about the nature of knowledge: static/dynamic, owned by teacher/ constructed by student). Cultural beliefs can be influenced - in fact, for a tool to be successful, it may be necessary to develop new ways of thinking about learning and working with the tool. There is also a need for the correct social identity in the students (e.g. viewing themselves as investigators, others as team members or competitors). Similarly there can be different ways to see the teachers and their roles.
- The practices dimension: the ways in which teachers and students engage in learning activities (individual work/group work, teacher-student relationships around the computer). Hereunder the choice of activities and the level of integration of the tool into other activities, the participant structures of students in groups, the participant structures of the teacher in the activities and the coordination of on-tool and off-tool activities.
- The socio-techno-spatial relations dimension: the organization of space and cyberspace.

- The interaction with the "outside world" dimension: interaction (online and offline) with people outside the immediate classroom context.

The literature on the social infrastructure and the ecology of schooling, as well as the thinking about how organisations react to innovation and change illuminates a landscape of designed technological innovation, which is fraught with difficulty. Some innovations take off as soon as they become available, some become ‘subverted’ and used for different purposes than those intended and some are not taken up, however much their designers claim their benefit to potential users. In the context of the present study this realisation does not mean that design efforts should stop, but that a better understanding must be sought of the ways technologies come to constitute a part of our practices.

As will become evident in the next chapters, ThinkSpace was appropriated in parts and for a variety of purposes by students and teachers. At times the tool was perceived as being useful for purposes that fitted the current ecology of the classroom and where attempts at reconfiguring particular elements of the ecology in relation to the tool were rejected. The thinking about the classroom as an ecological system rather than a number of correlated factors means that an understanding of how ThinkSpace interacts with the ecology is necessary, but it also means that this understanding will at this point be wholly incomplete. As ideas about using wikis and concept maps develop in the classroom, as the teacher and the students adjust their understandings of the subjects and of learning to suit new understandings and discoveries, so their view and use of the tool will change. Therefore an analysis of what happened in the two trials of ThinkSpace in this study is necessary for further design efforts. At the same time the analysis asks more questions than it answers while it opens new avenues for investigation.

2.2 Conceptualising learning

In order to think about how ThinkSpace can be integrated into classroom practices so as to support teaching and learning, it must first be established what ‘learning’ is taken to mean in the context of this study.

Learning has traditionally been conceptualised as the practice of an individual who acquires or takes possession of something (e.g. knowledge). For most of the 20th century the view of learning has been tightly connected with the individual learner; first with the learner’s observable behaviour in the behaviourist tradition (Thorndike 1932; Skinner 1938, 1968), and since with the learner’s internal representation of knowledge and mental structures in the cognitivist one (Piaget 1952; Ausubel, D.P. 1963; Papert 1980, 1994). Although this research has and continues to provide useful insights into human thinking and cognition, it has also been heavily criticised for concentrating on information rather than meaning and neglecting human interaction and the social aspects of cognition (Suchman 1987; Bruner, J. 1990; Säljö, Reimann et al. 1996; Lave, J 1997). Although most researchers within

the cognitivist tradition do not argue against the importance of social interaction, they tend to concentrate on the change in the individual's acquired knowledge and relegate the context within which the learning takes place to the status of interfering variables (Wertsch, J. 1993; Greeno, J. G. 1998).

In reaction to the cognitivist school of thought, which has dominated thinking about learning since the 1950s, a new tradition (or arguably a restatement of already existing ideas) emerged seeking to put participation in social activity and its context centre stage. The sociocultural and situative approaches, take a broader look at cognition, arguing that it is not only a property of individual minds, but is essentially social, distributed between people and bound to the particular contexts in which learning, knowing or doing takes place (Brown, JS, Collins et al. 1989; Lave, Jean and Wenger 1991; Pea and Salomon 1993; Resnick, Pontecorvo et al. 1997; Greeno, J. G. 1998).

Vygotsky's writing on human cognition has been one of the main sources of inspiration for this tradition. In writing about the development of the higher, uniquely human forms of thinking, Vygotsky (1978) argues that these functions are innately social in that they are mediated by cultural tools and artefacts, most importantly language. Therefore to account for human thinking and behaviour, people's interaction and communication must be taken into consideration; as Resnick et al. put it: "discourse is cognition is discourse" (Resnick, Pontecorvo et al. 1997:2). With this, the focus is shifted from studying individuals' cognition to studying human action, and to putting this action in its cultural, historical and institutional context. Cognition is 'lifted out' of individuals' heads and stretched over multiple individuals and the tools they use for thinking and communicating. This view of cognition as situated in the environment within which it takes place, provides a 'person plus' (Perkins and Salomon 1993) or a 'socio-technical' (Hutchins 1995) unit of analysis, rather than just the cognition of a single individual.

The tools which mediate human cognition become a very important object of study in the situative perspective, because they become part of human thinking, learning and cognition. We make use of both physical tools and of psychological tools or signs, which mediate action, but without determining it (Wertsch, J. V. 1998). The relationship between the tools – psychological or physical – and human action can be discussed in very similar terms to the discussion above of the relationship between agency and structure (in fact it is very much part of the same discussion). The tools neither entirely determine human action, nor are completely determined by it. The artefacts carry meaning embedded into them by their creators, designers or initiators as well as by their subsequent users, who shape the meaning of the tool – and therefore also of the action - through their use of it.

In fact action makes no sense divorced from its mediating artefact, the tool is part of action in that it makes the action possible, constraining and enabling it. Wertsch (1998) describes this as an 'irreducible tension' between the artefact and the actor, where the full understanding of the action

cannot be reduced to either one of the components. A good example of a tool in action is cycling. Neither the cyclist or the bicycle can cycle on their own – only in a synthesis of the two can the action of cycling be produced. Following the same logic, learning to count is inconceivable without the cultural artefact of numbers. As Säljö and others (1996; 1999) argue, all learning is learning to do something with tools, be they conceptual or physical.

In this sense cognition becomes distributed between people and artefacts, although Pea and Salomon (1993) argue that to call the cognition distributed is misleading, since the artefacts in themselves do not 'do' cognition. Rather they prefer the term 'distributed intelligence' emphasising the intelligence, which arises out of human activity and is crafted into the artefact. This intelligence is subsequently used by other actors – often without thinking of the cognitive struggle that went into crafting the artefact – and in turn becomes part of their cognitive process.

These ideas give rise to the relational view of knowledge and learning. If learning is becoming better at acting with tools – be it language, conceptual or physical artefacts – then knowledge is always in relation to something – the resources and affordances of a situation, rather than an individual's acquired property. As Clancey (1995) puts it, knowledge is more analogous to energy than to a substance. Therefore "teaching for understanding is a matter of cultivating the learner's relationship to objects of knowledge, developing it into a relationship capable of supporting intelligent action" (Bereiter 2002:101).

In presenting what he calls situativity theory, Greeno (1989; 1998) is an active proponent of the relational view of learning. He argues that the cognitivist approach and the interactional one (represented most prominently by Lave and Wenger (1991) and Rogoff (1991)) are each providing an incomplete picture of human learning. Whereas cognitive science analyses the structures of the informational content of learning, it does not account very well for the interactional context and vice versa. Greeno's solution to bridging the gap between the two (or between what Sfard (1998) calls the 'acquisition' and the 'participation' metaphors of learning) is to see learning as a process of attunement to the affordances and constraints of a situation and the resources available within it. Rather than seeing higher-order thinking abilities as application of general principles or symbol manipulation, it is seen as an "ability to discern important structural features of a problem situation and become engaged with the situation in terms of those features" (Greeno, J. 1989:138). This ability to discern and make use of the underlying features of a situation is what Greeno conceptualises as 'attunement' – thus providing a way of solving the problem of transfer from which situated approaches to learning suffer. Transfer of learning is seen as the attunement to the patterns of similarity and difference of affordances, constraints and resources between different situations.

Bereiter uses the attunement concept and sees 'understanding' as a special type of attunement, distinct from other relationships between the person and the 'knowledge object', such as 'liking' or 'having

doubts about'. He argues that "understanding refers to that aspect of a relationship that has to do with its potential to support intelligent action" (Bereiter 2002:112) and that deep understanding is attunement to non-obvious structural or causal properties of the 'knowledge object' and to its relations to other 'knowledge objects'.

From these ideas emerges a view of learning as an active process of attunement to how facts, concepts, language and other instruments can be used within and across situations. Drawing upon this thinking it is possible to arrive at a conceptualisation of ThinkSpace as an instrument which the learner can use to further his understanding of how other conceptual tools and facts can be used to argue a point, arrive at a conclusion or structure an essay. The learners are invited to use this tool alongside other instruments for thinking and learning and use the intelligence distributed between this tool and others to construct a web of deep understanding about the material with which they are grappling. Therefore, as Wilson and Myers (2000) point out, assessing the potential of a learning environment, such as one including ThinkSpace would involve understanding how components such as language, activities of individuals and groups, and the tool, combine in a way that results in participation in activities valued by the individuals in the organisation of school. In other words, how the tool in question is capable of supporting what is deemed to be 'intelligent action' in relation to the content material.

2.2.1 Collaborative learning

An important element of the 'intelligent action' with ThinkSpace in the classroom is student collaboration. The tool has been framed as a potential mediator of collaborative activity in line with the situative understanding of learning as being essentially a social and context-bound activity. Dillenbourg (1996) argues that whereas socio-constructivist (or socio-cognitivist) and socio-cultural perspectives are concerned with the 'inter-individual' plane, the situative view focuses on the social plane, treating cognition as shared. It is from this view that the understanding of the role of ThinkSpace in group activity is derived.

Stahl (2003, 2005, 2006) argues that in group collaboration meaning is created not as property of individual minds, but across utterances of different people and is a characteristic of group dialogue. This makes meaning making visible to researchers - just as they are visible to the collaborators themselves - because the collaborators in the group make meaning public through their interactions (Stahl, Gerry 2003). He describes tools, such as computer software, as being mediating artefacts to support the process of meaning making by helping the collaborators to articulate their ideas and preserve them in 'convenient forms':

> "In broad terms, computer support should provide a workspace in which ideas can be articulated, can come into interaction with other ideas from multiple viewpoints, can be further developed, and can approach consensus. It should afford, facilitate, or even encourage

> this multiphased community process. It should provide a convenient medium to formulate, represent and communicate ideas at the various phases. And it should preserve the ideas and their various formulations in its computer-based medium to allow for review, reflection and continuation at any time or from any place." (Stahl, Gerry 2006:212)

Following this view, the role of ThinkSpace can be seen as that of a tool around which the students and their teacher can gather as part of their classroom activity to engage in 'intelligent action', such as building representations of their study material, exploring their conflicting understandings of particular points of material or challenging each other to explain their views.

For such 'gathering' to be possible it is important to make a distinction between collaborative and cooperative activity. Whereas both describe activities where people work towards a goal together, the nature of the 'together' is different in collaboration and cooperation. Cooperation is mainly achieved by division of labour in the solving of a task, whereas collaboration is "a coordinated, synchronous activity that is a result of a continued attempt to construct and maintain a shared conception of a problem" (Roschelle and Teasley 1994:70). Collaborative activity focuses on convergence – the construction of shared meanings (Webb and Palincsar 1996) - and the study of it is most interested in the processes through which the meaning making takes place rather than personal outcomes. This does not mean that no division of labour takes place in collaborative situations, but rather that this division is heterarchical, rather than hierarchical. Where cooperators divide the task into independent sub-tasks and only interact when the parts need combining into a whole, collaborators move in and out of roles according to the type of task and situation at hand, displaying a more fluid role pattern (Dillenbourg, Baker et al. 1996). Dillenbourg (1999) argues that

- situations can be deemed collaborative where there is
  - a symmetry of status and knowledge between collaborators (where symmetry of knowledge does not imply heterogeneity and allows for differing viewpoints).
  - common goals, rather than competing ones – the goals being fluid and negotiated through the process of interaction.
  - a low, unstable and 'horizontal' division of labour between participants.
- interactions are collaborative when they
  - present a high degree of interactivity (not in terms of frequency of the interactions, but the extent to which these interactions influence the peers' cognitive processes).
  - have a high degree of synchronicity, again not in temporal terms, but in terms of a 'considerate meta-communicative contract' where the participants agree to wait for each other's messages and to take them into account as soon as they arrive.
  - are negotiable, provide space for negotiation and even misunderstandings.

When talking about collaboration in the context of this study, the focus is collaborative rather than cooperative interactions and situations. The objective of the ThinkSpace tool is to contribute to situations where learning partners are working together closely in pursuit of common goals and have a high degree of synchronous and interactive communication. Therefore the focus in the design of the uses of the tool is on negotiation of ideas rather than division of labour in achieving the outcomes of group tasks.

2.3 Learning in History

As it was mentioned in the previous chapter, history classrooms were chosen as a testing ground for ThinkSpace. This section will explore what is taken to be learning in history, which specific challenges to learning this subject presents and therefore also why history is a field where learning could suitably be supported by using ThinkSpace.

In conceptualising learning as 'intelligent action' in relation to situations, resources and tasks, it is necessary to differentiate between what is taken to be intelligent action in different school subjects. As Goodson argues, subjects "far from being monolithic entities, are comprised of shifting sets of sub-groups, 'delicately held together under a common name at particular periods in history'" (Goodson 1993:184). Since A-level History was chosen as the testing ground for ThinkSpace in this study, this section will be devoted to tracing the history of History and discussing the kind of action currently expected from History students.

The epistemological nature of history is at the heart of any debate of what school history should look like and what constitutes skilful action in history. As the view of reality as being objectively knowable and recordable is being challenged in postmodern traditions, so the view of history as fixed, and known also gives way to a move towards inclusive rather than exclusive accounts of historical events (Leinhardt, Stainton et al. 1994). Viewing historical narrative as well as historical evidence as constructions provides an impetus to the study of history different from the study of history as delivered tradition. It is this distinction which is ultimately at the centre of any debate of the purpose of school history. There is no space here for an exhaustive treatment of the epistemological nature of knowledge and history, and therefore the purpose of this section is to provide an overview of the issues colouring the view of teaching and learning history in school. After interviewing both historians and teachers, Leinhardt et al. arrive at the following definition of history:

> History is a process of constructing, reconstructing, and interpreting past events, ideas, and institutions from surviving or inferential evidence to understand and make meaningful who and what we are today. The process involves dialogues with alternative voices from the past itself, with recorders of the past, and with present interpreters. The process also involves constructing coherent, powerful narratives that describe and interpret the events, as well as

> skilful analyses of quantitative and qualitative information from a theoretical perspective (Leinhardt, Stainton et al. 1994:88).

The following discussion of the History subjects as well as learning in history must be seen in light of this definition of history as being a subject of active construction rather than didactic delivery of a pre-determined set of material. The material for this section is adapted from work done previously in (Shuyska 2007).

2.3.1 Contested nature of History

During the last five decades, the role of History in the school curriculum has been ferociously debated and to some extent reinterpreted. History is a highly contested political topic, closely related to issues of power, values and identity (Phillips and Arthur 2000). Although it has traditionally been part of a 'staple diet' of a school pupil, and although there is a broad consensus that History in an important subject and should remain part of the curriculum, questions have been asked about the purposes and outcomes of school history. There is much less agreement about whether it is a "socializing or a mind-opening subject" and whether it is "concerned with transmitting or examining values" (Slater 1995:xi).

The 'history of History' in England can broadly be divided into two main approaches: the 'great tradition' and the 'alternative tradition' (Haydn, T. and Harris 2010). At the core of these "traditions" is the debate about the nature and purposes of school history. 'The great tradition', dominant throughout the majority of the twentieth century, especially in the grammar schools (Husbands, Kitson et al. 2003) concentrates chiefly on chronologically organised 'grand narratives' of British political history and tends towards an epistemological view of history as being fixed. The main purpose of teaching history in this tradition is highly intrinsic, not necessarily directly applicable to for example gaining employment, and aimed at creating 'educated citizens' with a sense of identity (Haydn, Terry, Arthur et al. 2001) through providing a grounding in a set of (presumably) common attitudes and values. This approach to history, although challenged early on (see for example Keatinge 1913; Happold 1928), largely prevailed in both primary and secondary education for most of the twentieth century (Sylvester and Bourdillon 1994).

This view of history became unstable partially due to the changes in the student population (Phillips 2002) and partially to Piagetian influence on thoughts about pedagogy. Could history be taught so that children could understand it, while at the same time not simplifying it to the degree of falsification (Plowden and Britain 1968)? A major attempt to rethink the role of school history in England was made in the Schools' Council History Project, which formed the basis of the 'alternative tradition'. The initial work within the Piagetian tradition was subsequently challenged and focus shifted away from facts and towards the skills of doing history, such as investigation of evidence as well as empathy

(Brown, R. 1995; Husbands, Kitson et al. 2003), in emphasising the skills, processes and concepts of historical enquiry. Significantly the new approach suggested that history was useful above and beyond its intrinsic value, in helping pupils understand their own time and society better through the study of their past. Influenced by Bruner's (1960) notion of the spiral curriculum, the project challenged the largely Piagetian view of 'doing' history as being too complex for children below the age of 16.

The 'new history' was not uncontroversial. It was criticised for concentrating on skills at the expense of historical knowledge, for not providing children with an overview of their own history and for not teaching them anything of historical worth (Phillips 2002). On closer inspection the two sides of this debate are not that easy to separate, because, as Counsell et al. argued, the dichotomy between content and skills is a false one, and each aspect is necessary for the mastery of the other one (Counsell, Arthur et al. 2000). Still, the Schools' History Project has had a profound effect, perhaps most importantly in the way that it influenced the making of the GCSE. The GCSE criteria, which cashed the debates about history into "everyday classroom currency" (Medley and White 1992:64), were rather general, did not prescribe any specific content and were clearly influenced by the ideas of 'new history' (Phillips and Arthur 2000; Phillips 2002).

The debate about content, skills, chronology and the role of history in the curriculum is ongoing and much of the rhetoric remains the same. In 2007 Ofsted recommended in its report on History in schools that there is a need to "revise the curriculum to deal with the concern that young people study a few unconnected topics and so gain only a limited understanding of chronology and often cannot answer the 'big questions' of history" (Ofsted 2007). Furthermore this debate is nestled within a broader political debate surrounding the need for creating a cohesive and united society around British values in the aftermath of the terrorist attacks in New York and especially in London (Osler 2009).

2.3.1.1 A-level history

The development of A-level History has largely mirrored that of secondary History, although with some delay. When A-level was introduced in 1951 it was clearly associated with university entry requirements. It was a popular subject drawing mostly pupils from grammar schools. But with the comprehensive reorganisation of the schools in the 60s and with increased competition from a wider range of available A-level subjects History was less secure (Haydn, Terry, Arthur et al. 2001). In the early 80s History was in decline as it had to compete against a range of new academic subjects (for example economics and sociology) as well as technical and vocational courses (Perry, Brooks et al. 1993). Crinion wrote at the end of the 1980s that History was a subject that lived in the past and that "increasingly fewer students are willing to visit it there" (Crinnion and Portal 1987:155). He argued that vocational relevance and employability were more important to the students, and that also the methods in the A-level course had failed to catch up with the innovations elsewhere in the system.

Finally the A-level course failed to serve the needs of academia - the students seemed to be well-taught, but insufficiently educated.

In spite of the criticism A-level history reacted very slowly, mainly due to being perceived as the 'gold standard' of achievement for pupils in schools. Every attempt at change would raise a discussion about maintaining the standards. This is why a thorough revision did not come about before 2000, even though the notion of the 'slipping standards' was continuously criticised; see for example (Baird, Cresswell et al. 2000). The major change was the introduction of the Advanced Subsidiary (AS) level, and new modular structure of the curriculum which allowed the candidates to sit their exams in any of four examination periods rather than only at the end of the two years' course. In broad terms the current subject criteria for AS and A-level history (QCDA 2010) require the examination boards to balance the focus of the curriculum between content and skills. The students have to demonstrate historical knowledge and understanding both in depth and in breadth and display analytical and communication skills. The aims for history allow room for interpretation, but generally point towards development of different kinds of historical understanding in pursuit of both goals of identity building and of creating critically thinking citizens.

2.3.2 Knowledge, learning and enquiry in history

The current interpretation of the subject is thus oriented towards a blend of factual knowledge (content), understanding of historical concepts as well as skills in historical enquiry - three concepts which are at times difficult to separate (Counsell, Arthur et al. 2000). The content of history is probably the easiest to define – it is the facts and dates – the basic 'material' that history is made of. Concepts are divided into two categories: 'substantive concepts' and 'procedural concepts'. The substantive concepts, such as 'democracy', 'revolution' or 'church', present a challenge to students and especially to teachers. Because history as a subject lacks an extensive technical vocabulary, it relies on everyday language. This leads to misunderstandings and ambiguities in the teaching when the same term can have multiple meanings (for example 'church' as institution or as building) or when the meaning or connotation of the term have changed between the period in question and our time (Edwards, Dickinson et al. 1978). History also requires a high level of literacy because of its abundant use of abstract and complex terms such as 'parliament' or 'sovereignty', which must be explored in their own right before pupils can use them effectively (Haydn, Terry, Arthur et al. 2001).

'Procedural concepts', such as causation, change, continuity, significance, chronology and interpretation, shape the way we do history (Hunt, Arthur et al. 2000; Stow, Haydn et al. 2000; Husbands, Kitson et al. 2003). They are often referred to as 'second order' concepts (Counsell, Arthur et al. 2000) or second order 'structural' concepts (Lee, Peter, Ashby et al. 1995) emphasising that these concepts underpin the way we do history – in a sense the 'operating system' to the structural concepts' 'software' (Haydn, Terry, Arthur et al. 2001). The understanding of procedural concepts is closely

related to the student's perception of the nature of history and historical knowledge. The understanding of the often ambiguous nature of historical evidence and the interpretative nature of historical narrative has a strong influence on the student's grasp of the concept of historical causation or the role of interpretation, and the skills of constructing multi-causal explanations or analysing interpretations (Wineburg 1992).

The third overarching theme in history teaching and learning is 'skills'. This term is problematic because it is often vaguely defined and includes "all manner of understandings and processes, some specifically historical, others general" (Counsell, Arthur et al. 2000:56). There is a continuum in the variety of skills employed in doing history ranging from the more concrete or 'core' historical skills like working with historical evidence to more broadly applicable 'life' skills like critical thinking or argumentation skills. There is a large overlap between these categories (for example it is imperative to have good communication skills both as a historian and as a history pupil).

Put in situativity terms, the content and the two types of concepts can be seen as the resources and tools in any given situation involving historical reasoning. Intelligent action in this context will mean particular kinds of operation with the content and concepts. These different kinds of operations are defined by the skills, some specific to History, some general. Thus an example of intelligent action in a History lesson or exam is for the student to use the facts available in combination with an understanding of historical causality to construct a coherent argument about a possible reason for a historical event. Learning in History, would correspondingly be the learner's attunement to the ways the available facts interact, to the underlying principles of causality – and to ways of constructing a particular type of text containing a coherent argument with the help of this knowledge.

2.3.2.1 The challenges of intelligent action in History

Having conceptualised historical reasoning as skilful operation with or intelligent action in the use of historical concepts and content, this section will look at the challenges in achieving such mastery. Again, this is not a full treatment of the literature on the subject, but serves as an overview of the typical challenges in becoming adept at historical reasoning. A common thread in the literature is that genuine historical thinking is difficult to achieve and that school history does not always help students achieve it to a sufficient degree. Stearns et al. (2000) for example found that freshmen starting a university history course lack argumentation and analysis skills.

When comparing school pupils or university students of other disciplines (Jacott, Lopez-Manjon et al. 2000) to historians it is often found that the historical thinking and explanations that historians generate are qualitatively different. Non-historians are unable to think about historical questions on the same level of sophistication as historians do. Wineburg (Wineburg 1992) found that (even very able) school pupils have a poor grasp of historical reasoning. Confronted with a historical problem they tend

to examine it in a linear fashion, whereas historians flip back and forth between sources in constructing their argument. School pupils would be prone to teleological reasoning and their background knowledge would be obstructing their reasoning rather than helping it. Historians would use their background knowledge to their advantage, and would not be impaired by lack of background knowledge when dealing with unfamiliar historical events. Jacott et al. (2000) similarly found that adolescents are prone to giving intentional or personal explanations to events (even though their text books focus on structural explanations), and that historians give mostly structural explanations.

While not depending on the familiarity with particular historical content, historical reasoning seems to be highly dependent on the individual's conceptualisation of the nature of history. Bain describes undergraduates' most common understanding of history as follows: "The past is filled with facts, historians retrieve those facts, students memorize the facts, and this somehow improves the present." (Bain, Stearns et al. 2000:337). This again points to the most central importance of the students' conception of the epistemology of history as a discipline, something of which most students seem to be unaware. In a Swiss study Fink (2004) found that secondary students' conception of history is rather realist than constructivist and that they have little concern for the critical functions of history and historical thinking. In England, in their survey of over 1700 history pupils, Haydn and Harris (2010) found that most have only a vague idea of the purpose of studying history and that their explanations of the usefulness of the subject bore little resemblance to the goals outlined in the curriculum. They concluded that the debates about the epistemological nature of history have been between adults an have not percolated down to school pupils. The school and departmental effects the survey flagged up suggest that in some schools these issues are not being explicitly taught, and that directly addressing the epistemology of history does make a difference to the pupils' perceptions of the subject.

In continuation of the challenges in understanding of the fundamental underpinning of the subject, the mastery of the tools for historical reasoning also presents challenges to the learner. Lee et al. (1998) found that there is a gradual progression in children's view of history as strings of disconnected facts to a more complex view of the discipline as being actively constructed. Beginning from viewing historical evidence as 'Pictures of the past' children gradually reach a deeper understanding of evidence as being contestable and interpretable. Eventually evidence is put into its historical context and the pupils get a feel for the questions, which can be asked of historical evidence (Lee, Peter, Ashby et al. 1995).

Dominguez and Pozo (2000) suggested that a similar developmental process applies to the understanding of causality, where children initially lack a conception of causes and see the past as series of unconnected facts. Gradually learners move towards fuller conceptions of causality finally arriving at a fully interconnected causal framework, which they then link to an interpretive framework

and put within its historical context. They concluded that the teaching approach influences children's achievements in causal reasoning arguing that teaching the procedures of building causal explanations are more important than teaching the interpretative (or substantive) concepts that are part of the explanation. Voss et al. (2000) also found that the teaching approach is an important influence arguing for the utility of scaffolding children's causal reasoning. They found that when children are given the concepts that should figure in their work, they are capable of including institutional (rather than personal) explanations which previous research had shown was very difficult. In Vygotskian terms, he proposes to make use of the child's ZPD in order to achieve higher levels of reasoning.

The above evidence suggests that to act intelligently with the conceptual tools of history, the learner must construct a deep understanding of each of these tools, which is complex and can only be reached through gradual elaboration. This understanding is closely linked to the use of these concepts in action, both in terms of the student's own ability to apply these tools on a certain level, as well as in terms of how they are taught in the classroom.

Chapter 3: The ThinkSpace tool

ThinkSpace was a tool which came out of my need as a student for a device to help me organise my thinking. On the one hand I needed a way of creating a bird's-eye view of the topics I was reading about, and on the other, to keep track of the intricate details of each of those topics. Finally I wanted a way to move easily between the two. Having no id-depth technical expertise I used existing tool to provide me with the functionality I needed. 'ThinkSpace' was the name given to the resulting 'mashup' of software and ideas to indicate its purpose of providing the user a space to think and play around with ideas. The name also provided a useful shorthand for referring to what really was a complex of ideas and tools when talking to students and teachers. However in the classroom, the individual software elements of the tool - concept mapping and a wiki - were as often referred to in their own right and 'ThinkSpace' never became a brand or an entity in its own right. Therefore the name is here used mainly as a shorthand - albeit one that indicates the researcher's intended purpose for the tool: to provide students with a space to think, to represent their emerging ideas, to move them around, ask questions and come to conclusions.

This chapter presents the ThinkSpace tool, its conceptual foundations and, briefly, the technological tools used as part of ThinkSpace. The main part of the chapter will review the research literature on the two main components of the tool, namely concept mapping and wikis.

3.1 Conceptual description of the tool

ThinkSpace is designed to provide technological support for grappling with complex study material. The tool consists of two conceptual layers, and two corresponding technological tools. These two layers represent:

- the broad overview of the conceptual structure of the study topic
- the in-depth detail about each separate concept in the material

The main purpose of the tool is to allow for a gradual construction of a multi-layered representation of content material by the learner, showing both the broad outline of a topic as well as the detailed information about each of the main concepts. The two layers are intended to be used iteratively alongside each other, so that the overview and the detail levels gradually evolve as the learner's understanding and view of the topic material develops.

Metaphorically, ThinkSpace can be seen as a surface upon which the learner can place index cards and manipulate them (e.g. group or colour code them). At any point the learner can 'dive' into any of the

'index cards' to reveal detailed information about that card. Technologically this functionality is provided by replacing the index cards with concept mapping software, which allows the learner to draw figures to represent concepts and arrows to represent their interrelationships. The 'dive' into the detailed content is facilitated by linking each of the figures representing concepts to corresponding wiki pages[2]. Furthermore the wiki allows for linking content together via hyperlinks within the text on the wiki pages, thus allowing for easy movement within the hypertext material, as well as enabling a construction of further cues as to the structural relationships within the material (see Figure 1).

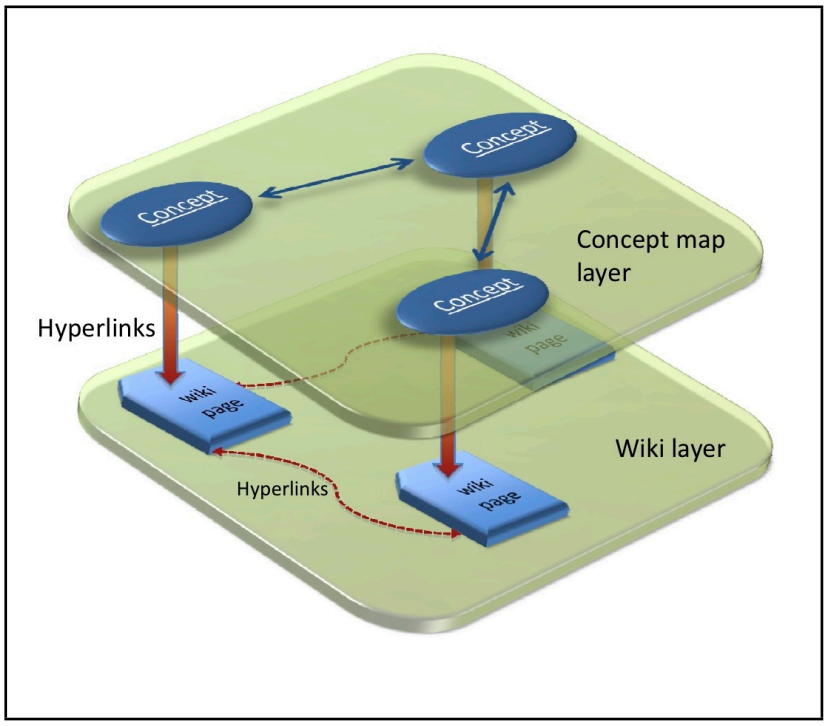

Figure 1: Graphical representation of the ThinkSpace tool

For example within the History curriculum, the students needs to grasp broadly the role a particular political party played within a historical event (e.g. the importance of the Bolsheviks in taking advantage of mistakes made by the Provisional Government in the Russian Revolution). They also need to be able to support this understanding with knowledge of the detailed content (e.g. the development of the party over time or key players in the party). ThinkSpace aims at providing the students with one way of keeping track of all the detailed information without losing sight of how it fits within the wider narrative - and visa versa.

Importantly reaching a 'finished' representation of the material is not the main aim of working with ThinkSpace. The learning is theorised to lie in the process of constructing the complex interlinked web of knowledge, planning which concepts are important for representing an argument and discovering links between details of seemingly unrelated material. The tool is designed to help students turn up

[2] Wikis as well as concept mapping will be explained in more detailed later in this chapter.

questions and invite sophisticated ‘grappling’ with the material - not to provide answers. As Gerry Stahl puts it: “Computer support for learning should facilitate the process of articulating ideas and preserving them in convenient forms” (Stahl, G 2000:74).

3.2 Technological foundations of ThinkSpace

No technical development was carried out for this study, however the search for suitable software and operation of it proved to be non-trivial. The main rationale behind the choice of software for the school studies was that the resulting solution should be

- low cost
- easy to use for both teacher and students
- require little or no configuration of the school systems and therefore easy to implement in any school

Initially a hosted wiki solution was chosen at PBwiki[3], which was free, but which eventually was discarded during the study at Park Hill school because the free version proved too restrictive in its functionality. It was replaced by an installation of TWiki [4], which was hosted at the Department of Education, and which required significant technical knowledge to install and run. In this case, the need for better functionality overrode the principle of ease of access and installation. TWiki was chosen for the (at the time) best combination of features, which included sophisticated access control as well as a relatively functional WYSIWYG editor[5].

The concept mapping software was also swapped during the first classroom study. At first CMap Tools[6] was chosen because it provided most of the necessary concept mapping functionality and was free to use. However, it required installation on the school computers, which proved to be very difficult despite close collaboration with the school IT department. After a long search, CMap was therefore replaced with Gliffy[7], which was a service hosted online, and which provided a better integration with the wiki, but which however required a monthly fee to sustain. (For more detail on ThinkSpace functionality, see Appendix 1).

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[3] Now at http://pbworks.com/

[4] http://twiki.org/

[5] WYSIWYG stands for ‘What you see is what you get’ and is a term for a graphical user interface to the wiki editor, which removes the need for learning wiki formatting codes and is generally more accessible than traditional wiki editors.

[6] http://cmap.ihmc.us/

[7] http://www.gliffy.com/

The iterative adaptation of the technological solution to the needs of both the conceptual ideas of the tool as well as to the constraints of the school systems was part of the overall tool development. The final solution reached in this study is far from ideal - at the time of the study, I was not able to find the tools to fulfil all the criteria I would have liked, and therefore the Gliffy-TWiki combination was the closest approximation that could be achieved with the resources available. To develop the full functionality needed to support the idea of ThinkSpace, it would have been necessary to develop a dedicated software solution, which was unfortunately not possible.

3.3 The two layers of ThinkSpace

3.3.1 Overview layer: Using concept maps for learning

The ThinkSpace tool makes use of what here is termed ‘concept mapping’. Concept maps are one of a family of graphical representations of knowledge that have been developed for use in education. The various kinds of mapping each operate on their own set of rules, but all of them share a number of characteristics. They all depend on a spatial layout of information, and some form of notation representing nodes, ideas or concepts, as well as lines or arrows connecting these nodes into an interlinked representation. This representation can among other things depict structural features of a knowledge domain, procedural information or the development of ideas. A wealth of mapping approaches seem to have been developed with little reference to each other (Lambiotte, Dansereau et al. 1989) and therefore there is a wide variety of notation styles and purposes. Among the mapping family are such approaches as Mind Mapping (Buzan, Tony 1993; Buzan, T and Buzan 2000), semantic maps (Lambiotte, Dansereau et al. 1989), concept maps (Novak, J. D. and Gowin 1984), semantic networks (Fisher, Wandersee et al. 2000), graphic organizers (Hawk 1986) etc. The approaches differ in the purposes they have been applied to (e.g. Mind Mapping for brain storming and externalising ideas or concept maps for elicitation of misconceptions or text comprehension) as well as constraints each imposes on the notation style (e.g. named or un-named links, constrained or un-constrained node names). Of all the existing visualisation approaches this study makes most use of the concept mapping literature, although concept mapping is interpreted more loosely than suggested by some of the initiators of the technique and the main players in the field (Novak, Cañas and others). Neither the exact form of ‘pure’ concept mapping, nor the theory of learning underpinning it, are adequate to frame the way mapping is used in this study. Furthermore, hardly any research exists on the use of concept mapping in History, the main body of research being oriented towards the sciences. Still, a lot is borrowed from the concept mapping literature, and this section will explicate what concept mapping means and how it is used in the context of ThinkSpace.

Concept mapping was developed by Joseph Novak in the 1970s in the course of his work at Cornell University for teaching science concepts (Novak, Joseph D. and Cañas 2006). In their 1984 book ’Learning how to Learn’, Novak and Gowin present concept mapping as a versatile teaching and

learning tool, which can be used by students and teachers to focus on the main ideas in any learning task, to foster discussion and negotiation of key meanings, to help students identify inconsistencies in texts and to help teachers identify inconsistencies in students' understanding (Novak, J. D. and Gowin 1984).

A concept map consists of concepts and links. A 'concept' is defined as "a perceived regularity in events or objects, or a record of events or objects, designated by a label" (Novak, Joseph D. and Cañas 2006:1). On the diagram, concepts are represented as ovals or boxes containing the concept label, usually a single word or short phrase. Relationships between pairs of concepts are indicated by connecting lines with single or bi-directional arrows, which are also labelled with a connecting word or phrase. A concept pair linked by a line represents a proposition, which in this tradition is taken to be a basic unit of meaning (see Figure 2).

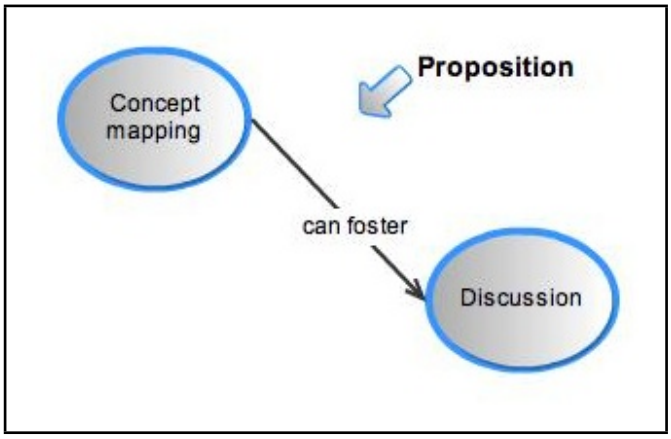

Figure 2: Illustration of main elements of concept mapping

Concept mapping is founded upon Ausubel's (Ausubel, D.P. 1963; Ausubel, David Paul, Novak et al. 1978) learning psychology. Ausubel's fundamental idea was that learning happens by assimilation of new concepts and propositions into the learner's existing cognitive structures, and that there is an important distinction between rote and meaningful learning. He stresses that rote learning leads to arbitrary and non-substantive incorporation of information into existing cognitive structures, which renders the learned information barely hinged to existing structures. Only by learning meaningfully, i.e. integrating new information into existing knowledge structures, will the learner be able to easily retrieve the information and allow for detection and correction of misconceptions (Novak, Joseph D. and Cañas 2006). Furthermore, Ausubel theorises a hierarchical structure of the conceptual frameworks held in our minds, organized by a principle of "progressive differentiation of trace systems of a given sphere of knowledge from regions of greater to lesser inclusiveness, each linked to the next higher step in the hierarchy through a process of subsumption" (Ausubel, D.P. 1963:25). Concept mapping can be seen as a "methodological tool of Assimilation theory" (Cañas, Coffey et al.

2003:13) and reproduce the idea of the hierarchical structure of knowledge by requiring the mapping to be hierarchical too.

The main characteristics of concept maps (in distinction from other mapping types) are

- their constraining of node content to 'concept' labels,
- the naming of links and
- their semi-hierarchical structure.

Node content constrained to 'concept' labels Whereas other mapping techniques allow idea-sentences, whole paragraphs or even pictures as nodes in the map, concept maps are restricted to concept labels. However, the distinction between concept labels and sentences or ideas as labels seems blurred: the authors themselves use labels such as '23.5 Degrees Tilt of Axis' (Novak, Joseph D. and Cañas 2006) and 'Why?' (Cañas, Coffey et al. 2003).

Named links Named links are a very important feature allowing the learner to explicate his understanding of the connections between concepts and allow the reader to decipher the propositions on the map. Links are labelled with a connecting word or a small number of words, allowing the proposition to be read as a sentence (i.e. grass IS green).

Semi-hierarchical structure Maps are constructed with the most inclusive concept at the top, progressing downwards toward more specific concepts and finally including example data at the bottom. The hierarchy is not strict because concepts can be multiply interlinked and because the 'branches' of the concept tree can be 'cross-linked'. The cross-links may represent synthesis of related concepts, new interpretations of old ideas or leaps of creativity on the part of the learner (Heinze-Fry and Novak 1990), and are thus important and indicative of quality learning.

These characteristics or constraints of concept mapping are only partially useful in the ThinkSpace study. Most importantly the semi-hierarchical structure of knowledge, which concept mapping pre-supposes is not seen as being useful in the context of the history classroom. It is not productive to attempt to reduce representations of historical understanding to hierarchies, because of the complexly interlinked nature of historical knowledge. Central, rather than top-level concepts are taken as starting points for the mapping in order to allow for a freer expression of a variety of ideas, concepts and types of evidence, which would not fit into a more rigid structure. Also the purpose for using concept mapping as part of ThinkSpace is the process of exploration of complex ideas rather than reaching a final representation of the curriculum. Therefore the characteristics of concept mapping are used as useful guides and prompts in this process rather than constraining the form the maps take. The practice of naming links especially is drawn upon to prompt the students' reflection about the interconnections within the material.

Concept maps have mostly been studied in terms of their 'effectiveness' and have generally been shown to be an effective teaching and learning aid in many different situations compared with other activities, even constructive ones (Novak, J.D. 1990; Horton 1993; Cañas, Coffey et al. 2003; Nesbit and Adesope 2006). Novak and Gowin (Novak, J. D. and Gowin 1984) proposed a range of uses for concept maps (showing students' misconceptions, aiding negotiation of meaning, fostering student dicussion, identifying inconsistencies in text) and concept maps have been applied in all these as well as other areas of learning. Most prevalent in the sciences, concept mapping has been successfully used for both individual and collaborative tasks in application to (among others): building student knowledge bases for problem solving (Pankratius 1990), organising information when learning from text (Nathan and Kozminsky 2004) and mapping the structure of syllabus material (Clark 2007). However, many of the studies of the effectiveness of concept mapping are short term, and the findings most often relate to 'artificial' free recall and researcher-constructed achievement tests (Nesbit and Adesope 2006). Furthermore uses of such constructs as 'placebo treatments' (Horton 1993) for the control group raise doubts about the authenticity of such quantitative measures of educational efficacy. Therefore it is difficult to assess the success of concept mapping as a teaching and learning tool - though overall it seems successful.

The understanding of the cognitive mechanisms which make concept mapping a useful educational tool is for the large part situated within the cognitive constructivist perspective on learning. The theorisation of the effectiveness of concept mapping for learning spans a continuum of views. On the one end of the spectrum are hypotheses about the way the pictorial representation of information in a concept map corresponds to similar representations in our minds. Taking departure in Ausubel's ideas about learning, in the most literal interpretation concept maps are taken to be "explicit representation [s] of [a learner's] integrated knowledge networks" (Jonassen, David H., Beissner et al. 1993:155). Also at this end of the spectrum are theories engaging with the visual nature of concept maps (see for example Paivio 1990; Winn 1991; Sadoski and Paivio 2001).

At the other end of the spectrum attention is directed to how the act of studying or constructing concept maps reshapes what the teacher, learner or group of learners do in order to understand or remember the material they study, a view which is closer to the conceptualisation of learning adopted in this study. Here, concept maps are rather taken for being "documents, in a class with essays and movies" (Bereiter 2002:98) and not as 'snapshots' of the contents of a learner's mind (McAleese 1998). The focus of this study will therefore be on how to use concept mapping as a tool to encourage students to construct a particular type of 'documents' or representations. Because 'concept mapping' does not refer to a single technique or a fixed step-by-step process, it is difficult to ascribe a single level of efficiency to 'doing concept mapping'. Furthermore, introducing new pedagogical tools designed to fundamentally shift the learner's orientation towards more meaningful engagement with

learning is, perhaps unsurprisingly, not straight forward and not easily measurable through quantification.

As Novak and others acknowledge, introducing concept mapping into education is a lengthy and complex process, and should not be considered a 'quick fix' (Heinze-Fry and Novak 1990). By the end of the first considerable study of using concept maps with students Novak reports to be 'keenly aware' that it was difficult to move away from rote-form toward meaningful learning: "We had grossly underestimated the logistic, curricular and pedagogical practices that needed to be modified if maximum benefit was to accrue from the use of metacognitive tools and a focus on meaningful learning" (Novak, J.D. 1990:43). Furthermore, as Cañas et al. (2003) found in reviewing a large body of concept mapping literature, concept mapping is at its best when it's an integral feature of the instruction rather than an isolated add-on to it and that the skill of the mapping facilitator has a significant bearing on the quality of the result.

Thus concept mapping in the context of this study is seen as a practice of constructing symbolic representations of knowledge. It is seen as a dynamic process or activity, in which participants engage in a dialogue with their peers as well as themselves. Choosing concept mapping over other techniques therefore means creatively using the constraints suggested by this particular style of mapping as tools to prompt particular types of intelligent action in the classroom: asking questions about the main concepts, examining their interconnections and trying to represent arguments concisely.

3.3.2 Detail layer: Using hypertext for learning

The wiki is a relatively new tool in education, having about 10 years behind it. Research on using wikis for learning was preceded by research on reading and writing hypertext, which stretches back to the introduction of Apple's HyperCard in the late 1980s. Since many of the non-collaborative features of wikis are shared with other kinds of hypertext, it is useful first to take a look at this literature.

The term hypertext was coined by Ted Nelson in the sixties "to mean a body of written or pictorial material interconnected in such a complex way that it could not conveniently be presented or represented on paper" (Nelson 1965:96). In a hypertext, such as a web page, information is presented in an interlinked network rather than a linear chain, which would be characteristic of traditional paper-based ways of representing information. This non-linear quality of hypertext was from the outset taken to present a great interest to education, because it could potentially enable the learner to actively construct alternative routes through material, and engage him with the structural features of the information in a way that linear text could not do (Landow 1991). It was argued that because of its non-linear structure, hypertext could allow for more explorative and differentiated learning, encourage learners to take initiative in their learning, and allow them to adapt the material to their preferred learning style (Stanton, Stammers et al. 1990; Nielsen 1995). Spiro, Feltovich and others proposed that

hypertext could be a powerful tool for learning in what they termed ‘ill-structured knowledge domains’ by allowing the learner to traverse the ‘topical landscape’ via different routes thus getting to grips with its features (Spiro, Coulson et al. 1988; Spiro, Jehng et al. 1990; Spiro, Feltovich et al. 1992). Furthermore, as with concept mapping, it has been suggested that hypertext mirrors knowledge structures in learners’ minds (Jonassen, D.H. 1993).

As with many other technological innovations for learning it is difficult to assess whether hypertext is living up to its high promise because it is a general technological tool with a plethora of possible applications, presenting a multitude of questions to researchers. As Chen and Rada (1996) point out, the diversity of research designs used to investigate the merits of hypertext for learning undermine the significance of individual findings. On the whole, findings of research on reading hypertext for learning are inconclusive (Shapiro and Niederhauser 2004). Perhaps unsurprisingly, they show its effects to depend to a very high extent on the type of hypertext (for example the level of explicit modelling and scaffolding support (Jacobson, Maouri et al. 1995)), the task the hypertext is used for (Britt, Rouet et al. 1996; de Vries and de Jong 1999), the kind of learner engaging with the task (Lin, C.-H. and Davidson 1996; Balcytiene 1999; Graff 2005) and various interactions of these factors (such as hypertext structure in relation to learners’ prior knowledge) (Potelle and Rouet 2003). Furthermore, when reading hypertext, the non-linear structure, as well as presenting potential benefits to the learner, was also shown to present obstacles which were thought to be due to the increased cognitive load of reading (Thüring, Hannemann et al. 1995; Rouet and Levonen 1996; Macedo-Rouet, Rouet et al. 2002).

Whereas the majority of literature on hypertext is concerned with learning from hypertext, this study focuses on learning with it. The major problem with learning from hypertext is that in reading hypertext documents learners are presented with ready-made textual structures to navigate and internalise. However, as Hammond (1993) points out, basic presentation of information in hypertext is by nature passive – it does not require active engagement with the material. Thus Jonassen concludes that “merely showing learners structural relationships […] is probably not sufficient to result in meaningful encoding of that information” (Jonassen, D.H. 1993:164).

This suggests that when writing hypertext, learners must attend to creating structure for themselves. This requires an active consideration of the internal structure of the material in order to separate distinct chunks, which can be interlinked, and to arrive at a logical way of connecting these chunks. In other words, it presupposes a constructivist approach to learning as active knowledge building. In this view, hypertext becomes a technological tool in a re-organised view of learning.

Scardamalia and Bereiter’s (1994; 2002; 2004; 2006) work on knowledge building and CSILE (later Knowledge Forum) is perhaps the most marked contribution to this field (and reaches far beyond the field of hypertext research). They propose turning schools into active knowledge building

communities, where knowledge is created in the same way as it is in scientific communities. Here hypertext structures become a tool in constructing 'epistemic artefacts' as part of a gradual idea development in a community of learners. In their studies, Scardamalia and Bereiter used CSILE to restructure the information flow in the classroom, so that it no longer flowed primarily through the teacher, and worked on establishing the hypertext as a representation of communal rather than individual knowledge. Central to the design of CSILE and Knowledge Forum are the 'epistemic markers' (such as 'my theory is' and 'I need to understand') used to scaffold learner's construction of knowledge. These markers direct the learners' attention towards particular moves in knowledge building, but they are not mandatory to use and are adaptable to the needs of particular knowledge building communities. Scardamalia and Bereiter's work, as well as work building on this, has highlighted important features of hypertext writing in education. Firstly, it is clear that a tool like Knowledge Forum cannot function as a 'stand alone application', but rather must be part of a much broader change

> "from a focus on carrying out tasks and activities to a focus on the continual improvement of ideas; from an emphasis on individual learning and achievement to the building of knowledge that has social value; from a predominantly teacher-directed discourse to distributed knowledge building discourse" (Scardamalia 2004:191).

Furthermore, to implement the learning culture in which the tool can be an effective learning support, gradual adaptation to new modes of learning must take place in the classroom, including fundamental epistemological shifts in students' and teachers' understanding of knowledge and learning (Bielaczyc, K. and Blake 2006). Finally, just as the tool cannot be viewed in isolation, so the functionality of hypertext is only part of a larger set of functions, scaffolds and features – some embedded in the technology, and some enacted by the teacher and learners.

ThinkSpace borrows many ideas from the CSILE and Knowledge Forum studies. Especially valuable is the thinking about the lengthy process of integration a technological tool into the classroom environment and the gradual reconfiguration of the goals and values of teaching and learning. However it differs from Knowledge Forum both 'ideologically' and technologically. ThinkSpace is not thought of as a tool around which the classroom activity would be structured by aims at taking a more humble role as a tool among many other tools which are used to support the variety of teaching and learning needs in the classroom. It is also designed with less of a commitment to a particular view of how understanding is achieved and is more open to interpretation by the teacher.

3.3.2.1 Wikis

Research on learning with wikis to a high extent revolves around the issues raised above of epistemological shifts in education and integration of technological tools into complex ecologies. The

wiki is a relatively new tool, having been in existence for about a decade. It is part of 'Web 2.0' or 'social software' in that it is directed at collaborative content creation. Wikipedia8 is undoubtedly the most famous example of a wiki and it demonstrates its potential: capitalising on the 'wisdom of crowds' (Surowiecki 2004) by allowing a multitude of users spread around the world to contribute content into a publicly accessible database, and by communal effort constructing a powerful and arguably consensual information base. The term "wiki" is derived from the Hawaiian word "wikiwiki" meaning "superfast" (Tonkin 2005), referring to the ease of editing the database. It is "a freely expandable collection of interlinked Web pages" (Leuf and Cunningham 2001:14) which enables the user to edit web content easily in an online word editor window – without any prior knowledge of web editing or installing specialised software. Désilets et al. (2005) write that the wiki introduced a new way of thinking that favours content over form, open editing over security and control, free-form content over structured content and incremental growth over up-front design.

The most important features of a wiki, replicated across its different implementations (such as MediaWiki, TWiki, Confluence etc.) are:

Wiki syntax A simple form of marking up or tagging text in order to format it. The wiki syntax differs between implementations of wikis, but is generally simpler than the traditional web mark-up language, HTML. Newer implementations also increasingly include WYSIWYG or graphical editors that make away with the need to learn wiki syntax altogether, although these implementations generally do not live up to the same degree of precise control over the editing as wiki syntax does.

Emphasis on hyperlinking, and easy page creation/editing The wiki syntax makes it easy to create new pages - linked to the current one - while editing the text. This encourages the creation of new empty web pages, which can effectively act as placeholders for future content and indications of information structure. Any existing page can at any time be modified by the same or different user, allowing for gradual and collaborative evolution of the content.

Versioning and revision history Most implementations allow to pu restrictions on access, and some, such as Wikipedia, have put procedures in place to control the quality of the material. However, because the fundamental wiki idea presupposes that all content can be edited by any user at any time, all versions are saved separately and mechanisms for reverting to previous versions of a page are provided. The revision history of any wiki page can be studied, so that at any time the development of the page is traceable to the individual changes made to the page throughout its existence.

In education wikis have initially been most widely applied in higher education, from where some of the evidence below is drawn – and have since been experimented with in schools. When applied for

[8] http://www.wikipedia.org/

learning, wikis promise to extend communication beyond the bounds of the classrooms allowing students to easily contribute to meaningful intellectual projects (Forte and Bruckman 2007). Within the classroom, Bruns and Humphreys argue, the wiki can facilitate "learning technical literacy, content creation in a digital environment , the art of collaboration, consensus building, creating explicit knowledge from tacit understanding, and effectively communicating ideas to other people though networked knowledge environments" (Bruns and Humphreys 2005:27). They view wikis as learning environments where the students are obliged to 'enact' their understandings and communicate their knowledge to others. Wikis 'oblige' students by their technological constraints: "Instead of opening a page and filling the screen and then naming the file, writers have to name the page before it can be created. The act of naming the page means that the writer is not just putting words into a space; the writer is already involved in issues of structure and organization" (Garza and Hern 2005, online). Wikis are seen as being particularly useful for thinking about the conceptual structure of material because there is no structure hard-coded into the software - the pages can be organised according to whichever principle is deemed appropriate (Duffy and Bruns 2006). Thus wikis fit very well into the rhetoric about facing the needs of the contemporary society due to their open-ended 'beta-state' nature which capitalises on collective content production and emphasises the need for collaborative and critical skills.

However, the 'wisdom of crowds' argument is difficult to sustain, research showing that having many editors of an article is not necessarily productive, does not automatically reflect well on article quality and only works through careful coordination; and that the bulk of the work is done by a core of writers, others playing supporting roles (Kittur and Kraut 2008). This raises questions about the assumption that using a wiki for learning will necessarily lead to a more open and collaborative learning style or lead students to practice collaborative and critical skills.

This concern is reflected in the findings in research of wikis in classrooms. When introduced into schools wikis seem to present a number of challenges (as well as opportunities), due to their reliance on learner interdependence (Lund 2008:36). Using a wiki in the classroom necessitates an epistemological change in both students and teachers, because it goes against a number of established practices. As Lund and Smørdal argue,

> "the activity structures that go into knowledge construction in a wiki represent a fundamental shift from the institutional and socio-historical practices that traditionally have served to foster individual knowledge construction or problem solving" (Lund and Smørdal 2006:44).

Firstly, involving the students in production rather than consumption of knowledge is a fundamental shift in itself (Forte and Bruckman 2007). As Honegger puts it: "Wiki is unsuited for lessons where the truth always comes from the teacher" (Honegger 2005:115). Secondly, an emphasis on communal

knowledge production rather than individual contribution is a departure from traditional understanding of schooling. Often the difficulties of working with wikis arise as the students are safeguarding this understanding, rather than teachers opposing technological change. Grant (2006; 2009) found that students tend to be 'territorial' when writing a wiki, and that attempts to edit other students' pages are met with hostility. She noted that this was especially marked when producing text, which is traditionally the 'currency' in the classroom, whereas this tendency was relaxed when working with other media, such as graphics, where students seemed to find critique more legitimate.

The tradition of individual knowledge production is perpetuated partly through individual assessment practices, and this also presents a challenge to the communal knowledge production that a wiki relies upon. Wiki content written in a truly collaborative style is difficult to analyse for individual contributions and students may feel that they must separate themselves from the others and ensure that their individual contributions are discernible in the communally produced text. Working in Higher Education, Cubric (2007) found that awareness of individual assessment led her students to write in a threaded discussion style to demonstrate individual contribution.

Even though the wiki does provide tools for studying page revision history, they are not directed at tracing individuals' editing patterns, which therefore becomes a cumbersome and time consuming task, which few teachers would be willing to undertake. Tools are emerging, which can facilitate this process, such as Larusson and Alterman's WikiPlayer (Larusson and Alterman 2007; Pierroux, Rasmussen et al. 2008), designed for research into wiki collaboration, but potentially usable for aiding assessment. However arguably an attempt to separate individual contributions would render using wiki technology meaningless because it negates the very potential for free collaboration which justifies using a wiki for learning.

3.4 Concluding remarks

Generally the literature on both concept mapping and wiki writing in education suggests a need for careful consideration of the ways in which these tools and technologies are introduced into the classroom. Both tools promise great opportunities for encouraging students to think and learn in meaningful and productive ways. On the other hand both tools present challenges with regard to finding ways of working with them in within the environment of the classroom. Both present potential departures from the most established modes of teaching and learning in school and therefore demand some extent of reconfiguration of existing pedagogical practice. At the same time, both wikis and concept mapping tools are technologically as well as conceptually open to interpretation and development, allowing for reconfiguration. Picking up on some of the promises and challenges outlined in the literature, the work with ThinkSpace in this study is therefore aimed at careful, mutual and gradual reconfiguration of tools as well as classroom practices to move towards achieving some of the potential offered by the technologies for supporting teaching and learning goals in the classroom.

Part 2 - Methodology and field work

Chapter 4: Methodology

4.1 Operationalising the research questions

The previous chapters arrived at a workable conceptualisation of learning, examined the research literature on the role of technology in innovation in organisations and outlined the issues of working with wikis and concept maps in the classroom. Using these insights it is now possible to operationalise the overarching research questions posed in the introductory chapter:

What processes and challenges are involved in designing and developing a new tool for learning in the context of classroom practice?

The research literature on innovating with technology in the classroom has drawn attention first to the gradual nature of the development of new practices which incorporate technology and secondly to the important role played by the students and the teacher in shaping these practices. On the one hand, the ThinkSpace tool is theorised in terms of being both a material and social object (Barley 1986, 1988; Orlikowski 1992, 2000; Orlikowski and Barley 2001). On the other, classroom structures are seen to be recursively organised by the students and the teachers enacting them (Giddens 1979, 1984). To investigate the processes and challenges of the meeting of classroom and technology therefore requires questions to be asked about how the teacher, students and researcher come to understand the place of ThinkSpace in the classroom and how these understandings shape the emerging practice with the tool. The first of the above overarching questions is therefore operationalised as two concrete research questions:

RQ 1: What are the respective contributions of teacher and researcher to the shaping of the innovation?

> RQ 1.1: How did the teacher's understanding of what the tool had to offer develop during the course of the research collaboration?
>
> RQ 1.2: How was an implementation of the tool co-constructed in the dialogue between teacher and researcher?

RQ 2: What were the students' experiences of working with ThinkSpace?

> RQ 2.1: What uses of the tool emerged in the two classrooms?
>
> RQ 2.2: What did the students perceive the affordances of ThinkSpace to be?

The first of these questions refers to the construction of the uses of ThinkSpace as it was negotiated between the teacher and researcher in 'putting it forward' into classroom practice. The second question pertains to the reaction to this 'proposition' by the students and the ways the practices with ThinkSpace came to be played out in the classroom. The notion used in both these questions to investigate students' and teachers' understandings of the tool is that of affordances. This notion, which was discussed in Chapter 2, is useful for connecting the material nature of the technological tool to the teaching and learning practices in the classroom by focusing on the students' and teachers' developing ways of relating the two.

The understanding of the processes of innovation and the meeting between classroom and technology form the foundation for asking questions about the potential for any of the emerging practices with ThinkSpace to form a productive support for teaching and learning. The second research question is therefore operationalised in terms of supporting teaching and learning activities on the basis of the deeper understanding of classroom practice:

RQ 3: In what ways can the ThinkSpace tool be used constructively within school practices to support learning and teaching activities?

> RQ 3.1: Which practices involving ThinkSpace had begun to emerge in each of the two development studies?
>
> RQ 3.2: How can these practices be further developed to support teaching and learning?

The view of what counts as constructive uses of the tool is derived from the understanding of learning as acting intelligently with the conceptual tools of the discipline. Therefore the use of ThinkSpace is deemed to be productive when the tool is used as part of and is supporting activities where the learners engage in conceptual practices which are valued in the history classroom, such as source critique or thoughtful construction of argument. This third research question therefore necessitates a careful analysis of the practices emerging through the processes of innovation and deriving practical conclusions about the ways ThinkSpace was used and thinking about how these ways could be developed further.

4.2 Overall methodological approach

To answer these research questions and to satisfy the goals of development, implementation and reflection upon the processes of implementation, this project draws on two closely related methodological approaches, namely design-based research and action research. Both of these are 'umbrella' approaches, which encompass a wide variety of methodologies and purposes. Both are founded on similar principles of action, participant collaboration and iteration, but they have slightly

different orientations and emphases, making them both useful instruments for framing the present study.

4.2.1 Design-based research

Design-based research (DBR) is used as the overarching approach in this study because it allows for a focus on the development of an innovative tool while linking it to real-life classroom contexts, as well as recognising the complexity of such a development project. While allowing for an innovation or idea-based focus as well as having design principles or theories as its goal, it takes an iterative approach to development, and offers the required flexibility in methods of data collection.

DBR (also termed design research or design experimentation) developed in response to the need to move away from predictive research approaches which, the proponents of DBR argue, have a limited impact on the use of educational innovations in practice (Amiel and Reeves 2008). As Dede (2005) argues: on the one hand, educational researchers are prone to undertake studies purely for theoretical purposes, rendering the resulting conclusions obvious to practitioners and, on the other, quantitative research in education often values statistical validation over sizeable effect. Neither of these approaches is easily translatable into practical application of the research findings. If we are to produce educational research that is both rigorous and attends to the purposes of education as well as the processes of learning, while at the same time being applicable in practice, we need to overcome the tension between ‘basic’ and ‘applied’ research which has traditionally been inherent in educational research (Mitchell and Haro 1999).

In response to these issues the design-based research approach, first introduced in the work of Ann Brown (1992) and Alan Collins (1992), seeks to enable educational researchers to combine researchability with practical need. The notion of design research comes out of the traditional design sciences like engineering and artificial intelligence. It is concerned with “producing and improving artefacts or designed interventions, and establishing how they behave under different conditions” (Gorard, Roberts et al. 2004:578). DBR is intervention research that is intended to inform practice and whose goal is to work toward a theoretical model of learning and instruction rooted in a firm empirical base (Brown, A. L. 1992). Design-based research is not in itself a methodology, but rather transcends traditional research methodologies, serving as an ‘umbrella’ approach aimed at bringing together theoretical and practical work in education.

The key features of all design-based approaches are:

- their theoretical as well as pragmatic design purpose and focus on designing tools or innovations that work
- the importance given to the context within which the design is to function

- an iterative approach to development of the target intervention or tool in cycles of design, testing and re-design
- close collaboration with the practitioners who are to use the resulting design.

4.2.1.1 The role of theory

Based on a pragmatic epistemology, DBR seeks to find a balance between improving practice and generating theory. It aims at both designing usable artefacts that will improve teaching and learning in real classrooms, and at the same time developing domain-specific theories by studying the forms of learning that take place and the means of supporting them (Cobb, Confrey et al. 2003). The theoretical element, as the same authors point out, is an important one, because carrying out design-based research is not a simple case of 'tweaking' the design until it works – although the theories resulting from such research may be 'humble' domain specific ones. The knowledge claims resulting from design-based studies are in the form of substantive and methodological 'design principles' that can be used to guide similar development projects, outlining both the characteristics of a potentially successful innovation and the procedures for its implementation (van den Akker 1999). Connecting the 'local' theories with higher order ones may well be a lengthy process with the theoretical insights emerging after prolonged work with the innovation and multiple design cycles (Amiel and Reeves 2008). The theoretical focus of DBR is what distinguishes it from other approaches such as formative evaluation, and to some extent from action research, in that working to improve the local situation is a necessary, but not sufficient process to satisfy the focus of the project (Barab and Squire 2004).

Sandoval (2004) further adds urgency to the need to foreground theory, proposing that designed tools or interventions

> …embody conjectures about learning reified in their organization of supports for learning. The study of these embodied conjectures in specific implementations can lead to increased theoretical knowledge about learning by uncovering specific aspects of the instructional context that affect learning. (Sandoval 2004:213-214)

Following this argument, theory assumes a very important role in the present study. On the one hand the ThinkSpace tool is intended to embody particular theories of learning and cognition, which drive its design as well as attempts at particular implementations in the local contexts. Thus the conceptualisation of learning as attunement to conceptual tools presupposes a focus in the design of ThinkSpace activities on gradual elaboration of the concept maps and wiki pages by students to represent their developing understanding and operation with historical concepts. On the other hand, the project seeks to generate design principles of its own, to provide insights into how broader theoretical concepts can be implemented in complex practice situations by investigating the implementation process. To this end a close analysis is undertaken of how the ideas embedded in the

design of ThinkSpace are received by the teachers and students and how theory and practice are mutually reconfigured through the practical engagement with concept mapping and wiki tasks in the classroom. Thus practice and theory become tightly intertwined and must be studied in each other's context.

4.2.1.2 The importance of context

One of the main motivating factors for the emergence of DBR approaches was the limited usefulness of traditional laboratory-based studies in real world context-rich classrooms. Barab and Squire write that for some research questions, which DBR tries to address, the full complex and messy context of the real world is the 'minimal ontology' for which the research variables can be adequately investigated, implying that laboratory conditions would be insufficient to answer these questions (Barab and Squire 2004). This is of great importance for drawing conclusions about the relationships between the embodied theories of the innovation under investigation and the particular implementations of this innovation. Such theorising would be meaningless outside of the complete context of the real world environment.

The complex cultural context of an intervention cannot be engineered in detail (since we may simply not know all the relevant variables), as would need to be the case in order to replicate any given study in a traditional sense (Hoadley 2002). Still, the design effort of the study does not only concern the intervention or tool itself, but also pertains to the context in which the innovation is being inserted. As discussed in more detail in Chapter 2, innovations must take into account the 'social infrastructure' of the environment if they are to function (Bielaczyc, Katerine 2001, 2006). No innovation will be able to operate as intended unless it is inserted into an appropriate classroom culture. Thus, for example, tools that are predicated upon shared knowledge construction will be difficult or even impossible to implement in classrooms orientated towards individual achievement measured by standardised tests. Following this line of argument, the development of the ThinkSpace tool must be seen in conjunction with the development of the social infrastructure of the classroom.

Obviously the social and pedagogical environment of the classroom is not easily amenable to change. The nature of the research project, my role as researcher and outsider, and the scope of the project, further limit the extent to which the classroom culture can be 'designed' to fit the orientation of the tool. However, because such limitations will in some form apply to most DBR projects, and indeed most attempts at innovation in the classroom, it is important to investigate the processes of the introduction and negotiation of technological innovations in the classroom and the gradual shifts in the social infrastructure that these can give rise to.

4.2.1.3 The iterative approach

The iterative approach to innovation in design-based research allows the researcher to make use of these gradual shifts for development of interventions that really work in their particular contexts, as well as make use of lessons learned during the development. This involves continuous cycles of revision, analysis and re-design. The intended outcome of each cycle is "an explanatory framework that specifies expectations that become the focus of investigation during the next cycle of inquiry." (Cobb, Confrey et al. 2003:10).

In the context of the ThinkSpace project, 2 major design iterations were carried out (disregarding the small scale day-to-day adjustments of design within each iteration) each feeding in to the construction of the overall knowledge about the too. The first development study helped clarify the technological infrastructure needed in the classroom for the tool to function, and the technological development of the tool was completed[9]. Furthermore a preliminary analysis of the social infrastructure allowed for a more targeted implementation process in the second classroom-based development study. The second study further developed the uses of ThinkSpace drawing on experiences from the first and more was achieved in terms of integrating the tool with classroom practice as well as extracting principles for further development of the tool.

4.2.1.4 Collaboration with practitioners

The importance attributed to the practitioner's role in the research is the last key feature of DBR to be addressed here. Various interpretations of the role of the practitioner in the research are presented in the literature. These range from very close collaboration (following the principles of action research in among others seeing the practitioner as "a valuable partner in establishing research questions and identifying problems that merit investigation" (Amiel and Reeves 2008:35) to the teacher 'merely' assuming responsibility for instruction with the innovation (Cobb, Confrey et al. 2003). A more detailed discussion of the complex roles the collaborating practitioners played in this project will be addressed later in this chapter. The general principle drawn from the DBR literature on this issue is that the close collaboration between the teacher and researcher "means that goals and design constraints are drawn from the local context as well as the researcher's agenda" (The Design-Based Research Collective 2003:6). This continuous co-construction of goals between the interests and understandings of the teacher and the embodied conjectures in ThinkSpace as well as the designer's understanding of those, determined the implementation of the tool in the two development studies. Consequently the role of the practitioner in the project was also negotiated on the intersection of the teacher's understanding of his context and the researcher's agenda.

[9] This does not mean that ThinkSpace was developed to its full potential technologically, but that no further technological development was deemed viable within the time span and resources of this study.

4.2.2 Action research

Following the ideas of design-based research for the overall framework of the study, action research is a useful framework to guide the two school-based investigations. At this level the principles of action research allow to focus attention on the roles of the individual practitioners involved in the studies, the concrete goals of the particular settings and the subject goals, as well as the micro-level iterations of problem solving and tool development. Zooming in on the peculiarities of each particular case allows for a rich analysis of the processes of development as they took place in the classroom. In other words, the action research sub-studies allowed me to attend to the needs of the particular classroom rather than only focus on overall tool development and theorisation.

Action research is, simply put, an approach to improving education by changing it and learning from the consequences of the changes. It is pragmatically and practically orientated and represents an attempt at instituting research for education rather than about education (Carr and Kemmis 1986; Juuti and Lavonen 2006). Action research is founded on the work of Kurt Lewin in the post war years, although its roots can be traced further back to the Science in Education movement of the end of the 19th century (Masters 1995). In response to a perceived false division between basic and applied social research, Lewin's work emphasised collaborative action and a commitment to improvement of the practitioner's situation (Davies, C. 1993) in order for the research to be able to contribute at the same time to theory, policy and practice (Burgess 1985).

Action research is not a single approach or methodology, rather it can be conceived as a set of overall principles, within which various flavours and emphases of purpose co-exist. The two main traditions within action research are the British tradition oriented towards education and linking research with practice, and the American tradition oriented towards bringing about social change (Norton 2009). What unites all the approaches is the connection of

> …theory and practice (and researchers and practitioners) through change and reflection in an immediate problematic situation within a mutually acceptable ethical framework. Action research is an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention, and reflective learning. (Avison, Lau et al. 1999:94)

The spectrum of purposes of action research spans from emancipatory aims, coming out of the work of Carr and Kemmis on critical educational science (1986), through improving teachers' understandings of their own practice (which can also include a critical stance) (Elliott 1978), to more theory oriented approaches (though still firmly grounded in practice). The present research, while acknowledging that technological innovation, is far from value neutral, does not take an explicitly critical stance, in that changing the teacher's understanding is not the main focus of the development studies. Nevertheless,

the principles upon which ThinkSpace is designed presuppose certain beliefs and attitudes on the teacher's part. Therefore, in the practical work of implementing the tool in the classroom, the teachers' views of teaching, learning and their subject came into focus. Thus, part of theorising the potential of the tool within the larger-scale DBR project, was an explication, discussion and, to some extent, development of the teachers' understanding of their practice.

There is also a spectrum of traditions and understandings of the practitioner's role. In some approaches the practitioner is seen as the instigator of the research project and the formulator of the problem to be addressed, whereafter the actual research is facilitated by an outsider-researcher. In others, sometimes referred to as practitioner research, the teacher is also the main researcher, and action research is seen as professional development (e.g. Sagor 2004). In this project the initiative for the research has come from outside the classroom and the problems to be addressed are – although they may correspond with the practitioners' existing concerns – initially defined by the researcher. However, the goals of the researcher and practitioner are gradually aligned (although not always harmoniously) as concrete goals for practical tasks and activities are developed.

Finally, this project makes use of the key characteristic of action research, which is an iterative approach to research and action. It is conceptualised in the form of a spiral of diagnostic and therapeutic phases which constitute iterations between four stages: planning, acting, observing and reflecting (Kemmis 2007) or in Lewin's terms: planning, execution and fact-finding (Lewin 1946). The main purpose of the iterative structure is to allow for gradual development of solutions to real-world problems, solidly grounded in the reality of the classroom, which is ensured through repeated cycles of reflection.

This cycle of close practice bound iterations, nested within the larger-scale design-based iterations of the overall innovation project was used to guide the day-to-day work in the classroom. In the two development studies, the loops of the spiral typically spanned a small number of lessons (1-3) although they were embedded in longer cycles of reflections spanning whole school terms. The length and timing of the cycles were determined by the interplay of the subject curriculum and the ideas developed between the teacher and the researcher about the potential applicability of the tool. Thus the reflective cycles were typically pragmatically guided, having to fit around the demands of the course, the ideas of the practitioner and the researcher, and in some cases technological development of the tool. The outcomes of these 'micro' iterations were therefore also often pragmatic, in the form of low-level conceptualisations of the usefulness of the tool for particular tasks, improvements in the usability of the technology as well as plans and investigation goals for the next few lessons. These small-scale reflection processes, which often took place at short informal meetings and over email, were in turn feeding in to larger cycles of reflection brought forth in more formal meetings and interviews. The

outcomes of these larger cycles were higher-level strategies for tool implementation, plans for further research and generally more thorough re-thinking of the project path.

4.2.3 Layering design-based and action research cycles

Distinguishing between action research and design-based research, two similar and related approaches, is a useful way of clarifying and analytically separating the multiple and complexly interlinked goals of this study. The relationship between the two approaches follows the structure proposed by Andriessen (2006). Andriessen, working in the field of management, sets out a methodological model combining action research and design-based research at different levels of a research project drawing on the strengths of both approaches. In his view design-based research is directed at addressing a particular type of research problem, namely the 'design problem', which is a combination of an evaluation problem and an explanation problem (Oost 1999, as quoted in Andriessen 2006). The design problem, he argues, contains three possible types of questions: first, what are the effects of an intervention in a given situation? (a question requiring an explorative approach); secondly, how can we achieve certain goals in the given situation? and will a particular intervention lead to certain goals in this situation? (both questions requiring hypothesis or theory testing approaches).

He sets out to outline a methodology for addressing design problems in a way that would contribute to both production of theoretical knowledge and the improvement of practice. His model (see Appendix 2) consists of a knowledge stream and a practice stream, where multiple action research projects (or cases) in the practice stream contribute to the overall theory formulation in the knowledge stream. Thus the action research projects are nested within the larger theorising and development purpose of the design-based research project. Each case contributes to the development of the innovation on a practical level as well as cumulatively adding to the base of situation-grounded findings, from which theory can be formulated at the level of the knowledge stream.

This model is a particularly useful representation for the present work. The distinction between the layers of the project is useful firstly for distinguishing between the focus of the overall project and the foci of each sub-study. Secondly it helps clarify and differentiate between my different roles as researcher, developer of the ThinkSpace tool and actor in the classroom.

In its entirety, the project can be categorised as design-based research, which consists of a number of sub-projects or development cases. The focus of the overall project is expressed in the above research questions, and would in this representation reside in the knowledge stream of the project. Addressing this main focus is only possible by initiating practical studies in real-life classrooms. The two school-based investigations, are seen as action research projects within the wider design-based investigation. Each of the studies will have its own agenda produced in the dialogue between the researcher and the particular teacher and will implement its own solutions. The foci of the development projects are

clearly distinct from the overall theorisation purpose of the project, in that they address practical problems of particular teachers, but the findings feed in to the theorising about the learning potential of the tool.

Similarly the distinction between the knowledge and practice stream of the design-based research project helps guide the evaluation of the status of different types of data collected in the course of the project through connecting them to my roles as researcher and designer at the moment of their collection. Finally it is helpful in disentangling the researcher's complex set of roles. It helps me, as researcher and tool designer, to stand back and critically investigate the different roles I assumed during the different stages of the investigation. Thus it becomes easier to make tacit assumptions, aims and agendas more explicit.

4.2.4 Roles: researcher, developer, participant

In any qualitative study where the researcher functions as an 'instrument' in the data collection (Burgess 1985) there will be a need for careful consideration of the researcher's role, bias and agenda. This is even more the case in design-based and action research studies where the researcher is entering into a collaborative relationship with practitioners in classrooms. The researcher's multiple roles have a tremendous influence on the credibility and trustworthiness of the data gathered in the study. Although it is impossible to completely clarify the researcher's roles at any given time, giving careful consideration to those roles helps map out the status of the different types of data generated throughout the project.

The three types of roles I played in this study were as researcher, designer/developer and participant/ actor in the classroom activities. My main role throughout the project was clearly that of researcher, but that stance was mostly taken outside of the field, when reflecting upon the impressions and data from the classroom. While in meetings with the teacher and in the classroom, other roles were adopted that could better position me to carry out the work with ThinkSpace on site. Thus my reflective researcher role was most applicable to the overall DBR project while in the sub-studies I functioned more as designer and participant than as researcher.

This simplified picture can in turn be broken down into its elements, which reveal more underlying complexity. Within each classroom-based research project there was naturally a researcher element, since the ThinkSpace project was presented to the teachers and the students as research. The teacher and myself entered in a finely balanced relationship in order for both to contribute expertise, while allowing for critique of plans, understandings and outcomes. Throughout both studies I presented myself to the teachers as a designer of the tool and investigator of its potential, but not a teacher or subject expert, thus emphasising the importance of their contributions. As I gained familiarity with the curriculum as well as with the teacher's style, possibilities arose for increasingly detailed contributions

to the planning of the lessons, where I crossed over into a participatory role. Correspondingly, as the teachers began to feel that they understood the utility and potential of the tool for their teaching, they contributed more detailed implementation plans of their own, thus crossing over into a designer role.

Similarly, in lessons, where my main role was as observer and facilitator of the technical workings of the tool, there was a shift in roles. As the technology began to run more smoothly and the students gained familiarity with the tools, less time was taken up by the facilitation of the technology. More of the researcher's time could be devoted to observation as well as conferring with the teacher about the progress of the exercise. The teacher's role similarly shifted as he gained confidence in working with ThinkSpace. He could devote more attention to both the content matter of the exercise, and also to moment-by-moment reflection about the effect ThinkSpace was having on his teaching and the students' learning, thus crossing over into a researcher role. In fact during the lessons in Clover Fields School, the teacher and I began to confer more and more as the study progressed, assessing students' understanding and progress, and making instantaneous adjustments to the lesson plan depending on the progress of the students. This allowed for a high degree of flexibility in the implementation of the tool. While this instantaneous adjustment was an effective way of working in the classroom, it makes the data collection more complex. In any lesson adjustments would be made, making the agreed lesson plans useful but not reliable (in terms of data).

The overall rule that can be applied to the data gathered in this project is that the classroom-based data, such as field notes (made during or soon after lessons), correspondence with teachers, planning notes and notes reflecting directly on the lessons, must be treated as a designer's or participant's notes, rather than abstracted researcher reflections. This data was produced with a specific agenda, which was different from the overall investigative agenda reflected in the research questions. In my roles as participant and developer, I was striving to make ThinkSpace function in the classroom according to my understanding of the utility of the tool. This data, often rapidly scribbled and formulated in emotional terms, allowed for consideration later and was the base for gathering data for more reflective purposes in the form of interviews and artefacts produced by the students.

During interviews, I assumed the role of researcher – although not entirely an outsider-researcher, since I had been working with the interviewees for prolonged periods of time. This familiarity had an impact on the interview process, because the interviewees were familiar with my views and agenda and may have formulated their answers accordingly. While an interview is never a conversation between equal partners (Kvale 1996), this familiarity imposed particular constraints on the interviewees. Attempts were made to diminish this problem as far as possible by emphasising that I would like to know what did not work as well as what did and ask recommendation questions about future use of the tool, in order to allow especially the students express their opinions more freely.

This conglomeration of roles will be reflected in the reporting of the findings. In order to distinguish between the positions that I assumed throughout the project, the different roles will be named. Thus throughout the following chapters I shall refer to my roles as 'researcher', 'researcher-as-designer' or just 'designer' to differentiate between the various agendas.

4.3 Overview of the study

The two ThinkSpace development studies were conducted in two different schools and were each of the duration of one school year. The work on the ThinkSpace project had been underway for two years prior to the doctoral work presented here. It was preceded by two pilot studies:

- 'Proof of concept' pilot, carried out as part of an M.Sc. in E-learning. ThinkSpace was briefly trialled in Park Hill School
- Investigation of teachers' views on history teaching done as part of an M.Sc. in Educational Research Methodology (conducted in other schools).

The data collection spanned a period of two academic years and the lengthy fieldwork period allowed for in-depth work with and reflection upon the design of the ThinkSpace tool. The following diagram outlines the time structure of the fieldwork.

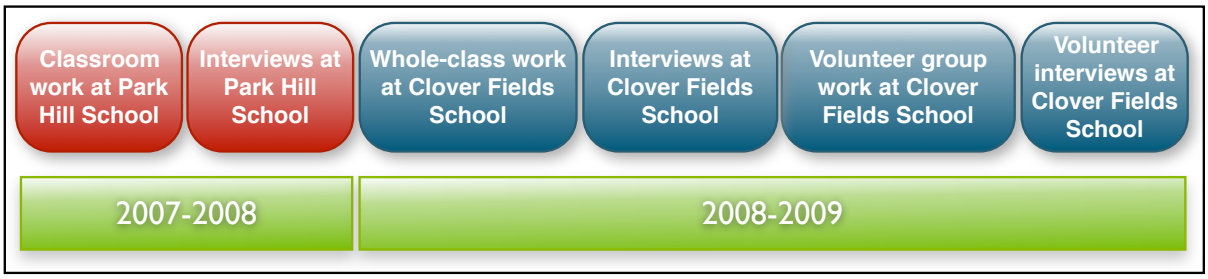

Figure 3: Timeline of fieldwork

The main periods of classroom work consisted of:

- planning meetings and correspondence with teachers developing and detailing practical implementation of activities with ThinkSpace for lessons and homework
- configuration of wiki and concept maps to suit lesson plans and pedagogical ideas
- participation in lessons, which entailed both observation of students and teachers working with ThinkSpace and facilitating the working of the technology
- configuration and maintenance of the technology outside the classroom (in some cases reconfiguration of the technological solutions)
- documentation of student-created wiki pages and concept maps

- reflection and documentation of reflection upon both the progression of the development study within the practice stream and trying to abstract ideas about ThinkSpace to the knowledge stream

During the work in both schools the tool was typically used in 'clusters' of lessons (typically 2-5 lessons) which were designed to fit around the curriculum and other practical concerns. Planning and idea-generation meetings were held before each cluster of lessons and in some cases before every lesson, where the teacher's time permitted. Subsequently meetings were held after lessons to evaluate and chart directions for further work. Above and beyond the more formal meetings, a lot of planning took place in brief stints of conversation with the teachers before, after or even during lessons.

In Park Hill school I was a participant observer in a total of 13 lessons (across 2 participating classes, see below) and a non-participant observer in a further 5 lessons. In Clover Fields school I participated in 10 lessons. The whole-class work ended at Christmas and a voluntary revision group was set up with 4 students to continue ThinkSpace work outside formal lessons. A total of 4 workshops was held with these students during lunch times, free periods or after school.

Students in both schools were interviewed after the completion of the classroom phase of the work. In Park Hill School there was a long gap between the completion of the classroom work in March and the interviews in June necessitated by practical circumstances to do with the timing of the exam. In Clover Fields school interviews with students were held directly after Christmas break and additional interviews were conducted with the four volunteer students in June after their completion of the exams.

The teachers were interviewed in both schools. In Park Hill school two formal interviews were held with the teacher, the second providing feedback and general conclusions about the students' reactions to the work with ThinkSpace.

4.4 Sampling

4.4.1 Selection of subject

The A-level history classroom was chosen as the site for trialling ThinkSpace in this study. The choice of subject was made on the basis of the suitability of the skills and practices valued by various school subjects to the initial purpose of the tool. The characteristics of history learning have been discussed in more detail in Chapter 2. In summary, history was chosen because it requires students to gain an overview as well as detailed in-depth knowledge of the material they study, both of which ThinkSpace is aimed at supporting. Also, history requires students to grasp complex concepts, understand narrative

and analytical representations of events and conduct their own analysis of multi-layered material, which again corresponds to the skills ThinkSpace is theorised to support.

However, history is not the only subject corresponding to these criteria. Many subjects within the humanities and social sciences rely on similar types of thinking and require students to develop similar kinds of skills. Subjects like geography or social studies could have been equally valid choices for trialling ThinkSpace. Therefore history must be seen as one choice among several possible options and the findings from this study as being potentially applicable (in some form and cautiously) to other subjects.

Year 12 was chosen as the level at which ThinkSpace was to be introduced because of the 'step up' in the complexity of the study material from GCSE and from the increased demands on students to develop their skills of analysis and independent thinking. Because the A-level criteria require students to go significantly beyond merely representing received narrative and to represent their own opinions about the material, this was thought to be a productive stage at which to introduce a tool designed to support the construction of representations. The trade-off in working with A-level students was the fact that the students were to sit exams at the end of the year, and that the exam pressure was an important factor contributing to their perception of working with the tool. However the ThinkSpace work was aimed at supporting the students in their preparation for the exam rather than taking the time away from exam preparation.

4.4.2 Selection of participants

The selection of participating teachers was a crucial and tricky decision. Because of the key role the practitioners were to play in the research it was vital to recruit teachers, who would be suitable collaboration partners in terms of interest, time commitment and even a match in character, which is important when initiating prolonged collaboration. Furthermore they needed to be curious and reflective practitioners, open to investigating new directions in their teaching and willing to take risks in a high-stake environment like the A-level classroom. Finally their general ideas about teaching needed, to some extent, to correspond with ideas forming the basis of the ThinkSpace tool.

This challenging combination of criteria was very difficult to fulfil and yet more difficult to sustain. Furthermore, an issue like teachers' attitudes to teaching and learning is something that merits a research project in its own right and can certainly not be judged during a short meeting. Therefore, bearing the above criteria in mind, the final selection of participants bore a highly opportunistic – although targeted – character.

Due to the extensive time commitment participation would entail as well as the need to be able to easily access the school, no specific participation criteria were imposed upon potential participants

(schools or teachers). Such criteria could have been type of school or the practitioner's level of ICT proficiency, but such restrictions were deemed too risky. Therefore the main criterion for participation was the interest on the side of the practitioner in the project and the proposed tool as well as the willingness to enter an open and time-consuming working relationship. Having said that, both the schools chosen, are well within the range of 'typical' English schools.

Both the participating teachers were recommended by a History PGCE tutor at the Department of Education as being open-minded practitioners, who would be interested in developing their practice and who might be interested in experimenting with ICTs in their classrooms.

The first school, Park Hill School (PHS), is a large urban mixed secondary comprehensive school. The school has a good record and attainment is above the national average. The teacher participating in the project, Allan10, was the head of the history department at the time of our work and had over 10 years' teaching experience behind him.

The second school, Clover Fields School (CFS), is a large suburban mixed secondary comprehensive. The school has a very good record and attainment levels at both GCSE and A-level are well above national average. The participating teacher, Thomas, had 6 years' teaching experience at the time of our work and was Lead Practitioner for ICT in the school.

Both schools are located in relatively affluent areas and ICT provision in the history departments was excellent as both teachers had full ICT suites in the rooms where they habitually taught (with a machine for every one or two pupils). In Park Hill the computers were located in a separate part of the classroom and in Clover Fields the computers were distributed along the walls around the main plenary area. In both cases all the computers were connected via broadband to the Internet. Thus in both classrooms access to ICT resources was sufficient and almost instant with no need to uproot the class to relocate to a computer lab. Additionally both classrooms had projection facilities, although in Park Hill the projector sometimes distorted colours, decreasing the legibility of colourful concept maps.

In Park Hill School, two Year 12 groups participated in the study, and in Clover Fields School, one Year 12 group. The following table presents an overview of the participating students.

[10] All personal and place names used throughout the thesis are pseudonyms.

	Park Hill School	Clover Fields School
Participating classes	12a and 12b	One class
Number of pupils	12a: 22 students (one student left during the study and one other joined the class); 12b: 16 students	14 students in whole-class work (one of the students only present in a few lessons), 4 students in subsequent volunteer group
Number of ThinkSpace groups	12a: 7 groups; 12b: 5 groups	4 groups, 1 volunteer group
Interviews	Group interviews: 12a: 2 groups (6 students); 12b: 2 groups (5 students)	Individual interviews: 12 students, repeat interviews with the 4 volunteer students
Unit of study	OCR; Module 2586: European and World History 1789 – 1989; Option: Europe 1890 - 1945 - Period studies; Study Topic 1: **Russia 1894 -1917** (OCR 2002)	OCR; Unit F964: European and World History Enquiries; Option B: Modern 1774–1975; **The Unification of Italy 1815–70** (OCR 2008)

Table 1: Participating pupils

4.5 Methods and data

Overall the methods used in this study can be termed ethnographic. However, in line with the complex research design, the study draws on multiple sources of data and the different types of data have varying status depending on the methods used to obtain them and must be treated accordingly in the data analysis. The main sources of data in this study are

- transcripts of semi-structured interviews (see Appendices 7 and 8 for examples of interview guide and transcript),
- field notes from participant observation in school as well as from meetings with teachers (see Appendix 9 for examples), and
- the physical artefacts produced by the participants on the wiki and in the concept mapping tool (see Appendices 5 and 6).

Furthermore additional material for analysis is drawn from teachers' meeting notes as well as email and Skype correspondence detailing the planning processes and decisions in the school-based investigations. The purpose of the conglomeration of methods is to capture a rich and multi-faceted picture of both the ways the classroom settings operate, the design processes of introducing

ThinkSpace into the classroom, and the students' interactions with the tool. The greatest challenge is to disentangle the issues that my different roles create in different data-collection situations and to assemble the disparate snippets of information obtained through the many different channels into a coherent understanding of what took place in the field.

The following sections outline the main methods of data collection and the status in analysis of each type of data. A later part of the chapter will engage with the processes of the analysis of the data.

4.5.1 Participant observation

Participating in lessons has been an important aspect of the research design. Lessons were both the setting for trialling the tool with the students as well as for gaining an insight into their lives as students and into their interactions with the tool. Thus the classroom setting presented me with interesting challenges in balancing my roles as designer, participant and researcher.

Participant observation is by nature a combination of "two somewhat different processes" (DeWalt and DeWalt 2002) in that participation and observation are arguably differently orientated, although not mutually exclusive. Spradley details the differences between participant observation and ordinary participation in everyday events in terms of

- dual purpose of engaging in situation-appropriate activities as well as observing the situation
- explicit, conscious awareness of the situation rather than tacit perception
- 'wide-angle' perception, paying attention to aspects of the situation which would otherwise be overlooked
- duality of role as insider as well as outsider
- introspection and careful examination of own perception of the situation and
- systematic record keeping (Spradley 1980)

In this study a further dimension is added to this list in that the situation in which I, as researcher, participate is to some extent of my own making, although largely enacted by the teacher. Thus the description of my role in the classroom can be termed designer-participant-observer.

The nature of my participation in the classroom shifted in the course of the two development studies. In positioning myself in the classroom (as opposed to building relationships with the teacher) I presented myself as a 'researcher with a good idea' who would like to 'experiment and try things out' with a tool that may well be helpful to the students' learning. Thus I was (in the first study implicitly and in the second explicitly) proposing an exchange of services: I would try to help the students with their subject learning and they would try to help me with my research. In both studies I differentiated myself from the teacher by assuming the 'technologist' role and emphasising again and again that the

teacher was the content expert. My participation in the classroom was as far as possible restricted to providing technical assistance with the tool as well as explanation of its functionality and conceptual purpose. In many cases it was difficult to distinguish between a technical or conceptual question and a content-specific one, and my presence in the classroom as an 'adult' further encouraged the students to blur this distinction. Therefore many subject specific questions were directed at me. In these cases the students were either referred to the teacher for answers (which I could not have provided in any case) or in the case of task questions, I would try to repeat the task as closely to the teacher's words as possible.

This distancing of myself from a teacher role was largely dictated by ethical considerations of interventionist research in classrooms. While I could be treated as an extra resource in the classroom, I lacked teaching experience and subject qualification. Thus it was important not to influence the delivery of content and to rely on the teacher's approval of any use of ThinkSpace as being pedagogically sound.

Nonetheless, as I gained experience by spending time in the classroom and got a firmer grasp of the content matter, it was possible for me to participate more broadly in the events in the classroom. Towards the end of the second study, I felt confident enough to volunteer quite detailed suggestions about pedagogical moves to the teacher, and on few occasions even content suggestions in application to the work with the tool.

The nature of my participation constrained the type of record that could be gained from a situation. In lessons where I acted mostly as observer, relatively detailed field notes could be written, capturing the proper order of events including interesting quotes, gestures and my perceptions of moods and attitudes. On other occasions, where participation was more intensive, direct observation and note taking had to be confined to moments where my assistance was not required. These lessons had to be written up from short-hand 'scribbles' captured during the action and bear a more sketch-like character outlining the main events in the ways they were retained in my memory. Such notes would be made as soon as possible after the event.

Importantly both the notes made during lessons and those made subsequently must be seen in the light of my agenda as designer and developer of the ThinkSpace tool. The main focus of attention during lessons was to make the tool function in the best possible way, to make the activities run smoothly and to communicate to the teachers and the students the purposes and procedures of working with wikis and maps. This agenda is clearly reflected in the field notes, which at times are of a highly emotional character, reflecting the joys and frustrations of successes and failures as seen through my eyes as designer rather than as researcher. Therefore these notes are good records of the processes of tool design and implementation, but not as evidence of the effects on students of working with ThinkSpace.

However, the events recorded in the observation notes will form a basis in the analysis for understanding the students' interactions with the tool in conjunction with other forms of evidence.

4.5.2 Interviews

Interview transcripts form the main part of the research-oriented (rather than development-oriented) data. A semi-structured interview format was used to allow for a large degree of flexibility, while also facilitating some comparability across interviews by structuring the interview guide around key themes and questions (Arksey and Knight 1999). The comparability was especially sought across the student interviews rather than the teachers', due to the differing nature of collaboration with the two teachers (although, naturally, many of the same themes came up in the teacher interviews, albeit in different formats).

Interviewing, although it can (in the most successful cases) seem like an ordinary conversation, is not a conversation between equal partners – in that the interviewer is in control of the direction of the interview (Kvale 1996) – and it is strongly directed by the goals and purposes of the interviewer. Therefore it is important to think carefully about the relationship between the researcher and the interviewee outside and inside the interview situation, and how this impacts on the nature of the data obtained in that situation.

The most difficult interviews in terms of relationships with the interviewees were the student interviews. These were especially challenging due to the complex relationship I had with the students during classroom time, and (perhaps even more) due to the innovative nature of the ThinkSpace tool. As shall be discussed in detail elsewhere, students came to associate my presence with ThinkSpace work, and correspondingly their attitudes towards the tool would sometimes become their attitude towards me – for better or worse. Thus the interview was at risk of becoming a tense situation, where students may not have felt at ease to express their honest opinions about the tool (which were often not complimentary) to me. Therefore it was very important to have strategies in place to make the interview a productive and honest conversation. The main strategy I employed to attempt to minimise these problems was to put the interviewee at ease as best I could, by looking as little as possible at the interview guide and by asking friendly and interested questions about their progress and their experience at the exams. I reminded the students that what they said would be treated anonymously, emphasised that the interview had an evaluative purpose, that I would like to hear their honest opinion, and that negative answers were valuable to me. To encourage the students to not shy away from negative opinions, I asked specific questions about what the student did not like about working with the tool and as far as possible balanced questions by providing both positive and negative prompts. Where critique was tentatively provided I encouraged it in order to elicit a more full response.

The students' familiarity with me could, on the other hand, also play a favourable role in the interview, in that students who would normally be wary of being interviewed by strangers, would be willing to talk more freely. The overall feel of the interviews was that the students were relatively comfortable in talking to me, and many offered quite substantial and thorough critique of the work we had done together. With most students the interview was an enjoyable experience, as evidenced by the chatty and empathetic nature of the conversation.

Group interviews were conducted with students at Park Hill School and individual ones at Clover Fields. The group interview strategy was adopted in the first instance to allow the groups to talk about their collaborative work as a team – which proved to form a very small part of the conversation, and was therefore abandoned in the second study. Furthermore, a group interview strategy was seen as more time-appropriate in the first setting, whereas I felt more comfortable with gaining access to students' time in the second school.

Teacher interviews were of a very different nature, in that they were framed as conversations between collaboration partners, rather than classic research interviews. The purpose of these conversations was to evaluate the work, which had been achieved with ThinkSpace and to assess our progress. Nonetheless, the conversations still reflected my role as researcher, and in the nature of the discussion, it was evident that the teachers' and my roles, agendas and interests were different due to our different positions. Also in these interviews it was very important to impress upon the interviewee that their critique was as valuable (if not more) than any positive conclusions. These conversations were also spaces for the teacher to take the time to reflect upon our work, which may not have been feasible during the hectic day-to-day planning. Therefore, the teacher interviews were treated as much as opportunities for reflection, musing and disentangling thoughts, as opportunities for critique and well-formed opinions. Because these interviews were longer than the ones with the students, time could be taken to puzzle over impressions and experiences as project partners, while at the same time provide different viewpoints from our differing stances as mainly-practitioner and mainly-researcher.

All interviews were audio recorded and then transcribed. The style of transcription was aimed at capturing the meaning and spirit of what was being said in a way which would later signal this meaning to the researcher. Therefore there was no systematic recording of minute features of the conversation such as the length of pauses or 'umms' and 'errs', such as might be the case in transcripts for conversation analysis or related approaches. Rather features of the interviews were recorded which were perceived to be important to the meaning of the conversation, such as capitalisation of certain words for emphasis or '...' notations for significant pauses.

4.5.3 Physical artefacts

Physical artefacts gathered in the course of the study provide the least interpretive part of the data. All activity on the ThinkSpace tool was automatically recorded on the wiki and in the concept mapping software. This part of the data consists of:

- Wiki logs detailing all editing activity on the wiki which was more than one hour apart (this means that the wiki saved a new version of a page when it had been edited, but did not record multiple saves within one hour, thus excluding page-saves that were close together – typically one person's work in progress). Potentially this lack of fine granularity can obscure fine details of collaboration, where two or more people edited the wiki almost concurrently. This means that the wiki logs definitely do not capture the collaboration that took place in the classroom during lessons. This is not considered a major issue, since many groups collaborated by discussing their work and then typing it in together, which could not be represented in physical logs. What the logs do capture very well, are the instances of out-of-class collaboration.
- Map snapshots showing the development of the maps. Gliffy automatically saved a version history of the maps, activated every time the user saved a map. Thus the detail or granularity of the version history depended on the user's saving pattern.

4.5.4 Correspondence and incidental data

Finally all correspondence – email, paper and Skype, as well as lesson plans and materials were gathered. Some of the correspondence – for example the Skype chats with Thomas at Clover Fields School – was treated like data for analysis, because it is in its nature a record of planning activities between the teacher and myself. Such correspondence was highly relevant and also often more accurate and detailed than my own records of planning conversations in the field.

The rest of the correspondence and the incidental materials were kept to help provide a contextual frame for the main data analysis. This data helped outline when events took place, what materials were used, give a picture of some of the time and technical constraints that the development projects faced and give an insight into the developing relationships between the teachers (as well as in some cases, the students) and myself.

4.6 Validity issues

Some researchers, like Lincoln and Guba (1985) argue that the traditional terms of validity, reliability and generalisability are not applicable to qualitative research because they are "dependent for their meaning on the conventional axioms, such as naïve realism and linear causality" (Lincoln and Guba 1985:293). They propose the definition and use of alternative terms: namely 'truth value',

'applicability', 'consistency' and 'neutrality'. Robson (2002) on the other hand, argues that rejecting the relevance of 'validity' and 'reliability' for qualitative social research, equates to suggesting that this research is in fact less valid or reliable than traditional quantitative approaches which have provided the definitions for the terms. He proposes instead to operationalise these terms in ways more appropriate to the requirements of qualitative work. Therefore these terms shall be used here in the discussion of how this project seeks to minimise potential threats to its validity.

Issues of internal validity are the most important to address here. External validity can be seen as being reasonably secure in design-based and action research studies, due to their being firmly embedded in the real-life context which they purport to study (Bell 2004; Cassell and Johnson 2006). The main issues of internal validity to be investigated lie in the effects I as researcher have on the research setting and in the quality of the data produced in the study.

How can the findings of this study be claimed to be valid, when I as researcher, in fact create the situation that is being studied? Hammersley and Atkinson (2007) argue that it is impossible to remove the researcher's influence on the production of data and certainly in the case of the present research little option is left for claiming a detached view of the situation. According to Hammersley and Atkinson reflexivity is a key feature of social research in that the researcher will always be a participant in the setting in one way or another, and will always be influenced by his own history and agenda, as well as influence the situation he studies. Acknowledging this feature of social research allows us to exploit it: "how people respond to the presence of the researcher may be as informative as how they react to other situations. Indeed, rather than engaging in futile attempts to eliminate the effects of the researcher completely, we should set about understanding them" (Hammersley and Atkinson 2007:16). The present study makes full use of this principle – there are multiple instances in the data that in different ways document the participants' reactions to my presence (my own reflections and observations, my emotional recordings of 'fears of rejection' in the second setting, students talking about their reactions to me in the interviews etc.). These are treated as valuable indications of the nature of the situation rather than attempting to eliminate them as 'noise'.

The multi-method approach in this study affords opportunities for ensuring the validity of the conclusions, through triangulation of the sources and of methods of generating data (Miles and Huberman 1994). Triangulation of sources was sought by interviewing both teachers and students about their work with ThinkSpace. Furthermore, informal conversations with the teachers after lessons invariably included the teachers' assessments of particular students' reactions in the lesson and comments on their progress, attitudes, situations and other traits. Such conversations provided the teacher's perspectives on individual students, which could feed in to an understanding of subsequent student interviews or student performance in class. Data generated by multiple methods can also be triangulated to provide a rich and credible picture of the situation. Findings from interviews can be

held up against records of the same events in observation notes as well as in the traces of these events in the wiki/map logs. In combination, multiple sources as well as methods of obtaining data, provide opportunities for creating a multi-faceted picture of the development projects.

4.7 Ethical considerations

The main ethical consideration in the present project was to ensure that the students' education was not disrupted by participating in the study. This was especially a concern because of the high-stake nature of A-levels in the students' lives. It could even be argued that A-level is the worst possible time to start experimenting with new ways of teaching and learning because the outcome of A-level exams has such an impact on the future of the students.

Therefore steps were taken to ensure that any such experimentation would be done in a responsible manner and to ensure that there would be no adverse effects on the students' examination results. The ethics strategy adopted in this study, in line with the overall research design, was that of close collaboration with the teacher. Any plans for innovation on the conceptual, theoretical and practical levels were formed in collaboration with the teacher, thus drawing on his expertise for ensuring that teaching standards were being maintained. In the classroom, the changes introduced in connection with this study, were acted out by the teacher. As discussed previously, the researcher's participation in the classroom was as far as possible limited to technical assistance and the interaction with content delivery minimised. Furthermore, the teacher's understanding of this approach was sought through frequent mention of his role as the pedagogical and subject expert and by, where possible, seeking his advice in those terms. Also to the students it was repeatedly emphasised that the researcher was merely there to help try out new ways of working, and that the teacher was the one in charge of the classroom at all times.

This strategy was also applied to dealing with students' at times negative reactions to working with the tool. The teacher's expertise was sought to determine what the appropriate plan of action should be in such cases and how the students' reaction should influence further work with the tool.

The second main ethical concern was to ensure that the information provided by the students in confidence during the interviews was not misused. The students were encouraged to speak freely and to openly criticise both the tool, myself, the teacher and the school. Although adverse comments were not sought in their own right, encouraging critique could sometimes result in bringing up issues of personal dislike or dissatisfaction with aspects of schooling. On the other hand students' critique of working with the tool could turn out invaluable insights into their ideas about school – as well as about the teacher's approach to teaching.

A very fine balance needed to be struck between using the information provided by the students to elicit more detail about certain aspects of the project from the teacher (as well as triangulating the findings), and maintaining the students' confidence by concealing their identity. It was important to take into account that the teacher would be easily able to guess which student had made a particular comment.

The strategy adopted in this case was to seek to distinguish between general comments about work with the tool and more personal utterances. Also, when it was desirable to triangulate a student's opinions about the project, the teacher was often keen to give his assessment of the student's progress and attitude without entering a deep discussion of that student's utterances in the interview. This way individual students could be discussed from the teacher's point of view and their confidence could be maintained. Finally, during the student interviews efforts were made to relate students' comments to the work with ThinkSpace, technology or view about learning in general, so as to encourage constructive critique rather than personal criticism. Overall this issue, although potentially tricky, could be reasonably well balanced because of the nature of the project, which almost exclusively concerned students' study of history rather than more sensitive personal matters.

Chapter 5: Description of classroom work and analysis of the data

This chapter presents a narrative account of the work in the two classroom-based development studies. This is a necessarily interpretive account aimed at presenting a coherent picture of the work. It includes the main characteristics of the two studies, the general order of events and attempts to convey a 'feel' of the work in the two classrooms. It would be impossible to represent all that happened in detail here, however this account aims at providing as thick a description as possible and will form the basis for the subsequent presentation of the findings.

The narrative description of each of the two studies is accompanied by a tabular overview of the events attached in Appendix 4. These tables present a more systematic view of the events in the two classrooms than is presented in the narrative account below. The overview is referenced in the text of this chapter by using lesson and meeting numbers indicated in the tables as well as table row numbers prefaced by the # symbol. The combination of the narrative and the separate overview is aimed at providing a good sense of the events in the two classrooms without excessive and unnecessary detail.

5.1 Development study 1 - Park Hill School

5.1.1 Phase 1: September-October 2007

The initial planning of the first lessons with ThinkSpace were aimed at outlining an overall pattern for woking with the tool. To this the researcher proposed a general scheme which could form the basis for more detailed planning of individual lessons. This scheme represented 'loops' of work which would correspond to areas in the curriculum chosen by the teacher.

1) Divide the class into groups of 3 […]

2) After a chunk of the syllabus has been completed, give each group 3 different pieces of reading (one for each group member)

3) Each member of the group finds the one or two main concepts in the reading

4) Each member of the group writes (as homework) a wiki article about that concept

5) The group get together in the next lesson and present the wiki articles to each other

6) They put their concepts on the map, discuss the links between them, and find links within the wiki articles.

End of loop.

The next loop produces a new set of wiki articles and concepts that must be integrated into the existing map and wiki.

Box 1. #1: Scenario presented to Allan in Meeting 1

This scenario was aimed at representing the purpose of ThinkSpace in that it incorporated a blend of in-class and at-home work, analytical challenge in finding the main concepts in the material, collaborative elements and integration of visual and textual representation of knowledge. On the other hand it was seeking to take into account the practicalities of the classroom with limited time for research and writing in class and the opportunity for the teacher to facilitate the most complex stages of the work.

This scheme was altered in the next meeting, and it was decided that the ThinkSpace work should take place primarily in class. The first few lessons would revolve around the reasons it was difficult to govern pre-revolutionary Russia, and the students would need to understand what difficulties were presented to the rulers by factors like the country's geography, social structures and style of agriculture. Each group of students was to write one wiki page on their assigned concept or factors so that the students had time to go in depth with one topic and draw on the other groups for the broad picture of the curriculum.

This was the scheme used in the first two lessons with 12A. However, when evaluating these first lessons, it was decided to alter the corresponding lessons for 12B. There each group would be asked to complete an overview of the whole curriculum topic with 7 pages corresponding to 7 factors, thus assigning multiple pages to each student. In the first lesson with 12B there was a fault in the mapping software due to the software setup on the school network, which necessitated the lesson to be re-planned 'on the hoof' and starting with the writing of wiki pages rather than with the mapping as planned.

The first phase concluded with a lesson where 12A did powerPoint presentations about the problems of governing Russia. At the end of this lesson Allan introduced a homework assignment which had not been previously discussed with the researcher, and which marked the beginning of the divergence in our views of the utility of the wiki. He asked the students to construct essay plans and then upload them to the wiki for him to access. This appropriation of the wiki seemed at odds with the purpose that the researcher was trying to put across and represented the teacher's shaping of the tool for his own purposes. This assignment was not completed by any of the students and no essay plans appeared on the wiki. A few weeks later, however, when the students were writing their essays, two students (one from the A and one from the B group) emailed the researcher requesting reminders on how to access the wiki. One of the students specifically asked for access to other groups' work.

At the end of this first phase of work it was clear that the technology underpinning ThinkSpace had been a major obstacle in the classroom due to the technical problems experienced in almost every lesson, and it was clear that alternative technological solutions should be sought. The students' engagement with the tool was also weak, as evidenced by the lack of essay plans, although some were accessing the work on the wiki for the construction of their essays.

5.1.2 Phase 2: November-December 2007

By the beginning of Phase 2 a new wiki was set up in order to facilitate better opportunities for collaboration and the students' wiki pages were transferred by the researcher. At this time Allan was swamped with work but he still managed to devote a considerable amount of time to the project. In Meetings 4 and 5 we started formulating the next mapping task, which was to be given to the students towards the end of the second phase of work. In both meetings we grappled with the role the map should play and what should be represented on it. In the first few lessons of this phase however, the students were to use the wiki rather than concept maps.

In Lessons 6 and 7 (one with 12A and one with 12B) the new wiki was presented and the students were set a note-taking task as homework, which Allan had finalised without the involvement of the researcher. This task again showed a departure from the researcher's ideas of the purpose of the tool. It focused on distributing the responsibility for the note-taking between the group members. The reason Allan gave the students for departing from the traditional note-taking routine was that the wiki would enable the students to better memorise the material because it required repeated reading of their own and their peers' writing. There was a better rate of participation in this task (however it is impossible to ascertain whether the students did indeed read their peers' wiki pages, and the later interviews suggested that this was not the case). The resulting pages were most often bearing a title corresponding to the question and therefore resembled traditional essay-type tasks rather than concept-oriented wiki pages.

In our next meeting we finally made significant progress in our thinking about the role of mapping and produced a map, which was a 'target' for expansion of the initial map the students made during Phase 1. Allan used one of the more successful student maps as a 'core' of his map and expanded it with the topics for the next part of the curriculum.

At the beginning of the next pair of lessons (again, one with 12A and one with 12B) Allan showed the 'target' map and the students set about integrating the new concepts into their existing maps following the Allan's example. In 12A instead of expanding their own maps, three of the student groups chose to copy the 'core' map, which Allan had used, from their fellow students' web11. When later asked about this in the interview the students explained that the previous phase of mapping was all but forgotten at this time and it seemed an easy shortcut to copy the map used for demonstration rather than to try to remember the logic of their own maps. Although most of the groups did produce expanded maps, some students seemed to try to memorise the example map rather than engaging with the thinking required to reproduce it - one student even tried to take a picture of the board with his mobile phone.

In this phase of work the engagement with the tool was not very strong and Allan also seemed to be having trouble using the wiki. Allan started lessons 8 and 9 by projecting some of the work the students had completed on the wiki onto the whiteboard. However he was having trouble finding students' work, and many students - especially in 12B - could not remember where they had saved their work. Also in Lesson 7 with 12B it was evident that some students were resisting further work with ThinkSpace. One student expressed general discontent about using computers and another complained that she had no internet access at home and asked to submit her homework on paper. However, Allan stood firm arguing for the merits of using technology and persuaded her to do it on the wiki.

5.1.3 Phase 3: February-March 2008

At Meeting 8 at the beginning of Phase 3 I focused the conversation on exploiting the opportunities for collaboration presented by the technology, which I felt had not been exploited so far. I proposed using the wiki to work with sources – especially pictorial sources, following leads in the literature suggesting that students were sometimes more willing to collaborate on pictures rather than written text. Allan took up the idea of using the wiki for source work, but preferred to do it with textual sources. I also proposed a work scheme for a peer review task, where the students would be tasked with reviewing each other's wiki pages according to a number of criteria. This idea was also taken up, and I subsequently drafted scaffolds or guides for both the source work and the peer review tasks.

[11] A 'web' is an area on the wiki assigned to a particular group.

The source exercise was the first one to be presented to the students in Lessons 11 and 12. Identical sets of textual sources had been uploaded on each group's web with the source work guide underneath. The students were asked to answer the questions in the guide in their groups in class and append their comments to the snippets of source text. The wiki as a choice of medium for this task was doubtful. The advantages that using the wiki presented over paper were: allowing the students better access to each other's work, and giving the teacher better access to students' work. None of these were utilised because the work took place in class. In fact Allan handed out print-outs of the task identical to what could be seen on the wiki page. Some of the more outspoken students in 12A voiced their discontent with the task and refused to use the wiki, but wrote on the paper instead.

The next pair of lessons (Lesson 13 with 12A and a corresponding lesson with 12B in which I did not participate), revolved around a card sort activity and whole-class discussion. Here Allan handed out a note-taking exercise to the students to complete at home, which was framed so as to lead up to an in-class debate event. This exercise was compiled by Allan shortly before the lesson without the participation of the researcher. Its focus was on individual note taking and the collaborative element had only a modest place in the task (and in fact was never followed up in class).

> Using pages 81 - 99 in Lynch, you will each make notes on the events of 1917 [...]. When you have completed them, please cut and paste them into your wiki group area under the heading "February to October 1917" followed by your name. Before we meet on 25th February, read the notes of the other two members of your group, and add your comments in red or in the margin.

Box2. #22: Extract from note-taking exercise handed out to students on 11/2-08 and 13/2-08

Also in this case, the main advantage afforded by technology over paper consisted in providing the students access to each other's notes, as well as allowing the teacher to keep an eye on the students' progress at any time.

This task had a record low participation rate with only four (out of 38) students putting their notes on the wiki (although a few others had done their notes either in Word or by hand). The remaining students were not chased for their work. Furthermore (to the best of my knowledge) a test also outlined as part of the task did not take place. Finally, none of the students had posted comments to the few notes that had been uploaded to the wiki and there was thus no evidence of collaboration around this task.

The next few lessons were more successful than the note-taking exercise. I had finally found an online mapping software (Gliffy), which allowed me to bypass the school IT system and which also integrated more seamlessly with the wiki. In Lessons 14 and 15 the students were asked to map the events of 1917 on a fresh map. In these lessons there was finally a buzz about the technology and the

students seemed to derive pleasure from working with it. Many groups were experimenting with shapes, colours and pictures (some productively, others less so) and the students seemed pleased to find the maps instantly appear on their wiki pages. At the end of the lesson with 12A (but not with 12B) Allan called the groups up to the board to present their newly constructed concept maps.

The presentations were indicative of the conceptual understanding the students had of the period. One especially able group produced what Allan in the interview called a 'textbook level diagram' and in their presentation it was clear that they possessed a good grasp of the material and used the map to display it. The maps seemed to function as helpful presentation devices for the students.

The final set of lessons that I witnessed in the classroom at Park Hill were dedicated to the preparation and staging of a debate. Allan insisted that the speeches must be individual assignments because they would count as part of the assessment of individual students' progress. To merit the use of the wiki for this exercise the pages set up for the debate speeches were set up on the basis of the peer review scheme. Only three students uploaded their speeches onto the wiki (although others had again prepared theirs in other formats), and again no comments were posted by other team members as way of critique. Although they were meant to be used for assessment, Allan did not chase the students for written versions of their speeches, and instead was satisfied by letting most of the students present their knowledge orally in the debate.

Although more work with the tool had been initially planned, the students' exam was set earlier than expected, and therefore there was no time for another phase of ThinkSpace work.

5.2 Development study 2 – Clover Fields School

5.2.1 Phase 1: September-November 2008

After having done a brief 3-lesson pilot trial with the tool in the summer of 2008, the work proper started in September. From the pilot important lessons were learned about the need to introduce the tool gradually and to simplify tasks as much as possible. The technology was also tested on the school system and ran reasonably smoothly.

In the first meeting we carried out a mapping workshop, where Thomas drew an overview map of the first part of the syllabus for the course. The challenges in aligning Allan's and my understandings of concept mapping in the previous study had highlighted the need to establish common ground early on and during the pilot work with Thomas drawing maps together proved a productive exercise. Using the resulting map we could begin to make overarching plans for which parts of the syllabus would be suitable for using ThinkSpace and in what ways.

We decided to introduce the wiki first and bring in the concept mapping separately later. In the first lesson, after a brief introduction of the tool and its purpose the students started by creating wiki pages about concepts pertaining to the first Key Question on the syllabus. Regardless of technical problems we were having with the school network (unrelated to ThinkSpace), the students seemed to concentrate on the task and give the wiki a chance.

In the beginning of the next lesson a prize was awarded to a James for being a 'wiki star' because his contributions were of high quality and he had created links between pages as well as edited another student's material. Thomas then spontaneously asked me to create a new map on Gliffy because he had had an idea on how to bring mapping into the work. He brain stormed concepts pertaining to the Key Question with the class and put them in a 'parking lot'12 on the map. Students were then asked in pairs to find links between pairs of concepts which were added on the board. Thomas emphasised that the map was a tool for arguing connections: "we're not just talking about lines on paper, we need to justify [what the links are]" (CFS Field notes). He also made an effort to connect the abstract conceptual ideas to the curriculum by probing the students for concrete examples. For homework the students were asked to write wiki pages about the concepts on this map.

Most of the students added content to the wiki at home and before the next lesson the wiki writing had gained speed. When asked whether he had somehow spurred the students on, Thomas gave the following assessment of the situation:

> Jaffa Cakes. And individual attention. I went through the wiki on my own whilst they were taking some notes on something else and made comments about it as they worked - I helped out with a few technical issues, and sent them off. A bit of praise goes a long way!
>
> I stressed that there didn't have to be long articles, and that in many ways this wasn't about getting everything down, but a way of reviewing and clarifying their thinking.

Box 3. #4: Email from Thomas 30/9-08

In Lesson 3 concept mapping was introduced and the students were given instructions on how to use Gliffy. The groups were then asked to find the main concepts in snippets of text they were given about various Italian intellectuals at the time of the Unification. Although the students seemed to have a hard time concentrating in this lesson, all groups managed to produce concept maps (of varying quality) and - just like at Park Hill - there was a little buzz of excitement when they found their maps were 'magically' appearing on their wiki webs.

[12] A 'parking lot' is a concept mapping technique proposed by Novak and Gowin. Concepts are written in a list where they are temporarily 'parked' before including them in the web of propositions on the map.

The mapping continued in Lesson 4, where the students were asked to concentrate on just one of the intellectuals (Mazzini). The map created by one of the groups ('the Carbonari') who had chosen Mazzini in the previous lesson was copied onto the other groups' wiki pages and the students were asked to expand and enhance this map. Little was added to the maps above and beyond simplifying names of concepts and links. The students were also asked to write wiki pages about some of the concepts on the Mazzini map, which they started doing in the lesson. This task was not very well thought through and we did not manage to explain the mapping task clearly to the students.

In Lesson 5 the students were shown how to link the wiki pages to concepts on the map. The students proceeded with writing pages about concepts related to Mazzini and linking them to their maps. Although Thomas mentioned in the follow up chat that he saw interesting discussions emerge during the group work, using ThinkSpace seemed to be conceptually difficult for the students. There were also some unproductive uses of the tool: Johanna - a quite able student - seemed to be playing with fonts and pictures rather than engaging with the substance of the material, which Thomas interpreted as a sign of resistance to using the tool.

Lesson 6, the last before half term, was spent finishing the Mazzini maps. The central concept on the map was changed from just the name 'Mazzini' to 'How important was Mazzini?' – to function as a homework essay question. The mapping activity was directed at turning the maps into operationalisable essay plans. The students were asked to make the links into logical chains of argument which could be readable as 'sentences' and would 'make sense'. Thomas modelled the mapping task on the board providing an example chain of links, which could form part of an argument. Still, the task was difficult for the students to understand. At the end of the lesson Thomas projected the groups' maps onto the board and read through their maps to demonstrate how usable arguments for essays could be formed from the diagrams. One group in particular, 'the Marinari' group, had succeeded in conveying their point of view in their map. In a subsequent email assessing the quality of the student maps, Thomas wrote:

> At first glance they seem very basic […] They are descriptive rather than analytical. This might not be a bad thing in itself - they could well be part of the process by which they come to know the material more thoroughly. However, I would have liked to have seen more judgement, and less stating of facts.
>
> The Neopolitani show some judgement - at the bottom there's a comment that Mazzini failed to inspire the peasant classes. However, the only map, as far as I can see, that comes close to forming an argument is that of the Marinari - given that they clearly focus on the lack of support from the peasants.

Box 4. #10: Email from Thomas 3/11-08

5.2.2 Phase 2: December 2008

After extensive planning over email and Skype (##10-13), Thomas and I agreed on a three-lesson scheme for the next round of work, which would begin with using the tool for source work. The source work scheme would then feed into a mapping task, which again should enable the students to use their work in ThinkSpace for planning an essay.

Lesson 7 started with a whole-class dissection of a pictorial source. Then the students were directed to the wiki, where five sources (including the pictorial one) were pre-loaded on separate wiki pages on each group's web. Underneath each source was a comment field, where the students were asked to post comments in reply to the following tasks:

> - ask a question about the source, it's meaning or provenance […]
>
> - explain how this source helps us to understand one reason why the revolutions fail
>
> - assess the weight of the source in persuading us about the reasons for the failure of the revolutions
>
> - or answer a question posed by another person.

Box 5. #12: Email from Thomas 3/12-08

The students' comments would appear on the wiki page in the order they were posted thus providing a record of individual contributions as well as an opportunity for students to have written discussions. In Meeting 3 held directly after the lesson Thomas analysed the comments and posted replies praising good work and suggesting alternative angles or possible improvements. These replies were used in the beginning of the subsequent lesson (Lesson 8), where the students were directed to their computers to read and reply in turn. This produced another iteration of reflection upon the sources.

The next task during Lesson 8 was to create concept maps that assessed the relative importance of a number of factors for the failure of the 1848 revolution. The factors were to be plotted on the map, their interconnections shown, and additional concept 'bubbles' representing the sources (from the previous lesson) added in order to show which factor's importance each particular source supported.

Lesson 9, the final lesson of the whole-class work was dedicated to completing the maps and focusing them on answering the upcoming essay question. Thomas asked the students to represent on the map - by either spatially arranging the concepts or by colour coding them – which of the arguments or factors were in support and which were countering the statement that 'weak leadership' was the most important factor for the failure of the revolution. Then the students were asked to outline their main argument in a short paragraph on the wiki page underneath the map. This should function as their

introductory paragraph for their next essay. Thomas later referred to this lesson as being the most successful one because the majority of the students were engaged in complex thinking and the groups who were struggling the most were not afraid to say so and to ask probing questions.

5.2.3 Phase 3: Volunteer-group work – January – May 2009

Thomas and I agreed that whereas some students seemed to be resisting working with ThinkSpace, others were quite enjoying it, and that we should give those students an opportunity to continue on a voluntary basis. All students were invited to participate and four of them (Alice, Ben, Caroline and James) expressed their interest. We set up a 'Revision club', which met four times after lessons or during lunch hour.

For the first group meeting a new web was created on the wiki called 'Revision web' to signal to the students that this was something that they could build towards their exams. This web was structured around the four Key Questions of the course. The setup of the meeting was aimed at creating a serious but friendly atmosphere and to encourage the students to take ownership of the project.

In the first meeting it was agreed that information should be transferred from the old group wikis to the new one as way of revision and to structure the information better. The pages that subsequently appeared on the Revision web were almost exclusively created by James and Ben and many of them were edited collaboratively by both students – something rarely seen previously. This collaborative writing often went beyond mere division of labour, but clearly shows that the two students read and attempted to improve upon each other's work by altering the wording and adding information to the pages. Later, when preparing for a mock exam, another quite extensive phase of wiki writing took place.

In the second meeting, attended only by the two boys, the question of mapping was raised. James doubted the usefulness of the mapping, but was willing to give it another go. Following on from his query, the two subsequent meetings were mapping workshops.

In advance of the third meeting I proposed to Thomas a plan for the mapping activity which was similar to the last mapping lesson before Christmas in that the students were asked to rank-order factors in terms of importance. Thomas agreed with the task and this activity gave rise to a very interesting episode where James and Alice disagreed about the rank-ordering of the factors. The two engaged in a productive discussion, while Caroline seemed puzzled and incredulously asked Thomas: 'do you want us to argue?!'. The teacher found this a very telling comment: "they still want to be told what they need to know, want to know the right answer" (Field notes, 1/5-09).

This mapping workshop seemed to change James' mind about mapping. At home he continued working on the map we had started in the workshop, expanding it, adding new concepts, links and

notations (e.g. link colours), as well as creating a wiki page to house information about one of the concepts.

The last workshop was run along the same lines as the previous one, mapping out another Key Question – although we did not get as far with the activity this time. Thomas was pleased with how the two workshops had gone and proposed that I come along to the lesson immediately after the second workshop where we would try to replicate the mapping exercise with the whole class.

There was a marked difference between the atmosphere in the wiki club meetings and in the whole-class session. It was very clear that many students were disconcerted at my presence. While Thomas presented the achievements of the wiki club on the board, most of the class were looking down into their desks rather than at the board. The students were then asked to contribute concepts to the map about one of the key questions. The class were very unwilling to volunteer anything, and Thomas resorted to various 'tricks' to get the discussion going (such as voting and getting the students to write their concepts on paper and then read them out). In this context Caroline stood out taking initiative and speaking more freely than she had done in the revision group workshops. Here she took the lead in the discussions of the map and was clearly trying to set an example to her classmates of how the task should be approached.

During exam revision time James (and also to some extent Ben) returned to the wiki. Whereas there is no evidence of students outside the revision group coming to read the material on the wiki, comments from the volunteers during the interviews suggest that a number of the other students turned to the maps and pages on ThinkSpace during revision.

5.3 Analysis of the data

The two classroom based studies and the subsequent interviews with students and teachers resulted in a large body of data. This data was primarily in the format of field notes, meeting notes, logs of Skype conversations, interview transcripts and records of mapping and wiki activity. This section will discuss the approach to bringing together all these sets of data and the analytical processes that lead to the formulation of the findings discussed in the subsequent chapters.

The overall approach to the analysis of the data was primarily inductive and iterative. Because no *a priori* theoretical framework was used to guide the data analysis, the main focus in the analysis was on the interaction between the data and the research questions asked in this study. The data was gathered over a relatively long period of time, the total fieldwork period spanning almost two years. This allowed for some degree of interaction between data analysis, study design and data gathering, which Hammersley and Atkinson (2007) call for. The design-based nature of the study presupposed some analysis of the data between the two case studies in order to inform the design of the second iteration

of classroom work. This part of the analysis was focused primarily on the design goals of the project and therefore most of the formal stages of data analysis took place after the end of the second classroom study. However, because of the extended duration of the field work, a large amount of informal analysis took place during the data collection in the shape of note-taking, discussions with supervisor and peers, as well as with the second collaborating teacher, Thomas. In fact the data gathering can be seen as part of the analytical process in that I as researcher had to make decisions about what to record and how to represent the events I was witnessing.

An interpretive approach is taken to the data analysis, where the researcher is taken to be an instrument of the data collection (Burgess 1985), and the data gathered are taken to be constructions rather than given entities which were just picked up by the researcher. The analysis is therefore, in Lincoln and Guba's terms, 'a reconstruction of those constructions' (Lincoln and Guba 1985:332)

Due to the researcher's complex set of roles, which was discussed above, these 'constructions', were captured from multiple viewpoints and had multiple underlying agendas. Therefore the main objective of the analysis was to reach a valid and trustworthy representation of the events in the two classrooms, which would take into account the voices and agendas of the teachers, students and the researcher in my multiple incarnations. At the same time, the multifaceted focus of the study, encompassing both teachers and students, their expressed views as well as behaviour in the classroom, and relating this to technology as well as pedagogy, meant that the data was complex and contained an intricate web of connections. Therefore a lot of effort was directed towards making sense of the data and building a picture of the two studies, which was both true to the multiple sources of data, the researcher's experience as well as focused on answering the research questions. 'A coherent interpretation' rather than 'the one true interpretation' of the data was the aim of this sense-making process. To ensure the validity of the claims made on the basis of this interpretation, however, the main principle followed was to create a thick description (Denzin 1989) of the two classroom studies through the narrative account (presented in the next chapter) as well as throughout the presentation of the findings - or at least as 'thick' as possible given the space constraints of the thesis.

Three main types of data were the focus for analysis: the interview transcripts with teachers and students, the field notes from classroom observations and meetings with the teachers, and the artefacts and their traces produced by the students during the study (wiki pages and maps, as well as the statistics recorded on the wiki and mapping software). The first two categories were textual data and were treated in similar ways. The last category underwent a separate set of analytical procedures. Both sets of data underwent descriptive and analytic treatments. These stages were not hermetically separated and were in many cases iterative, as questions arising during an analytical stage demanded new descriptive stages.

5.3.1 Descriptive stage

The first step in the analysis was a descriptive stage aimed at gaining an overview of the events in the two classrooms and beginning to formulate working hypotheses about what answers the data might yield. This descriptive exercise must be seen as part of the analysis, because it was part of the 'reconstruction' of the data and was by no means a neutral exposition of the events.

The data was subjected to a number of reduction and display treatments, advocated by Miles and Huberman (1994). The exact form of these treatments was derived from the purposes of the study rather than adapting any existing frameworks. The focus of these displays was on getting a good grasp on the events in the two classrooms, so that these could later be interrogated in light of the data from the interviews. The following data displays were created:

- For each study, a tabular overview of all events (a type of extended case summary sheet) including short-hand summaries of lessons, correspondence with teacher and students, meeting summaries and decisions made with regards to the design of ThinkSpace activities (see Appendix 10).
- For the Park Hill study, a tabular overview of wiki pages completed by each student across the groups. The necessity for this display arose from emerging questions about lack of student participation in wiki activities in PHS.
- The developments in wiki pages and maps were captured as the studies progressed in documents detailing the difference between previous and current lessons. This was especially relevant in the Clover Fields study because of the higher student participation rate in ThinkSpace activities. Notes about instances of collaboration, comments left by students or other interesting occurrences were appended (see Appendix 11).

The outcome of creating these overviews was a better grasp of the mass of events in each of the two classroom studies. On the basis of the displays and the researcher's overall understanding of the events, a narrative account of the classroom studies was compiled, which formed a basis for a condensed and more interpretive account presented above. The construction of the narrative enabled questions to be formulated for the next stage of analysis (for example: What were the reasons for the low student participation rates in PHS? What were the patterns of collaboration on wiki pages in CFS?) In this way the data came to direct the analysis alongside the research questions, grounding the subsequent conclusions in the data.

5.3.2 Interviews and field notes

The field notes and interview data underwent the same analytical treatment in that all textual data was coded according to the same coding scheme. However this does not mean that they were treated as

one. The distinctions between the researcher's different viewpoints at the time of collecting the two types of data were always kept in mind and once coded and disaggregated the data chunks were at all times kept with a label indicating their origin so that the difference in their status could be taken into account in the interpretation of the data.

All interview transcripts and field notes were formatted and converted to a uniform text format. The resulting files were imported into the qualitative analysis software, AtlasTi. Atlas was used in a very straight forward and pragmatic manner. Although the software has extensive functionality allowing for automation of certain analysis procedures and constructing complex graphical displays of relationships between codes and categories in the data, most of this functionality was not used. Instead AtlasTi was used for data management purposes, as a labelling and sorting tool - functions, which could arguably have been performed with non-purpose built software such as Excel, or even on paper, but for which Atlas provided convenient automation and shortcuts. Because of the limited use of the complex analysis functionality of the software many of the doubts about using CAQDAS were countered (Gibbs, Friese et al. 2002). It is not claimed that the software in any way automates the process of analysis itself (other than by reducing the necessity for printing and cutting up paper) and the use of software must in no way be seen as in itself lending credibility to the analysis.

The analysis was not a strict exercise in Grounded Theory (Glaser and Strauss 1967), but was nonetheless solidly grounded in the data. A coding scheme of 49 categories was developed (Appendix 12). Codes were developed gradually throughout the analysis process by interrogating the relationship between the data and the questions I wanted answered. The guiding principle for construction of the codes for this study was taken from Miles and Huberman, who argue that codes are "astringent - they pull together a lot of material, thus permitting analysis" (1994:58). Thus codes were created in order to make the data intelligible in relation to the research questions, by accounting for a recurring theme or pattern in the data and allowing to group utterances into a manageable number of categories.

All relevant data was coded into one or more of the 49 codes. The unit of analysis was taken to be a 'chunk' of text (quote or a piece of description) which in some meaningful way and in its own right could contribute to answering a research question. These 'chunks' or 'units' were anything from one sentence to rather lengthy exchanges in interviews. The key criterion for including or excluding something from a unit was whether there was a change of topic in the extract, which would merit a change of category. The relevance of data for including into or excluding from the coding was judged on a case-by-case basis: if a unit was not judged to contribute the understanding of the focus of the study it was not coded. These judgements were at no point final: as new insights emerged, data previously judged irrelevant were subsequently coded.

The coding scheme was developed partially on the basis of the research questions (for example the code: "Teacher purpose for using ThinkSpace or understanding of ThinkSpace" was a direct

consequence of RQ1) and partially dictated by the emerging insights from constructing the narrative account of the classroom studies and continuous re-reading of the data during analysis (for example the "Sharing ideas" code emerged as a result of several students using this phrase in the interviews). The coding scheme was a dynamic construction which emerged throughout the analysis period and was gradually refined as the focus of the analysis became clearer. The research questions and the coding scheme were in a dialectic relationship as they mutually influenced each other. A framework outlined by Srivastava (2005) was followed in asking: What are the data telling me? What do I want to know? What is the relationship between the two?

The function of the coding was not in itself to lead to firm conclusions about the data, but to serve as a sorting mechanism for the large amount of data. Data relating to each code were subsequently exported into separate spreadsheets. Once separated, the data in each category was exposed to close scrutiny and interpretive summaries were written of each item in the table (see Appendix 13). The purpose of the summarising process was to begin to extract meaning from the data to contribute to the formation of the final conclusions. To direct the summarising process, the following questions were asked of each item:

- What does this item tell me about the code is has been assigned? (i.e. What does this interview excerpt tell me about the teacher's understanding of teaching and learning?)
- Does this item appear under other codes? (i.e. Has this text been coded with multiple categories?)
- If so, what is the relationship between the two (or more) categories in this item? Are they in agreement? Contradiction? Is one forming the context for the other? etc. (i.e. What is the relationship between the teacher's statement about his understanding of teaching and learning and his concurrent statement about his understanding about the purpose of ThinkSpace?)
- How does this item contribute to answering the research questions? (i.e. What does this utterance about the teacher's understanding of teaching and learning tell me about the formation of his views of the affordances of ThinkSpace?)

The resulting column of interpretive summaries was read through for a condensed view of my emerging understanding of that category. Keeping the summaries attached to the coded data, which was labelled with its source of origin, and which in turn was coded and easily retrievable in AtlasTi, facilitated easy movement between the raw data and various levels of interpretation and allowed to quickly put any interpretation in context and re-code and re-interpret the data as my understanding developed.

Questions arising during this part of analysis were probed by conducting further types of analysis. For example a question arose about the development in Allan's view of the wiki and the mapping during

the course of the work. To trace the changes data was rearranged chronologically by task, and units coded for the teacher's and researcher's views of ThinkSpace, as well as the developing consensus, were placed side by side for comparison. This enabled me to compare the the teacher's and researcher's rhetoric about the purposes of ThinkSpace over time.

5.3.3 Wiki pages, maps and editing statistics

The artefacts produced by the students in the course of the two classroom studies presented a different set of opportunities for analysis, both in support of other data gathered through observation and interview, as well as in themselves. The wiki pages and maps represented a blend of textual (wiki text), graphical (maps, wiki graphics) and statistical (wiki editing statistics, saved changes to maps) data. This data, especially the wiki editing records, underwent a separate set of descriptive and analytical treatments.

TWiki, the wiki tool used in this study, automatically records a range of usage information, which was useful especially for answering the third research question. For each revision of any given wiki page, TWiki records the following information: revision number, author of revision, time of revision and revision content. The revisions can thus be compared and each student's contribution can be scrutinised. This information was used to investigate patterns of student collaboration on the wiki.

Firstly a data display was created in the form of a matrix for each student web, showing which students had contributed to the various revisions of each wiki page. Also the teacher's and researcher's revisions were noted. Pages to which multiple students or both the teacher and a student had contributed were marked up for further analysis (see Appendix 14).

This display enabled me to gain a quick and crude overview of the levels of collaboration across student groups (although it was insufficient to talk about nature and quality of such collaboration). However, even such a rough overview established that very little collaborative activity was visible in the wiki edits at Park Hill School, and therefore further analysis of wiki statistics concentrated on the Clover Fields data. Also this overview allowed to draw preliminary conclusions about the levels of participation in wiki writing of particular students, as it was very clear which students contributed to a high number of pages and which ones to hardly any.

To gain a clearer picture of the types of collaboration that may be happening on the wiki and to be able to draw conclusions about any possible patterns of collaboration, the information about revisions underwent a qualitative analysis treatment.

Each page which was marked up in the matrix display as being a potential object of collaboration was scrutinised in turn. Each revision of any given page was compared to the previous revision and coded

according to two parameters: the type and importance of the changes (see Appendix 15). The coding criteria were the following:

Type of contribution:

[C]: **Page creation**

[1]: **Spelling and grammar** - or other minor edits - no visible engagement with meaning (sometimes due to the timing of the edits - almost concurrent)

[2]: **Minor wording changes** - a little visible engagement with meaning

[3]: **Additions** - can be where the students have concatenated their work or added a sentence or a section

[4]: **Linking** - adding a link or turning existing content into links to new or existing pages.

[5]: **Restructuring** - moving material around in a way which indicates a meaning change

[6]: **Substantial meaning edits and additions** - visible engagement with the content on the page. The quantity needs not be substantial - but the meaning making must be clear.

Importance of contribution (in terms of collaboration):

[0]: **None** - Shows that the student has either not read or ignored previous content.

[1]: **Low** - Only shows that student has read the page

[2]: **Medium** - shows some engagement, but not in depth

[3]: **High** - shows that student has thought about the material

All edits of high importance were then marked up in order to allow to study patterns of the most substantial collaborative editing events.

5.3.4 Presenting an account of the findings

The systematic analysis of the data resulted in an in-depth understanding of the data, which was triangulated between the multiple data sources. The final stage in the presentation the findings from the analysis was to select the most important, interesting and revealing claims. Because of the broad nature of the gathered data (including accounts of both technological, personal and social factors, as well as personal reflections on all these), not all the conclusions emerging from the analysis were equally relevant to the research questions.

The decisions about which facets of the ThinkSpace work should be represented in the thesis were ultimately guided by the researcher's judgements about what conclusions were of interest to the research community, and which were trivial. The goal in constructing the representation of the findings was to highlight important features of innovation in the classroom firmly grounded in the data rather than representing every feature of what the researcher saw. Therefore the findings chapters must be seen as interpretive pieces of analytical work, which were necessarily selective.

Part 3 - Findings

Chapter 6: Teacher engagement with the ThinkSpace tool

This chapter is the first of three chapters presenting the findings resulting from the analysis of the study data. It will engage with answering the first research question by making sense of the teacher's role in the ThinkSpace work. The next chapter will look at the students' engagement with ThinkSpace and their appropriation of the tool. The third findings chapter will draw out the classroom practices emerging in the context of the ThinkSpace work, which suggest ways of using the tool productively in the classroom. The questions to be addressed in the present chapter are the following:

RQ 1: What are the respective contributions of teacher and researcher to the shaping of the innovation?

> RQ 1.1: How did the teacher's understanding of what the tool had to offer develop during the course of the research collaboration?
>
> RQ 1.2: How was an implementation of the tool co-constructed in the dialogue between teacher and researcher?

The chapter engages with each of the two school-cases in turn. Some of what took place in the two classrooms was in close accordance (for better or worse) with the ideas of the researcher, other events projected a different view of how ThinkSpace could be put to use in the classroom. How, then, did these differences come about? What made some ideas easy to implement in practice, others very difficult, and what made up the difference between the two school settings? By seeking answers to these questions a picture emerges of a complex set of influences, which can be traced back to the most fundamental ideas about knowledge, learning, understanding, teaching and schooling.

Even a brief glance at the data for this study reveals that the two teachers' understandings of teaching, learning and schooling were complex. Both teachers were experienced, proficient, engaged professionals, committed to their work, their subject and the students they taught. At the same time, neither could be said to be fitting entirely comfortably within the fabric of schooling of which they were part. The first part of the analysis of each study sets the stage for investigating the teachers' understandings of ThinkSpace and their resulting influence on the construction of practices of working with the tool in the classroom. It seeks to understand each teacher's views of teaching and learning – both their fundamental 'theoretical' or 'intuitive' understandings of how we learn, as well as their practical enactment of those views.

The second part of the analysis uses this understanding of the teachers' viewpoints, approaches and motivations to disentangle the processes of co-construction of the ways ThinkSpace was used in the teacher-researcher collaboration. It traces the emergence of the events described in the previous chapter with an eye to understanding how the processes of collaboration as well as each actor's understandings came to direct the actors' emerging views of the affordances of the technology in the classroom.

6.1 Park Hill School

6.1.1 Teacher's views of learning and purpose of ThinkSpace

As is evident from the description of the events in Park Hill School, there were several points of conflict between the teacher's and the researcher's understandings of the ways ThinkSpace could be used in the classroom. The main point of negotiation was the use of the wiki. The researcher had envisaged the tool being used for promoting collaborative 'grappling' with the conceptual structure of subject material by utilising its two technological sub-parts collectively. The adoption of ThinkSpace in the first development study at Park Hill School, on the other hand, can be described as being in two parts, separated into the mapping and the wiki component. Allan seemed to fit the mapping in with the classroom routines and integrated mapping tasks readily into the overall work of the class. The exact nature of the mapping tasks was debated in the planning meetings because the teacher's and the researcher's ideas of the purpose of the mapping differed somewhat, but overall the mapping tasks were close in their conceptual nature and purpose to the ideas embedded in the design of ThinkSpace.

The wiki component of the tool, on the other hand, was taken up by the teacher almost entirely in isolation from the mapping activities and for purposes quite different from the ones presupposed in the design of the tool. The wiki was given a much more administrative role and, as shall be discussed in detail later in this chapter, was seen primarily as an efficient means of keeping tabs on individual students' homework completion and progress. The idea of the students writing collaboratively on the wiki seemed to be quite at odds with Allan's understanding of the wiki's main potential, as being a convenient system for storing and allowing the teacher access to student-created material. Some of the reasons for this can perhaps be found in Allan's views of the fundamental purposes of schooling, learning and his roles and responsibilities as teacher.

6.1.1.1 Fundamental purposes of schooling

In the interviews Allan expressed his views of the purposes of schooling and his role as teacher, which were complex and reflected his active thinking about these issues. He was critically questioning his practice in what seemed to be an on-going quest for establishing a satisfactory balance in his teaching between competing concerns. The main tension identifiable in Allan's views of schooling was in his somewhat conflicting commitments to the subject matter and his passion for teaching history on the

one hand, and his commitment to raising students' standards and improving their skills on the other. This tension is not a necessary or universal one, but one that seems to be necessitated by Allan's understanding of how different teaching and learning goals can be achieved.

It was evident in the classroom that Allan was a superb story-teller, had a very good understanding of his subject material and valued the subject of history in its own right. The students were often captivated by the narratives of Russian history which Allan produced in the lessons. In their interviews various students mentioned their appreciation for Allan's excitement about his subject, the opportunities his lessons offered for discussing the interesting questions in the curriculum and their enjoyment of his teaching style. Allan's commitment to the subject in its own right also came through in the teacher interviews, where he lamented the instrumentalisation of education:

> …even lower down the school there's a tendency to assume that everything must be done because there is some vocational purpose to it.. rather than because it is just interesting. (PHS Teacher interview 1).

> I want them to be […] more self-confident, to have enjoyed the material and really thought about it. (PHS Teacher interview 2)

Both from the interviews as well as from my observations in the classroom it was evident that discussion and articulation of ideas were very important practices in Allan's teaching. He described his interest in collaborative work as stemming from a belief in using the articulation of ideas as a means to understanding the subject better:

> ..it's all about learning language really. The kids that do really well are the kids who have power over language, so.. collaborative work for me it's.. to enable them to articulate and make sure they understand. Discussion is important because [...] it provides you with a chance to hear the same idea discussed by someone who's closer to your experience as a learner. (PHS Teacher interview 1)

However, he had a persistent concern that these favoured methods were not reaching all his students, as he went on to say: "It may be that we don't add much value through these discussions, because those who are already good at discussion [are the ones who benefit from it]".

In the classroom Allan was most at ease with the most able group of students. I repeatedly noted that in 12A there was a small group of very bright and vocal students who particularly tended to draw his attention. Allan was aware of being especially good with this type of student (perhaps at the expense of other students) because he could 'engage with them intellectually'. This was also noted by the head of school who observed a lesson, as Allan described in an interview: "she gave me sympathetic and

supportive feedback, but she said: look, what about all those kids who are not participating" (PHS Teacher interview 2).

While engaging on a very high level with the able students he felt like it might be wasted effort because this type of student could succeed regardless of his teaching:

> I'm not sure whether […] we're adding that much value to how well people do […] The point of education is to offer people opportunities who don't have them. […] There are a few people […] who don't need teaching and a few people you can't teach. And you can make a difference to the 90% of the people who fall between those two poles. (PHS Teacher interview 2)

He was thus actively questioning whether he was adding enough value in his teaching and whether he should adopt a different teaching philosophy. He compared himself to another teacher at the school who took a different approach. Because she followed the curriculum more closely and told the students more precisely what was required of them, she achieved better results with lower achieving students. Allan on the other hand, set a premium and spent time on exploring the ideas together with the students. He talked of being torn between his wish to empower students to learn and to give them a wide experience of education and the necessity to ensure standards, and the strong language of the following quote suggests that this was a very important issue for him:

> Instead of offering them opportunities, which I think are going to be useful for them in a wider educational sense, maybe I should just say, well let's not.. it's actually outrageous what I'm saying, but maybe we shouldn't worry so much about the wider educational.. just keep to the syllabus, keep it all very simple and.. pass things.. But I'm not sure I can - instinctively I just I don't think I can do that. (PHS Teacher interview 2)

It is not within the remits of this research project to discuss whether this tension is inevitable and what role the current design of the school system plays in this dilemma. To Allan it seems to have been a real concern on which he had reached no closure at the time of interview. What is interesting to investigate here is how this tension influenced the development of Allan's view of the affordances of ThinkSpace.

Although it is not possible to make any causal claims about the influence of Allan's views of the purposes of schooling on the ThinkSpace work, this fundamental tension was clearly an important issue for him and tentative parallels can be drawn to his adoption of the two components of ThinkSpace. In fact the poles of the argument correspond quite well to the two different ways that the mapping and the wiki were adopted.

The tasks Allan devised which used concept maps were directed at underpinning the conceptual exploration of the material by the students. The maps were used in a way that allowed students to have

discussions about the interconnections between the main concepts in the material and to explain their views to each other. The wiki, on the other hand, was mostly appropriated for 'administrative' purposes. The tasks including the wiki in many cases only differed from similar paper-based tasks in that they allowed the teacher easy access to students' work and where the wiki could serve as a repository for notes akin to a paper folder. The two poles of the fundamental tension expressed by Allan between his liberal ideals for education and the more vocational and pragmatic concerns are mirrored in the explorative, creative and collaborative role assigned to the concept mapping and the formal and individual role given to the wiki writing.

6.1.1.2 Nature of history teaching

The overall tension about the purposes of education also reflected upon Allan's ideas about the more specific purpose of his subject. The general debate about history teaching, which to some extent echoes the 'liberal-vocational' debate, addresses the balance between the 'content', 'historical skills' and 'life skills' which should be achieved through the teaching of the subject (although this distinction is a blurred one (Counsell, Arthur et al. 2000). When mentioning the skill sets developed in history during the interviews, Allan seemed to quite markedly separate the core of 'learning history' or just 'learning' from wider 'life skills'. Both in talking about using ICT as well as student presentations in the classroom, this distinction was evident:

> I want them to be really good at doing presentations, that's a life skill. And I also think it will help them with their learning. I want them to be ICT literate, because I think that the more confident you are with computers, the greater range of things you can do in your job. (PHS Teacher interview 2)

> There are an awful lot of jobs which you wouldn't imagine involve public speaking, but which do. So I'm very keen on that as a side benefit of doing this kind of course (PHS Teacher interview 2)

Thus learning history seemed to become separated from skills the students would need later in life, which were framed as 'side benefits'. This view of history, although not necessarily explaining Allan's understanding of particular affordances of ThinkSpace, suggests a strong external motivation (in addition to ones internal to subject teaching) for using the tool. Whereas it is not suggested here that the technology was treated as part of a box-ticking exercise (indeed a project like this one is not the easiest way to tick boxes) having technology-oriented reasons for using the tool suggests a separation of its use from the core goals of the course. This may provide one of the clues to the weak integration of ThinkSpace with other classroom activities, which will be discussed in more detail later.

6.1.1.3 Practical constraints on pedagogy and the teacher-student relationship in the classroom

To the complex picture of Allan's concerns with the purposes of teaching in general and teaching history in particular, are added the practical constraints imposed on Allan by the busy pace and the heavy workload of everyday school life and by his role as head of department. From the interviews emerges a sense of Allan's frustration with his engagement with the students - that he somehow could not reach all of them in the ways he may have wanted to. In fact Allan emphasised in the interviews as well as during our work together that the time constraints he faced as head of department were at times crippling, and thus prevented him from engaging with the students' learning to the extent he wanted. This echoes findings in the research literature, such as McIntyre's, who writes that "the careful professional prioritization which is necessary in dealing with the complexity of classroom teaching involves the simplification or neglect of much available information" (McIntyre 2002:130) and calls for a recognition of the limits of what is possible to achieve through classroom teaching.

Allan pointed out lack of time as being the main barrier to both following the individual students' progress and to using a wider range of teaching methods:

> ..one's time is very very limited, so an awful lot of what you have to do is off the cuff. Therefore I tend to end up talking, because I can talk fluently with minimal preparation, whereas creating nice activities […] takes more time (PHS Teacher interview 2).

This provides one possible reason why the wiki activities that Allan formulated outside of our meetings (the note-taking exercises of 3-5/12-07 and 11-13/2-08) very closely resembled standard note-taking homework rather than activities designed for the wiki – anything but a close replication of existing practices would have required a time commitment which would not have been possible.

Another highly practical issue related to time is the way the time constraints impacted upon Allan's relationship with the students. Insufficient time for lesson preparation made it difficult to achieve sufficient differentiation and to include a full range of students because Allan tended to talk to the class, and talk at quite a high level. Furthermore, there were instances (both in and outside ThinkSpace work) where elements of assignments were omitted: promised tests were not set (e.g. the test in the debate exercise) or parts of the assignments were dropped without mention (e.g. collaborative elements in multiple wiki exercises). These omissions most probably had multiple foundations, but arguably the lack of time for preparation and lesson planning is an important factor.

Perhaps most importantly for the ThinkSpace project, Allan's busy schedule was arguably an important factor for the way students were assessed and held accountable for their progress. Even early on in the year, I noted that students came unprepared to class, and that it seemed to be treated as the norm. When 12A were doing PowerPoint presentations in the beginning of October, some groups

had not prepared at all, whereas other presentations were unfinished. On another occasion, in February, Allan spent part of a lesson chasing missing essays – some of which seemed to have disappeared 'in transit'. The low student participation and accountability was certainly the case in ThinkSpace work, where very low numbers completed the set assignments – but seemed to be accepted in regular classroom work as well. In all cases, it was noticeable that Allan thanked and congratulated the students who had completed the work, but did not rebuke the ones who did not. He was aware of this problem, and in the interview talked about being somewhat shocked at its extent. He proposed improved accountability as a way to raise standards in the students' learning:

> .. you've seen how bad we are at enforcing.. One way we can do better is make the kids work harder. Make more demands on the kids, or make them more scared of us than they are of some of their other subject teachers, so they do our work (PHS Teacher interview 2)

The lack of enforcement of work completion had consequences for ThinkSpace work, because the students were not pressed to complete their work or to adopt new ways of working. This has arguably been a barrier to the class engaging with the technology and any pedagogical changes it may entail.

6.1.2 Co-construction of use-practices of ThinkSpace in the classroom

Having examined the ways the teacher's fundamental understandings of schooling as well as the practical realities of the classroom may have influenced his view of ThinkSpace, attention will now be turned to the researcher's role as designer of the tool in the negotiation of its use with the teacher. The communication between the teacher and researcher in the planning of the ThinkSpace activities influenced how the teacher came to perceive the affordances of the tool. Some of this communication is preserved in meeting notes and formulations of tasks and materials, and is revealing of how the negotiation of the meaning of the tool took place. Attention must be paid especially to the different vocabulary used by the teacher and the designer, because this difference is indicative of the tensions that formed the basis for the development of the actual implementation of the tool in class.

Allan's initial motivation for working with the tool was recorded in his own notes from one of the first meetings:

> Concept mapping and linked wiki is working naturally in with trying to get concepts across. I think that this is getting us to talk about concepts rather than just facts (Allan's meeting notes 1/10-07).

It was clear that Allan has previously been thinking about how to reorient his teaching towards the conceptual structure of the material. The ThinkSpace project provided him with an opportunity to take up those thoughts again. At the end of the second phase of our work, he reiterated this as an important aim of the project:

> I feel that I am making my way forward rather slowly, but that the process of thinking about concepts a lot proving very useful for me, and will prove very useful for the students (Allan's email 1/12-07).

Even though this initial goal is in accordance with the researcher's main ideas about the utility of ThinkSpace and points to a combination of the wiki and concept map into one tool, when looking at the dialogue that took place around the formulation of the practical tasks, a pattern emerges with a move towards disaggregation of the two technological elements of the tool. The reflection upon concepts was targeted through the mapping activities whereas there was a move towards talking about the wiki as a storage facility for students' work. In the course of the year the use of the tool became more and more removed from the original scheme proposed by the designer and it is visible in the dialogue that the designer tried to pursue the initial idea, whereas the teacher had a different understanding of the tool.

6.1.2.1 Development of understanding of the wiki

Of the two elements of the tool, the wiki was the one where the Allan's and my perceptions of the tool differed the most. These differing perceptions developed early in the collaboration. In the first planning meeting the wiki component was presented to Allan as a place where the students would write 'wiki articles' which they subsequently would present to each other, discuss and find links between. In Allan's notes from the meeting, he introduced the term 'note-taking plus', which seemed to set the tone for his view of the wiki as a facility for sharing notes. Also early on, when he set criteria for a 'good wiki' for 12B, the collaborative potential of the tool was not mentioned. The criteria were: "clear, accurate (facts and English), and it must make key concepts clear in a memorable way" (Allan's meeting minutes 1/10-07).

In the next round of planning, this difference grew. Allan stressed the importance of all students getting to know the entirety of the material and in that meeting I noted: "All students must get to know all areas. Therefore the task must encourage collaboration on all wiki pages." In the subsequent meeting Allan's and my notes about the same exercise plan show a remarkable difference:

> …each of the members are responsible for one part of the notes. They need to start off a wiki-page each and then add to each other's. (My meeting notes 30/11-07)

> Students will all do the same note-taking task, but they will then forward their notes, which will be moderated and improved by their neighbours, electronically, and forwarded to me for next lesson. Then these notes can go onto the wiki, so that their work can be shared. (Allan's meeting notes 30/11-07)

There is a striking difference in perception of the purpose of the wiki. Whereas the designer is arguing for making sure that students collaborate by reading and improving each other's notes, the teacher would like a more formal note-taking form, where the students 'moderate' each other's notes before sending them to the teacher. Furthermore this moderation is (presumably) carried out through word documents, and only once the notes are complete are they 'uploaded' to the wiki. The actual implementation of the task was a blend of the two directions – the tasks were distributed between the students, but no collaborative editing took place.

In the subsequent round of planning there was a visible negotiation of the meaning of the wiki. An individual content-based note-taking exercise originally proposed by Allan was not carried out on the wiki because the I, as designer, argued that the wiki should remain conceptually based. In its stead, as described in the previous chapter I proposed a group task with pictorial sources, as well as a peer review task.

In the last part of the collaboration it was clear that our perceptions of the affordances of the wiki were far apart. It was especially visible in a note-taking task formulated by Allan where the students were asked to "cut and paste [your notes] into your wiki group area under the heading "February to October 1917" followed by your name" (Note-taking exercise 11/2-08 and 13/2-08), thus demanding clearly individual contributions with the wiki providing easy access for a moderating teacher.

Thus it is clear that the teacher's and designer's perceptions of the wiki differed from the beginning and the teacher's initial understanding seems to have prevailed and indeed further developed. Although the designer argued for the introduction of collaborative practices mediated by the wiki, this happened to a very limited extent. Indeed the only instance of collaborative wiki editing that took place happened in the very beginning of the year, and even then it bore the character of division of labour rather than collaborative engagement with the text.

6.1.2.2 Development of understanding of the mapping

The mapping component of ThinkSpace presented a somewhat different picture. Firstly, as opposed to the wiki, concept mapping was a technique that Allan was familiar with (although perhaps not under that name or in this exact form) and was utilising in his teaching to explain the conceptual structure of historical material. This was evident in the first lessons, where a Allan created a map on the board which he used as a stepping-stone to the presentation of ThinkSpace.

Furthermore, following the argument presented above (that the two tools corresponded to the two poles in Allan's conflicting view of the purpose of his teaching) he saw the mapping as a tool for conceptual engagement:

> …The purpose of all the map work is to show the.. interconnections between factors [...] To get an overarching holistic understanding of the problems besetting Russia in the early 20th century.

He saw the mapping as possible tool to direct the students away from the 'narrative trap' by focusing their attention on the main characteristics of the material and away from the detail of the events:

> Once you've got the headlines for 1917, then all the text, you can fill in afterwards. That is why I'm keen to do stuff through concept mapping (Quote recorded in notes from meeting 26/1-08)

Thus his view of the affordances of the mapping tool corresponded much more closely with the designer's initial ideas than was the case for the wiki. Therefore the dialogue around mapping was of a very different nature and, in terms of co-constructing uses of mapping, the discussion was evidently a more constructive one.

Because the wiki never came to function as an 'encyclopaedia' of the syllabus, but was instead used for collation of notes, the map could not come to function as a navigation device for the wiki. The connection between the map and the wiki was not entirely excluded from the negotiation because the designer was working on changing the teacher's perception of the wiki throughout the project and this was often done by means of connection to the map. Here there is a visible trend towards disaggregation of the wiki and the map. Thus in the first task the two were closely integrated:

> Each group has then got to produce one wiki page with their topic. They also have to produce a map each that shows how their topic relates to the bigger picture. (Field notes 27/9-07)

This task reflected the integration of the detail and overview levels in asking the students to put their wiki pages in the context of the broader issues in the curriculum. In Phase 2 of the work, the tasks were formulated in similar terms, but there was less effort to bring the wiki and map together. The 'note-taking' which had replaced the term for writing wiki pages was set as homework and in response some of the students produced wiki pages termed for example "WhyDidWorker-MilitancyRemainAThreat" replicating the question in the homework assignment rather than any concepts on the map. Towards the end of the collaboration, the map and the wiki became entirely separated – although there are still attempts at integrating them. In the meeting discussing the mapping of the events of 1917 it became clear that the mapping would be a stand-alone exercise which would in no way be connected to the wiki:

> I don't think the students will ever get to connect these concepts to the wiki. […] I tried to propose that the students re-distribute the concepts to the overall map […] so that they could

> be interlinked - but we quickly agreed that that would be too complicated. (Field notes 11/2-08)

The main point of discussion around the mapping was therefore the purpose of the mapping itself as a tool for conceptual engagement, rather than in conjunction with the wiki. The turning point of that discussion was whether the map should be continuously grown to represent the students' growing knowledge of the curriculum, or whether new maps should be created for each 'round' of mapping to provide simpler (i.e. more local) and more detailed overviews of each part of the syllabus. The former, which was the designer's direction, was intended to be in keeping with the notion of gradually constructing the 'wiki-encyclopaedia', where the map was to function not only for conceptual 'struggling' with material, but also serve as a visual representation of the knowledge expansion. The latter, which was the teacher's view, was more focused on fitting in with particular parts or key questions in the syllabus, and therefore was perhaps more practical in the absence of the wiki writing. Whereas the two are not mutually exclusive (because it is possible to create sub-maps, which are in effect extensions of the overall representation), they can be treated as such here because of the relatively small amount of mapping done by the students, where any sub-maps would be seen as separate tasks. The outcome of this discussion was that the first round of maps the students made were not discarded as first planned due to the researcher's efforts to attempt to represent the students' knowledge in a continuous fashion on the maps. The final round of mapping however, was framed as a separate exercise independent of the wiki or of previous mapping.

In this discussion of the way the mapping tasks should be structured there was more evidence of productive dialogue, where both our understandings of the mapping were altered, than was the case in the implementation of the wiki. For example in one meeting we got to grips with the next mapping assignment, both coming to a new understanding. Allan was proposing to start new maps for this task, as I recorded in my field notes:

> ..because the big one didn't fit in with this topic, but I was against it, because none of the topics are going to fit neatly with the whole map and we had a bit of a collective 'aha' moment when we decided that not all of the existing bubbles on the map needed to be engaged in each round and that we in this round will be working on only part of the map. (Field notes 30/11-07)

From this new understanding we could formulate the task, which we had otherwise struggled with, and which also included activities on the wiki. The development of the mapping tasks, although not always in accordance with the researcher's ideas, was therefore a more interactive, more thoughtful and, arguably, more successful process. The difference in our understandings was in this case a productive tension that led to new discoveries, whereas in the case of the wiki, it remained a stumbling point – perhaps because the different views were simply incommensurable.

6.1.2.3 Teacher's resulting view of ThinkSpace

Because of the relatively low volume of student work on ThinkSpace, the teacher can be seen as the main influence on the way the tool was used in the classroom (in the sense that the students didn't appropriate the tool in unexpected ways or invent their own uses of it). Therefore, without completely disregarding the role of student reactions to the tool, Allan's goals and understandings of teaching and learning coupled with the development dialogue with the researcher, account for most of his resulting view of the affordances of ThinkSpace. This view is visible in his retrospective 'vision' remarks recorded in the interviews about how he might potentially want to use the tool in the future.

Allan's overall vision of the tool repeated and reinforced the pattern of complete separation of the wiki and the mapping activities. The wiki became a space for administration of individual students' progress and an online storage folder for their work:

> I'd almost like them to have an individual wiki, which is kind of a web-based collation of all their notes […] allowing me to look at what everybody's doing and.. I mean there's no reason why even essays shouldn't be written on the wiki. (PHS Teacher interview 1)

Whereas originally the wiki had been presented to him as a tool for collaboratively writing an 'encyclopaedia' of the syllabus, Allan's final view positioned the wiki solidly as a space for note-taking, and thus as an individual space. As he commented: he was "not really sure that you can make collaborative note-taking work" (PHS Teacher interview 1). Interestingly he did remark once that this space could be used for students' reflections on their own learning through taking 'field notes' of their progress. This possibility did not receive much attention in our work – perhaps because the collaborative potential of the wiki (which pre-supposed shared reflection on progress) was the designer's focus.

Allan saw the wiki as being a powerful tool for monitoring each student's progress – although he was aware that he was advocating a strict controlling agenda:

> What I like about it is that you could then put all the tasks on to the wiki and then you can see exactly what has and hasn't been done. I mean.. but this is almost kind of a police state, sort of monitoring, isn't it? (PHS Teacher interview 1)

This ties in well with Allan's awareness of the lack of control over student work and the low participation rates, showing his ambivalence between policing student progress and giving them free rein. Finally, the wiki was seen as potentially a useful tool for both communicating with parents and for documenting student progress at parents' evenings as well as allowing for a 'meaningful conversation' about their child's work due to the instant availability of the students' collated work online.

Allan's final view of mapping was less straightforward. Whereas the wiki was seen as an individual tool, the mapping was seen as useful for collaborative activity, and it was used as such in the classroom. However, at the same time, many of Allan's comments about his assessment of the mapping have a directional nature that indicate a view of the mapping as primarily a teaching tool, rather than a technique for engaging students with constructing their own representations. This, again, mirrors the inherent tension in Allan's view of teaching as focusing on students' own conceptual engagement, where dialogue and peer collaboration plays an important role, and at the same time at getting the conceptual structure of the material across as efficiently and simply as possible.

Thus on the one hand Allan saw the mapping as a tool for pushing the students to engage actively with the material:

> ..it's very good at fostering them talking to each other. […] The virtue of the things like the map making is that it forces them to do something with them […] The goal is to make them do something with the material. (PHS Teacher interview 1)

- whereas on the other he talked about letting the students study the maps rather than constructing their own and using the maps as teaching aids:

> ..it has given me the idea that you should be able to summarise everything in a single diagram […] I think it's much much better than giving a list of […] what you do in the syllabus. (PHS Teacher interview 1)

Allan also talked about wanting to use one of the maps produced by the most able group in 12A with another class – thus handing out the diagram as a ready representation. Another example was Allan's mention of an overarching concept map he had created on the whiteboard for another course to which he had continually referred throughout the year – again as a teaching resource rather than a tool for conceptual struggle.

These two ways of thinking about concept mapping are in no way contradictory and merely represent different uses for mapping - as well as underscore concerns Allan had in his teaching. The way Allan talked about the mapping suggests that he had expanded his use of a technique he was already familiar with to include different variants of it.

To summarise Allan's retrospective view of ThinkSpace in his own words:

> [Question] one is: does mapping.. enable us to think about concepts? And I think the answer is definitely yes. Questions two is: does having a direct link from the map to the wiki really help? And I think the answer to that is possibly no. […] the third question is: is it just a useful tool for being able to keep tabs on what people are doing? Answer to that I think is yes.

6.2 Clover Fields School

6.2.1 Teacher's views of learning and purpose of ThinkSpace

The work at Clover Fields School was in many respects quite different from the first study (although similar in others, which will mainly be addressed in the next chapter). It was characterised by closely aligned views of the purpose of ThinkSpace between the teacher and the designer as well as development of both the components of the tool in tandem. Student participation and levels of collaboration were higher and the amount of content produced with the tool was considerably larger. Still, this was far from an un-problematic study and it is interesting to compare the different types of difficulties arising in the two studies. Some of the differences may be attributable to the two teacher's different outlooks on schooling.

Where Allan talked about difficulties in resolving conflicting priorities in his views of learning and teaching, Thomas displayed a much clearer stance upon what schooling is about. He articulated this view very clearly in his interview, and it appeared to be reflected in the way he conducted ThinkSpace work in the classroom.

In the very first minutes of the interview Thomas firmly identified himself as having a socio-constructivist understanding of learning and seeing knowledge as being socially negotiated. His understanding of learning had shifted since he had first come in to teaching. At first he had a notion that you needed to "create some kind of obstacle course through which you sort of had to channel the knowledge, [so] that it would fix itself in your brain" (CFS Teacher interview). This notion had given way to a different view:

> I think a more mature understanding is that there is a web of knowledge inside people's heads but also in connection with the knowledge about something in other people's heads. And in order to get people to learn you've got to somehow disrupt that web, make new meanings, new links, new joinings (CFS Teacher interview).

Thomas' view of his role as teacher followed naturally from this conception of learning. He saw his role as being a facilitator of learning, as 'enabler' and as the person who presents the students with learning opportunities rather than transmits information to them:

> I've always seen teaching as a question of enhancing the capabilities of other people other than merely trying to make them [memorise] (CFS Teacher interview)

Following this, his view of the feeling of loss of control that collaborative group work and working with technologies can engender was in contrast with the concern that Allan had expressed after one of

our first lessons. On the contrary, Thomas did not believe that he was in control of his students when in front of the class and cherished the opportunity to disrupt their routines:

> I actually think that sometimes you sit in a class and everybody's listening really quietly and you can look in Kayleigh's eyes and they're dead […] telling herself that she gets it, but isn't engaged, isn't thinking and talking and questioning […] if they're not learning when you're standing and talking to them as a traditional teacher then, hey, you might as well try something else. If that results in that kind of 'loss of control' […] what's the control for? I mean.. are teachers just there to be sort of scions of social structure or.. or are they there to help children learn stuff? (CFS Teacher interview)

Inspired by Paolo Freire's work Thomas's view of the main purpose of schooling was to teach children that "they have the power to name the world" and to enable them construct their own informed opinions about what happens around them. Therefore what mattered to him was less the content that the students were learning, but more whether they were putting effort into finding out about the world and whether they enjoyed this quest for learning.

This view of education was not unproblematic – and Thomas was well aware of this. Because he was secure in his own stance on the purpose of his teaching, he saw the main tensions as being outside himself in the wider educational system. Thomas positioned himself in tension with educational policy as well as with the school culture. Firstly he perceived a tension in the state's official view of the teacher's role:

> "The state has this excellent teacher view as an 'expert' and it's never quite sure whether you're an expert in your subject or educational psychology or […] It seems quite sure that it wants you to know your stuff, presumably so you can tell it to kids." (CFS Teacher interview).

He also saw a contradiction 'from above' in the way the students' work was being marked by examiners:

> "I come out of board meetings […] thinking: gah, brilliant! […] This is about YOUR ideas, having an opinion about these sources. […] And then when you get the results back […] the first comment you get on a D: this is a very short essay, it doesn't contain very many dates" (CFS Teacher interview).

Apart from tensions imposed 'from above', Thomas saw his ideas as being problematic within the school. At the interview as well as on other occasions during our collaboration he spoke about the prevalent 'paradigm' outside as well as within the school, where colleagues and students have ideas about teaching, which are difficult to contest: "any attempts to sort of.. suggest that that's not the way,

just makes everybody horribly uncomfortable" (CFS Teacher interview). Thomas saw the perpetuation of this paradigm as partially stemming from a

> …collusion between teachers and students where teachers give you boring stuff to do that doesn't take very much brain power, you sit very quietly and do it and then we'll all go home happy by the end of the day […] both kind of kidding ourselves that it was a good day (CFS Teacher interview).

Thomas' expressed purpose for participating in the ThinkSpace project mirrored his goals in his teaching and his frustration with participating in sustaining the state of affairs. He felt that although he may have constructivist ideas about teaching and learning, he could rarely exercise them in practice because of the 'immense power of socialisation' he was subjected to in the educational system.

> …this could help me in my ongoing quest to think differently about my history teaching. […] I hoped that it would make me think about the ways people construct knowledge […] and to create lessons and opportunities for learning that were more active on [the students'] part. (CFS Teacher interview)

6.2.1.1 Nature of history teaching

Thomas had an outsider's perspective on the history subject and on teaching history. Not having been trained in the historical tradition, he reported to have enjoyed the investigative side of history. This outsider perspective made him perhaps more critical of the purposes of teaching history and of the traditional ways of doing it – although, as he acknowledged, he had not entirely escaped the socialisation into the profession.

> …there's a huge undercurrent of thought in most history teachers, probably a good deal of it is in me as well, that history is about transmission, [… it] is not just facts but also a kind of socialisation tool […] for me it's more about teaching children that they have the power to name the world […] There are so many histories out there, there are so many different perspectives […] it's about emancipation, enabling, it's about creating citizens of the world – […] based on the stuff that I'm trying to teach, which is rationality and enlightenment (CFS Teacher interview)

This understanding of history sits very well with Thomas's view of learning as creating opportunities for discovery and enabling students to construct their own view of the world around them.

It is evident that Thomas's thinking about learning was very closely matched to the conception of learning that underpinned the design of ThinkSpace. Therefore his view of how the tool could

contribute to the overall direction of teaching in his classroom also corresponded well with the initial ideas of the researcher.

6.2.1.2 Connecting technology to pedagogy and the curriculum

A very important influence on Thomas' view of ThinkSpace was his previous experience with using technology in the classroom as well as his engagement with the technological side of the tool throughout the project. Whereas Allan's understanding of the technology primarily stemmed from my exposition of its capabilities, Thomas' direct engagement with the wiki and the mapping software allowed him to formulate more personal understandings of the affordances of the technology.

Thomas' interest in using technology in his classroom far predated his participation in the ThinkSpace project and he was using blogging, Google Docs and Bubbl.us (a mind mapping software) with his students. He had also previously attempted to use a wiki (without great success), and was therefore knowledgeable as to the nature of this technology and its 'inbuilt' or associated purpose.

He exhibited a view that technologies – especially Web 2.0-inspired tools - need to be carefully embedded in the school practice and that students need to be prepared for using them. Therefore even before we started the pilot study with ThinkSpace, Thomas prepared the class for working with the tool by working with them through the concept of a wiki and not least exercising their enquiry skills. In the interview he recounted his view of the effects of this work:

> There was a sort of frame of reference there that they knew what they were doing in terms of enquiry, so the whole: here's a blank page, you fill it in, was not half as daunting […] we say this a lot in education […] it's what you did before that helped make that work. (CFS Teacher interview)

Thomas' view of technological tools for learning, which was exhibited throughout the project, was that these tools required specific corresponding pedagogical strategies without which they would not function as intended. This view of technology was most clearly visible when we failed to integrate the right pedagogical tools. After one of the pilot lessons, Thomas wrote on his blog:

> I was so amazed at the possibilities of the tool […] that I fell into the trap that we all do with computers from time to time; namely that if I put the children in front of a PC, give them some textbooks and a 'task' to carry out, they will learn […] We had created a very concrete set of problems […] which they were emotionally engaged with […] Yet, when we asked them to work, it was at a very abstract level […] They didn't know very much at all about the [topic and] I hadn't thought carefully about what I wanted the students to be able to do, or to know by the end of the lesson (Thomas' blog post, 3/7-08)

This reflection upon what made that particular lesson unsatisfactory, shows Thomas' engagement with the technology on an abstract level and his understanding of the need to embed it in tasks which are suitable in level of abstraction, difficulty of material as well as have a clear purpose. Also on other occasions we struggled with structuring the tasks for the work with ThinkSpace – for example when the students were asked to construct maps about Italian intellectuals, only to be asked to continue another group's map about a different intellectual in the subsequent lesson.

At other times, Thomas showed a very firm grasp of the way the wiki and the map could be connected to each other and related to the curriculum as well as to the type of assessment the course demanded. The most notable example of this was perhaps the last set of lessons in Phase 2. These lessons centred on students creating concept maps of the factors influencing the 1848 Revolution in Italy. Thomas integrated the source work the students had done on the wiki previously (and which was practice for the source critique they would need to do in their exam) into the mapping task by asking students to put sources on the map as concepts and link them to the factors they supported. Furthermore this map was to be used as a planning device for an essay (which there was no time for in the lesson, but which the students did when preparing their essays at home). In the formulation of this task (which Thomas did primarily himself) he exhibits a complex view of the ways in which the two technological components of ThinkSpace can be used to pursue particular pedagogical goals.

Some of this detailed understanding could be due to his very practical engagement with the student content on the wiki. Throughout the project Thomas closely followed the development of the student work on ThinkSpace and participated actively by leaving comments on the wiki pages after class and directing the students to these comments in subsequent lessons. This not only allowed him to reflect upon the quality of the tasks the students were set as well as individual students' progress, but also spurred the students on to amend their wiki pages.

On one occasion I participated in a commenting session, which was embedded as part of a task where the students were to post short opinions about sources on the wiki in the form of comments which would appear on the page underneath the source signed with each student's name (Lesson 7). After the lesson Thomas commented on individual students' opinions leaving them comments which praised good work, encouraged bolder opinions and asked questions to guide their thinking about the material. He directed the class to the comments in the subsequent lesson, and many of them took the opportunity to reply:

Thomas' post (in reply to existing comments):

> Brilliant comments lads!
> @Alfie - do you think that this letter helped the pope's position - did he manage to prevent further revolution?

Alfie's reply post:

> I don't think it did help the Popes position as he completely changed his ideas which led to confusion as no one knew what he was thinking. The revolutions did continue however there were no new ones that broke out

Box 6. Exchange of comments on the wiki

This close engagement by the teacher with the content on the wiki appeared to allow for a close reflection upon the very practical applications that the tool could be put to. It was thus possible for us to engage in detailed discussion of issues such as the difference between using the comment field on the pages as opposed to editing the wiki pages themselves, the affordances of the wiki as being a detailed record of the students' own thinking for their revision and how the patterns of participation on the wiki differed from participation in corresponding tasks using post-it notes or whole-class discussion sessions. Thus, being grounded in his own practical experience, the formation of the teacher's view of the affordances of ThinkSpace was guided by very 'local' observation and detailed analysis of the usability of particular features of the technology for particular tasks.

6.2.2 Co-construction of use-practices of ThinkSpace in the classroom

As touched upon above, the Clover Fields study was characterised by the teacher taking a large part of the responsibility for generating ideas and formulating tasks that were to be carried out with ThinkSpace. This idea generation was almost always embedded in a process of discussion and negotiation with the researcher, which allowed for constructive collaboration. Thomas' extensive engagement with the technology of the tool and the close correspondence between our initial views of the affordances of ThinkSpace meant that the collaboration had a more iterative nature than was the case at Park Hill School. Thus moment-to-moment analysis was possible during lessons and we could seek each other's advice to instantly make changes to the lesson.

Because our fundamental views of ThinkSpace were aligned early on, the collaboration was targeted at exploring different functionality of the wiki and concept mapping and targeting the tasks to suit particular purposes within a common understanding of the overall purpose. Also the design and evaluation of tasks was often about getting this purpose across to the students rather than to each other. Thus whereas at Park Hill the collaboration centred on defining the purpose of mapping and wiki writing in the classroom, in this study the purpose was decided in advance and the main effort was directed towards implementing the tool to suit that purpose.

The most notable negotiation of approaches and affordances took place around mapping. Whereas Allan at Park Hill School had been using mapping techniques extensively in his teaching prior to the ThinkSpace work, concept mapping was largely unfamiliar to Thomas, although he had had forays into mapping before. Thus here the designer's outside influence had the most noticeable influence.

Firstly Thomas asked for a thorough introduction to concept mapping and was given a paper to familiarise himself with the technique. Having read the paper, he could try out the vocabulary and techniques described therein for himself. He used this knowledge in a planning meeting preceding the main study, where we constructed a map of the curriculum which was to serve as a target for the mapping tasks we would present to the students. But this limited personal exposure to concept mapping was not enough for Thomas to fully translate mapping into practice and was therefore supplemented by extensive experimentation in the classroom. Again, the overall purpose of the map as a device for structuring students' thinking, gaining an overview and functioning as a navigation device to their wikis was set from the beginning. Therefore the experimentation with mapping concentrated on how best to engage the students with the conceptual work that mapping can create opportunities for, and how to integrate the mapping best with the curriculum.

Here the researcher's experience with mapping from the Park Hill study was helpful. Because the students in the first study had been familiar with mapping and could draw on their previous experience, they seemed to be able to construct maps much more effortlessly than was the case at Clover Fields. Drawing on this familiarity we could analyse their maps to learn from their understanding of the tool:

> Thomas: It strikes me that these are 'topic' diagrams - rather than question ones. 'problems' means that they're listing and describing and linking
>
> Jane: thinking back to the concept mapping literature it's always about central questions […maybe] it's about the way you phrase the question. Because these maps also started out with a question, which was 'what problems was the Russian Empire facing'
>
> Thomas: you might have a point - 'why did the revolutions of 48 fail' is easier than [another way of putting it] (Skype meeting 25/11-08)

In this conversation a new understanding of mapping was formed in collaboration, drawing on the example maps from Park Hill, the researcher's memory of the events as well as the researcher's understanding of the concept mapping literature. This was an on-going process of formation of understandings, which had not reached its conclusion at the end of the project. In the last whole-class lesson after the volunteer group workshop, the issue of the central concept or focus question was still evolving:

> Thomas posed the question of 'Was unification possible because of Austria's weakness?' - and asked the students to look for factors dis-confirming the question. […] it would make more sense to pose it as a statement to which the students could say: no, this is not true because... On the map […I] asked for permission to change it into a statement […] and then finally changed it into a concept of 'Austrian weakness' (Field notes 8/5-09)

This was one of the few cases of direct researcher engagement with content during a lesson, which exemplified the ongoing process of negotiation of mapping. It was necessitated by my sense of students' confusion and made possible by the open-minded and friendly nature of our collaboration.

The co-construction of our view of the affordances of the wiki was more limited – although not entirely absent. For example new functionality was added to the wiki in the form of an embedded commenting field at the bottom of each wiki page, which allowed for experimentation with new ways of engaging the students with content production and altering the ways the teacher could provide feedback on student work.

Also our understandings of the way the combination of the wiki and the map could be implemented in practice were not static, although the main thrust of our thinking was similar. Still, there was occasion for a critical approach to each other's ideas. Whereas the designer's approach was coloured by a more theoretical view of the tool, the teacher had a better grasp of the practical reality of the classroom. This difference allowed for productive tensions and modification in the implementation of the tool. Still, the main effort in this study was directed towards overcoming the tensions between the collaborative and constructivist nature of the tool and the ideas about schooling exhibited by the students. This tension will be the main subject of the next chapter.

6.3 Concluding remarks

The main lesson to be learned from the analysis of the formation of the teachers' views of the affordances of the tool is about the importance of the teacher's previous fundamental understandings of the nature of schooling. In both development studies, the teachers' overarching views of how ThinkSpace might potentially fit in with their teaching purpose and their practice functioned as a directing force to their approach to the project. The tool-designer's influence must not be overlooked in the development of practical applications of ThinkSpace. Nonetheless, because of the nature of the collaboration, which positioned the teacher as the classroom expert, the designer's ideas about the implementation of the tool had an impact only if they were within a range of compatibility with the teacher's underlying ideas. On the other hand, if the range of correspondence between the two actors' ideas was suitable, productive tension and positive challenge led to the expansion and refinement of ideas about the practical use of the tool.

This evidence of the role of the teachers' underpinning views of learning on the introduction of collaborative technologies must however not be treated as conclusive. It must be seen within the scope of the present study, because there is nothing to suggest that Allan's and Thomas's views of the purposes of collaborative technologies are inflexible. On the contrary it can be argued that both teachers acted as questioning and critical professionals, and that engagement with the ThinkSpace work encouraged them to scrutinise their existing practice. Therefore continuing engagement with ideas of collaborative learning practices could perhaps engender more fundamental changes in teaching practice over longer periods of time.

Chapter 7: Students' uses and views of ThinkSpace

The previous chapter sought to uncover the ways in which the teachers' views of affordances of the ThinkSpace tool were formed in the engagement with the researcher and the tool as well as the immense importance to their views of the tool of their general views of teaching and themselves as teachers. This chapter will go towards answering the second research question by engaging in a corresponding analysis of the formation of the students' views of the ThinkSpace tool:

RQ 2: What were the students' experiences of working with ThinkSpace?

RQ 2.1: What uses of the tool emerged in the two classrooms?

RQ 2.2: What did the students perceive the affordances of ThinkSpace to be?

The material for the analysis presented here comes mainly from the student interviews, which are seen in the context of classroom observations – as well as any comments the teachers made about individual students or the whole class. The influence of the researcher on the students' view is not foregrounded in this analysis because a large part of the communication about the tool was through the teacher. Therefore the influence of the teacher's communication to the students takes on a more important role. However, the researcher's active involvement in lessons, interviews and especially the workshops with the revision group at Clover Fields calls for some attention to be paid to the student-researcher relationship and was taken into consideration throughout the analysis of the data.

Whereas the previous chapter was divided into two parts engaging with each teacher in turn, this chapter will be structured around themes rather than individual schools. Some of these themes cut across both development studies and some are most prevalent in a particular case. The themes were dictated by the topics of conversation emerging in student interviews - some proposed by the researcher and some dictated by the concerns most pressing to the students.

The analysis seeks to be sympathetic to each individual student's view of learning, school and working with ThinkSpace. Unfortunately each individual student interview provides too little material to enable thorough case studies of each students' views - but conversely the student participants must not be treated as one. The themes which cropped up across interviews, are used here to single out individual students' voices when they address the issues especially pressing to them.

Across the two school cases different issues gained more importance: in Park Hill school there was very little student engagement with the project and therefore it becomes important to uncover reasons for the low rate of participation. At Clover Fields students engaged more readily in the project,

although this was not the case for all the students, thus it becomes interesting to examine difference in personal approaches to the ThinkSpace work rather than look for environmental factors. As was the case with the data from teachers, it is clear when looking at the student data that to view their attitudes to the introduction of ThinkSpace into their history lessons purely in terms of their attitudes and engagement with the computer technology would be a truly impoverished view. Even though some students expressed excitement about using technology, it is hard to find support in the data for the view that students welcome computer-based learning tools purely on the basis of their technological nature. On the contrary, as shall be argued in the following, the students are very cautious when it comes to altering schooling routines and technological considerations are of little importance in their choices.

7.1 Students' interpretations of ThinkSpace seen in light of their learning and study practices

Most often, when students were asked about their experiences with ThinkSpace, they couched their replies in terms of their practices of studying and learning at school. Investigating the ways they spoke about these practices illuminates the ways they came to work with ThinkSpace while also providing a view on to the students' understandings of what it means 'to learn' and 'to study'.

The analysis in this section is separated into two parts. The first, shorter part, looks at the ways students talk about practical tasks they carry out in connection with school and the ways the ThinkSpace tool fits or does not fit with their conceptions of how these practices are, and should be, carried out. These practices are distinct activities, which stand on their own in the ways the students talk about them: taking notes, writing essays and revising for exams. The second, larger part of the analysis, engages with the ways students talk about their learning in more general terms, where the focus is more on achieving a learning or understanding goal, than on completing a task or conducting a well defined 'school activity'. Naturally, this is a highly artificial distinction, and to take it literally would mean to claim that practical tasks performed in school are not about learning and this distinction is used purely for the purpose of lending structure to the analysis. The distinction is made on the basis of the emphasis students put on one or another aspect of their learning and school experiences and on their expressed purposes for using (or not using) ThinkSpace.

7.1.1 Students' views of ThinkSpace in light of practical school tasks

7.1.1.1 Taking notes

Note-taking was a task which was a fundamental part of school life for most students and the theme of taking notes emerged strongly in both the teacher and the student interviews. Notes often carried enormous significance to the students, to the point where, as Thomas argued, some of them confused their notes with their knowledge. In Park Hill School, note-taking became the main metaphor for the

utility of the wiki, with Allan's interpretation of the wiki as a 'note-taking plus' device, and many of the students therefore spoke about the wiki in terms of being a tool to aid their note-taking practices. The sense coming out of the Park Hill interviews was that the wiki was not particularly supportive of the students' learning practices.

In viewing the wiki as a note-taking device, the students often treated it as being no different from using a sheet of paper to take notes, and the wiki came to act as a 'folder' for containing the notes. Some students understood it in terms of purely paper-based metaphors: "writing it by hand or writing it on the computer […] It didn't make any difference.." (Amber, PHS Group 2B interview 13). If wiki pages were not equated to hand written notes on paper, they were talked of in terms of note-taking in a word processor, as being a habitual learning technique in History: "I typed them and then just copy and pasted them.. It didn't make much difference." (Laura, PHS Group 7A interview). In this sense, the teacher's 'note-taking plus' metaphor seemed to loose it's 'plus' for the students and was instead a cumbersome disruption of their tried and tested ways of keeping track of their notes. The wiki was equated to a second paper folder containing a disparate set of notes – neither here nor there:

> I would never put everything up on the wiki […] to not have it all in one big folder.. aesthetically it seems nice to me [to have it all in one place] (Geoff, PHS Group 7A interview)

For most of these students the wiki became a distraction, requiring them to 'take notes' which they would not use. One student however saw a benefit in his notes-folder being online:

> I've got terrible organisation with notes […] I think that's definitely useful for people that aren't, you know, that organised, cause.. you lose stuff from class, all the handouts and stuff, they can go [on the wiki] (Harry, PHS Group 2A interview)

Most students however perceived the material on ThinkSpace as being separate from their main body of work and somewhat inaccessible :

> …it felt like when I was using the wiki that wasn't so much doing work that I would be referring to, and I guess I didn't refer to it for my revision […] but it kind of felt that it was separate [...] partly because it wasn't going in my folder (Laura, PHS Group 7A interview)

Laura went on to propose that to make the ThinkSpace work more present, it would need to be integrated more closely with their other work, while again referring to the need to have it on paper: "having it printed out and being sat there and having to write an essay plan from it" (Laura, PHS Group 7A interview).

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[13] Note about the student interview reference format: The interviews are referred to as [Student name][School name (PHS = Park Hill School, CFS = Clover Field School)][Group number in the case of PHS interviews; the letter after the number indicates whether these students were in 12A or 12B][Interview number (1 or2) in case of participants in revision work at CFS]

7.1.1.2 Writing essays

Essay writing was another clearly defined school-related activity, which all students were familiar with and which many students found challenging. When talking about ThinkSpace in the context of essay writing, the map was pointed out as being a potentially helpful tool for structuring essays and outlining arguments.

Geoff from Park Hill School talked about how he found mapping useful in the beginning of the year for helping him gain a view of the material, which he could then turn into an essay:

> You can look at this and you can see factors and you can link them […] Writing it up off the top of your head is impossible to kind of.. visualise.. or remember all of that at once (Geoff, PHS Group 7A interview).

In Geoff's case the map served as a tool for gaining a bird's-eye view on the topic he would write about, from which he could glean the networks of links that he would need to translate into an essay.

Alice in Clover Fields School, saw the links displayed on a map the group had made in class as being particularly helpful to constructing her essay plan. In this phase of her essay writing, rather than concentrating on the concepts displayed on the map, she translated the links into an essay structure, which she saw as being essentially a chain of connections:

> …it reminded me of all the links we did and the sources, so this was kind of my plan (Alice, CFS interview1) and

> …in our actual essay, we have to try and link all the stuff together, so.. using that, we could! I mean, it's like a one line, but then you can build on it more (Alice, CFS interview1)

The visual layout of the map prompted Alice to think about further elaborating the structure displayed there and look for further connections that might have been previously overlooked:

> ...it did make you think of how then you could link more of these together (Alice, CFS interview1).

Richard, a student in Park Hill School talked about a different aspect of concept mapping in connection with essay writing. He used the map to avoid writing a 'shopping list essay', which is an unfortunate as well as typical way students tend to structure history essays. Richard's group had represented the 'factor' they were asked to write about (the geography of Russia) at the centre of their concept map (see Map 3 in Appendix 5) contextualising the other factors in terms of geography. Richard felt that this put the various themes he was to include in his essay in perspective and allowed him to structure his essay better:

> …that first task was really helpful with the first essay we did, cause it really made my essay kind of link together in a whole way. I don't think without doing that [...] it would have been […] like: ok, industry and then the next thing, whereas this kind of […] paragraphs linked together a lot better.. I think maybe because of my understanding of […] how it's all.. all came under the Geography (Richard, PHS Group 2A interview)

This student used the map to focus on the structure of the course material in order to create a coherent essay. In this sense the mapping can be seen to break the habitual preference students express for displaying information in the form of lists, bullet points and chronological paragraphs. The 'shopping list' structure, in representing historical events as strings of disconnected facts or bits of information, represents a lack of understanding of the subject material, as was described in Chapter 2. The A-level student is required to move away from such naive representations of historical events, and therefore it is of potential significance if students can use maps to help them move towards constructing more complex representations and move away from the 'narrative trap'.

7.1.1.3 Revision

Revision for exams was the third 'stand-alone' activity the students talked about. In a high-stake environment such as an A-level classroom, the exam preparation was an important and high-priority activity. In the interviews there was a sense that many students had their own routines and rituals when revising, which they trusted to be the most efficient means to get them the best results. The role most often assigned to ThinkSpace in connection with exam revision was that of a 'database' or 'repository' of material, which could be drawn upon in the revisionI liked the idea of having it all on the Internet, so that when we came to exams there was just a massive database for anything we needed to know (Ben, CFS interview1).

The focus in this role of ThinkSpace was mostly on making revision material readily available and handily abbreviated rather than on constructing fresh representations of material in preparation for exams. Although Ben was one of the most prolific producers of content – both in terms of the wiki and mapping – his focus was on having access to a condensed version of the course material – written by themselves or others – which would allow him to save time and effort in revision. As he went on to point out:

> …[on the wiki] we've got a lot of different sources for revisions [...] So I could read through that and not have to read through different textbooks and stuff. (Ben, CFS interview2).

Richard, as one of the few students at Park Hill School who did use ThinkSpace material for revision, also singled out this potential of the tool as being most useful: "I think I used [Group 7A's notes], I printed that one off cause it was better than ours" (Richard, PHS Group 2A interview).

This use of their own as well as others' material for revision, while potentially providing a wider range of resources and a different perspective for the students, also presents a potential problem to the students' learning. As well as giving access to notes written by peers, there is a risk of discouraging students from writing notes of their own because they gain access to those of others. The theme of 'energy saving' or 'work avoidance' appears in many of the student interviews – the wish to attain maximum results with a minimum of effort. In Caroline's interview it became clear that working with ThinkSpace in class discouraged her from making her own notes on the course:

> …for [the Elizabeth course] I did that, but then I felt for Italy I didn't need to do it as much because I had the wiki, so I didn't really feel like I needed to make notes as well (Caroline, CFS interview2).

While this can be interpreted as a measure of success of using the wiki with the students, Caroline's next comment highlighted the problematic nature of such 'success'. As Caroline went on to suggest, because the lessons were mostly discussion-based rather than conductive to direct note-taking, she was not the only one to rely on the wiki for exam revision. Other students also lacked their own notes about the course and used the material on the wiki to fill that gap: "I think last minute everyone thought: oh no, I don't have any notes! Then used the wiki." (Caroline, CFS interview2). Because, by the end of the year, most of the content on ThinkSpace had been authored by the four students in the revision group, it is doubtful whether these notes produced by others were the best tool for the students' revision.

This highlights how encouraging students to use each other's work potentially leads not to improved engagement with the course, but rather to minimization of effort. It is tempting to assume that students' intrinsic interest in the topic matter of the course will entice them to engage with the tasks they are set. However for many students this is not enough incentive and others must be carefully thought through. Students who openly admit to having trouble engaging with the material, such as Daisy ("Books are a bit of a no-no for me" (Daisy, CFS interview) could arguably see an opportunity for limiting their reading to the study of the 'condensed' versions of the material on the wiki. This must not be taken to mean that weaker students will do so more readily than high achievers. The tendency to minimize effort does, however raise important questions about the design of the tasks the students are asked to complete with ThinkSpace and the incentive structure supporting the use of the tool.

7.1.2 Students' views of ThinkSpace in light of learning activities and goals

This section presents the ways students talked about the roles of ThinkSpace could play in their learning according to a general progression from 'simpler' or more primary ways of engaging with the study topic to gradually more complex ones. The simpler ways of operating with the material do not

disappear as more complex goals emerge, rather they take on less importance and come to play more subsidiary roles. Thus the need to gather and access material easily does not disappear as the students' attention shifts toward grappling with the concepts in the material and refining their understanding of it. Rather it becomes a supportive rather than a leading activity. The 'progression' presented here must not taken to mean that some learning activities are less valuable than others, and all activities must form a part of getting to know the subject. It is evident, however, that some students in the two classroom studies had more complex understandings of both the subject content and methods and had more multifaceted views of what learning entails.

7.1.2.1 'Taking it in'

A few, generally lower achieving, students interpreted studying history as 'taking it all in'. While this is a challenge to anybody faced with a new body of information, for a few of the students this was the main challenge presented to them by the course. One student foregrounded the role of memory for learning:

> ..it's cos they remember everything and they have really good memories […] Especially for the exam, I just find it really hard to like.. remember everything, all the little details (Chelsea, CFS interview).

When asked about the nature of learning specific to history, the emphasis is put on chronology and narrative rather than on analysis and interpretation:

> It's all dates, it has to be in dates, when things happened [and elsewhere:] the full facts, yeah, which I think is important to know, because when you do the essay, you're going to need all the dates and things, to just beef up your essay and show that you know (Anna, CFS interview).

> Just have more knowledge about things […] knowing things that other people won't know (Chelsea, CFS interview).

Because learning history was here seen as mainly about remembering dates and strings of events, methods which involved listening and absorbing were seen as most conductive to learning: "I think I learn best by just the simple methods, if that makes sense […] Just notes off a board and just talking through stuff" (Jade, CFS interview).

When Thomas complained about some students mistaking their notes for their knowledge, he meant such 'taking-it-in' understandings as are displayed in the quotes above and the reluctance of some students to engage more actively with the study material. In this light the wiki is seen as a device helpful to the accumulation of the factual knowledge in one place and allowing for a cumulative effort

– "then collectively you have more notes" as Anna put it. Although features specific to the wiki, such as linking and collaborative editing of pages are mentioned, they are mostly seen in this cumulative sense, providing access to more information.

7.1.2.2 Gathering and accessing material

A strong theme in most student interviews is the role ThinkSpace can play in allowing students to collect and easily access their work. It echoes the theme discussed above on accessing material for revision, but focuses more on the opportunities internet access can present for enhancing understanding. Computerisation of school work, however, was an issue that divided the students – some appreciating the ubiquitous access to their work and others feeling the computer was a constraining medium.

Alfie saw computerisation as an opportunity to adapt his working routines to suit his work preferences. He did not read the set sections in the book before the lessons, but saw the wiki as being presenting an opportunity to revisit classroom material afterwards and attain better understanding:

> …when you went home, there was the stuff that you did in the lesson, you could look at […] to get some idea of what you'd done in the lesson […] and understand it. Sometimes if you didn't get it and you can go on there and see what you've done (Alfie, CFS interview).

On the same note, Caroline saw the tool as giving her the option to continue working at home on a piece of work that was started at school:

> …say you do it in class and you get half way through, then you want to finish it at home and you can't take a book home or something so you have to do it at lunch. Then.. well as long as you have internet at home, I guess you can do it. (Caroline, CFS interview2).

Whether Caroline would act on the increased flexibility that she saw the tool to provide is made somewhat doubtful by her added 'I guess'. However, she did single out the potential for more continuity between school and homework as being one of the properties of ThinkSpace.

The view of technology as providing added flexibility, however, was not shared by everyone. On the contrary, some students perceived technology as being a constraint on their learning routines. Because a computer is less portable than paper and access to the internet is not ubiquitous, working on ThinkSpace was perceived to be less flexible than working on paper.

> …if I'm reading notes, I usually end up pacing round my house […] Whereas with the computer I have to stand still and stare and hope it goes in (Ben, CFS interview2).

> I don't have the time to be sitting on a computer, whereas I can take notes, I can do them on the bus, I can do them on the train, I can just write where I need to, but if all the work's on the wiki, then I can't get to it to help me do my notes (Johanna, CFS interview).

The issue of access is clearly a divisive one and the students' definitions of ubiquitous access differ considerably. It is interesting to note that whereas Johanna was perhaps the student most vocally opposing ThinkSpace work, Ben was quite keen on participating and one of the four students to participate in the revision workshops. Similarly, whereas Alfie showed little engagement with the tool, Caroline also participated in the workshops and showed more interest for the tool. From the existing evidence it is difficult to find a unifying principle that explains their attitudes to technology as providing or reducing flexibility other than personal preference of working patterns.

Another facet of this theme was the opportunity ThinkSpace presented for collating the work in one place, representing convenience rather than flexibility. Some students saw concept maps as providing a convenient way of summarising all they needed to know and freeing them from the need to collate their own overviews or assemblages of material. They valued the map as a gateway to information:

> There's just everything there, rather than if you look in the index, I guess it'd be.. you have to work out yourself […] and look for it and stuff. But if it's just there in front of you, then you can't miss it (Archie, CFS interview).

The visual nature of the maps was foregrounded as having particular affordances for navigating through information:

> …that's just better with links to a bit of text which you need to know (Archie, CFS interview).

> …if you're reading a mind map, then you think, actually I want a bit more information on it […] rather than have to go through and search for stuff, you can click straight on it and it just takes you to it (Caroline, CFS interview1).

These quotes give a sense of 'shortcut' in this view of the mapping as applied to reading maps. The focus is on having all the needed information easily available rather than on questioning the way the topic is represented on the map.

The wiki was also in some cases seen to afford convenient shortcuts by allowing for easier navigation than a book would:

> One of the most vital things of course is linking to different pages just by clicking on them: 'oh, I don't know what that means' - click on that and find out. Because obviously if you're reading a book […] you've got to look it up in the glossary and find it, but here you just click it (James, CFS interview1)

This quote conveys a sense that the wiki could present opportunities for exploration, which are more difficult to achieve in paper-based media. However this and the other references to ThinkSpace as support for collating and accessing material rely on the material 'being there' and present little awareness of the processes of the construction of representations, which were the main purpose for the development of ThinkSpace.

7.1.2.3 Making material easier to understand

The issue of understanding study material and access to simplified writing of peers rather than far-away authors or authoritative teachers, was a common theme in many interviews. This is one of the few themes that spans across the two school studies and is mentioned by students of a relatively wide range of attainment. The student-authored material on the wiki was often seen as being less threatening than textbooks and more easily accessible for the students.

> …seeing people my age, what they've written, it was just easier than listening to a teacher who knew everything, it's like cause they might overestimate our understanding levels on what they say (Archie, CFS interview)

> … it's not just a load of.. big texts that you're not going to understand, because everybody else, in the same position's put things on it. So you're all in the same boat, it's written so that everyone can understand it (Anna, CFS interview)

These students foregrounded the way seeing other students' writing is a less daunting route into the material than the way the teacher or the textbook presents it. They felt they had a better chance of understanding the material once it has been 'brought down to their level' by other, perhaps more able students. One student at Park Hill saw the wiki as a chance to actively construct a simpler picture of the material from the textbook, which in the beginning of the year seemed inaccessible:

> This kind of stuff was more useful at first because […] it's less easy to approach […] the book when you didn't know everything […] When we just have a section that we've been working on.. just simple like that .. it's good just for.. kind of quick stuff. (Harry, PHS Group 2A interview)

Later in the year, he felt that the necessity of using the wiki as a scaffold for understanding fell away because the textbook became more familiar and their increased knowledge of the subject meant that they could approach it directly.

Another group at Park Hill school talked about the wiki as a scaffold for their understanding in the context of using a range of resources to support their learning. Grace and Eve were both low achieving students and found the AS-level course very challenging. They talked about how they supported each

other through revision by explaining material and asking clarifying questions of one another. Also during the year especially Grace had to draw on a range of internet resources to attain a level of understanding that would allow her to participate more in class. Although they quickly disengaged from the wiki, Eve saw its potential for being one of the resources they could use to gain access to more understandable explanations:

> There was one time where [the teacher] had it up on the board and someone had done it in bullet points, and that was really helpful […] It was something that would have gone completely over my head before and I was just reading through it when it was up on screen and went: yeah, it's quite good (Eve, PHS Group 4B interview).

And Grace, who was quick to oppose the wiki, conceded that having access to Eve's notes could be helpful: "Sometimes it's good though, because.. she puts more information in" (Grace, PHS Group 4B interview).

For Grace however, gaining looking at other students' material was daunting in itself because "Some stuff, you know, it was just as bad as the books" (Grace, PHS Group 4B interview) and the low quality of her own work compared to others' put her off using the tool.

7.1.2.4 Dealing with the complexity of the subject material

Many of the students were struggling with the increased complexity of study material that they were presented with at A-level. Both the amount of detail and the requirements to construct coherent pictures and arguments out of all the detailed information had increased since GCSE. In the interviews students talked about the strategies they were constructing for dealing with the increase in complexity. For many of them constructing detailed notes was a way of capturing (if not conquering) the complexity and concept mapping seemed to represent a challenge and a threat to their ways of creating order in the material.

Perhaps the most prevalent understanding of the concept map was in opposition to the more familiar learning tool, namely note taking. The two were often juxtaposed and talked about as being mutually exclusive – as Chelsea put it: I'm a list kind of person. Often students made this point in rejecting mapping as a learning tool:

> I don't like mind maps.. I do structured notes, so mind maps don't work for me (Johanna, CFS interview)

The juxtaposition of linear textual notes and concept maps was primarily grounded in how they tended to perceive concept maps:

> I think they just look too messy […] you get all the lines crossing over.. it just looks messy for me […] I don't like it […] I'd rather do structured notes than mind maps (Johanna, CFS interview)

> I found it a bit messy […] it was messy in my mind […] with history I like to kind of think structured in my head (Anna, CFS interview)

As Anna's quote indicates the claim of 'messiness' was sometimes connected with the students' insecure grasp of material, where they found it easier to 'take structured notes'. This suggests that the engagement with the deeper structure of the material is a challenging task, which some students may find daunting. This is supported by the way students talked about 'notes' which suggests that they treated them as a 'received' technique ('notes off a board' – Jade, CFS; 'collective accumulation of notes' - Anna) or as something which can be produced with relatively little thinking: "I like them to be like.. traditional notes, like just blocks, and then just write and write and write" (Caroline, CFS interview2). In this light mapping appears to be perceived as the difficult option. This needs not imply that students resisted engaging with the mapping because they lacked the capacity to do so. They may simply have chosen to complete work to the extent they saw was required of them, and not perceived any added benefits from doing the difficult task of mapping.

The second reason linear notes were preferred to maps was that concept maps contain 'less information' than textual notes.

> Especially with history I find there's too many links to make […] I'd find it useful to […] have a list of links with bullet points of evidence, extra information and stuff like that. Whereas with the mind map, [it's] a bit more.. difficult to do (Ben, CFS interview2).

> I just find it easier to learn from just notes opposed to mind maps […] you can get more information than on mind maps. Mind maps I find a bit sketchy, you don't really get that much actual information on them (James, CFS interview1).

In opposition to the view of maps as being too messy to be able to engage with, these quotes rather show an awareness of the complexity of the material and the difficulty in reducing that complexity into map format. However, condensing complex material into a simpler form was a challenging task, and the benefits of doing it were perhaps not immediately obvious. Interestingly, the struggle with reduction of complexity is part of the initial purpose of the tool, and the role of the map was presented as being a gateway to the complex 'information', which can be explored on the wiki.

7.1.2.5 Grappling with understanding the relationship between information/factual knowledge and understanding/argument

In continuation of the theme of grappling with the complexity of the material lies the theme of the students struggling with turning information or facts or narrative into understanding or argument or knowledge. This theme is especially prominent in the Clover Fields interviews, although this must not be taken to mean that this issue is irrelevant in the other school (rather that the students' engagement with the ThinkSpace project there did not give reason to talk about this in detail).

The students' struggle with getting from facts to ideas or arguments was often expressed through slightly vague references to gathering information, 'linking it together' and 'sharing ideas':

> …the wiki […] helps you to get your knowledge and enables you to link it together (Alfie, CFS interview)

> …it was a way in which we could all write our ideas and collect information about stuff and then you'd have one place where you could go and find it and look at what other people have written, and share your ideas. (Jade, CFS interview).

> It was good to find everyone's opinions all in one place […] and everyone's views from one piece of paper. And everyone put their work into one, which is good, because then it gets other people's perspectives. (Daisy, CFS interview)

Here the emphasis is on the wiki as a communal collection of material upon which other students can draw for their own learning needs and where they can draw upon the ideas of others. However, the active engagement with the material, which is suggested by the terms 'ideas', 'opinions' and 'perspectives' is questionable when the terms are scrutinised more closely. These terms are often taken to mean 'factual information' or a sort of 'packaged commodity' that the students can pick up and use without implying the need to engage with these ideas in a deeper way, even sometimes juxtaposing 'ideas' and argument:

> I think [the wiki] was just more a place to just like.. collect ideas rather than like […] being able to write in an argumentative way (Jade, CFS interview).

On the same note, another student suggested that ideas are something, which can be easily itemised: "I prefer to just list any ideas that I come through under headings" (Chelsea, CFS interview).

These views of such nebulous concepts as an 'idea' as being something rather tangible suggest that these students had not reached a firm understanding of how ideas and opinion emerge from factual evidence. One student stated that "you can get other people's ideas if you use an opinion sort of thing" (Alfie, CFS interview) showing a less than secure grasp of what is to be done with an idea once

you 'get' it and how to turn it into an 'opinion'. This was mirrored in his somewhat formulaic understanding of how to write a good essay in History: "you need good knowledge of your subject. Knowledge.. you need to be able to evaluate and analyse things, so that you get the marks" (Alfie, CFS interview). He seemed to be aware of the need for evaluation and analysis, but not entirely sure how to do it.

7.1.2.6 Connecting parts of the course into a coherent entity

An issue which surfaced in a few student interviews was the need to connect the various parts of the course into one coherent picture of the study topic. The students, being presented with book chapters, factors and key questions, spoke of the need to bring these pieces together, like a puzzle being completed. ThinkSpace was by some of them mentioned as a possible tool to help them find connections between the pieces of the puzzle.

> …it made you start thinking about the overview of the whole course and how a lot of the factors linked together (Alice, CFS interview1)

Perhaps most eloquently, this view was expressed by Archie, who saw the tool as enabling him to connect disparate parts of the material into one picture of the entire course:

> It gave me like a broader view of what we're learning. So overall, if everything links together, it's just […] a big picture, whereas if you don't have a link it's just like a jigsaw and you've got to try and put them together to find out (Archie, CFS interview).

He saw 'linking' as being an important part of understanding history, although he was less sure what 'links' were and how they were useful. In fact, when probed on what he meant by 'links' and why he thought he got 'more points' for linking in the exam, he had trouble explaining she showed a vague understanding of this:

> If you can link the factors together it shows a better understanding of what you've been taught, I assume […] I've just been taught it from the history department, basically (Archie, CFS interview).

This highlights an important issue in both the work with ThinkSpace as well as in the way student data must be treated. Although students may express opinions about 'linking' or 'analysis', they do not necessarily have a firm grasp of these concepts and their expressions must be treated with caution. Interestingly, Archie's expression of uncertainty about the meaning of 'linking' brings to the forth a phenomenon which was noticeable in the classroom. Because both the teacher and (largely also) the students were unfamiliar with concept mapping, finding a suitable role for the mapping was difficult and the mapping tasks went through various incarnations of vocabulary. Concepts were presented to

the students in terms of 'key points' or 'ideas' and even 'bubbles'. The propositions were explained in terms of 'sentences', 'making sense' and 'links'. This uncertainty is picked up by Archie most explicitly, but was also visible in the classroom. However, Archie also expresses clearly and in his own terms, that the role of the tool for him is to provide an overview, which can join the pieces of the puzzle – even if he is unsure of the inner workings of this overview.

The view of ThinkSpace as overview also highlights another issue. Some students felt that this was indeed the role of the tool, but that the overview was only achievable once they had gained a certain understanding of the course material and felt more in control of it. Harry from Park Hill School, was mentioned earlier because he saw the wiki as a space where the group could construct a simpler representation of textbook material. Elsewhere, however, he talked about the way the tool could serve as an overview, but didn't come to do that because of timing issues:

> … a lot of the overview stuff I might have got into later in the year, but we did do less things by the end of the year […] it's only near the end of the year that you get the whole timeline in your head and you start grouping everything together (Harry, PHS Group 2A interview).

This suggests that he (and other students who expressed similar ideas) saw 'overview' as something retrospective, rather than something that is constructed alongside learning new material during the year. For this very reason multiple students expressed that mapping was a summative and backward-looking activity and not suitable for ongoing 'grappling' with new material. This can perhaps provide part of the explanation to why the wiki and the map were often treated as separate tools rather than an integrated environment, and certainly rises questions for consideration in any further development of the tool.

7.1.2.7 Drawing upon peers' ideas

Classmates naturally play an important part in learning in the classroom. As discussed earlier, the tool was some times talked about in terms of of collaborative practices, such a helping each other grasp difficult material or to collectively accumulate a notes database. These practices, however, fall outside the main goal as defined by the terms 'collaborative learning' in Chapter 2, as situations where learning partners are working together closely in pursuit of common goals and have a high degree of synchronous and interactive communication. ThinkSpace was only rarely talked about as something which could prompt discussion or be used to change a student's mind about an issue. This must not be taken to mean that such situations were absent (and several such occurrences will be discussed in detail in the next chapter), but that collaboration was not at the forefront of the students' minds when talking about ThinkSpace.

Alice, a high achieving student from Clover Fields School was the only student who talked about this affordance of the tool more extensively. By the end of the year she came to see discussion of study

material as the main purpose of working with the tool: "although we were doing the wiki, it was more of a discussion point" (Alice, CFS interview2). During her exam revision, she appreciated the possibility of analysing other students' points of view in order to broaden her view of the course:

> … it's nice to […] have different view points on it and their ideas and could you incorporate that into your thing and even if you don't think they're right […] could you pick flaws in their argument and put it in your own. So it widens your understanding (Alice, CFS interview2).

Alice's analytic and interpretive approach to any representations she might find on the wiki was mirrored in her general understanding of learning and specifically learning in history. She approached books with the intention of 'grasping what they are trying to say' and treated historical sources as literary text:

> …the author's trying to tell you something and.. the way they say it is different to the way you express yourself. So trying to decipher that, […] it isn't black and white, there's a lot more I think underlying meanings in a lot of literary text, so.. it's when it comes to sources I feel it's kind of like the same (Alice, CFS interview2).

She saw the revision workshops as conductive to the kind of thinking she liked about history:

> I think it was because we had the mind maps up.. we had loads of links together. […] we had to link.. the main point to other points and.. that was a more discussion based thing than PowerPoint and 'this is what you need to know' (Alice, CFS interview2).

In this quote Alice was most likely referring to a particular workshop where the students were asked to decide upon the relative importance of factors to a central question using a concept map. She had an interesting and extensive discussion with James disagreeing with his judgement of which factor was the most important. She felt that discussing the material in class helped her hone her critical faculties in the particular topic of discussion, which directly influenced her ability to construct essays in the exam:

> I think discussion develops your answer more […] to make real history in the essay you need to discus it and put your own viewpoints on it. So I think it did help in the exam to be able to.. write an essay that I actually know about (Alice, CFS interview2).

She compared the Italy course to her other course on Elizabeth I, which she perceived as being 'knowledge based' – and to a large extent irrelevant. She was able to find more relevance and get excited by the Italy course, largely due to the prevalence of discussion and analytical activity on that course.

7.1.2.8 Gradually constructing ideas and tracking their development

One of the high achieving students in Clover Field School, James, talked about ThinkSpace in the context of his growing understanding of the fluid and developing nature of his ideas about the study topic. The nature of his engagement with the tool developed throughout the study and he came to see the tool as helping him trace his overall developments throughout the course.

James was the only student who extensively engaged with the wiki. Both in the initial whole-class phase of work and subsequently in the revision phase, he was the one who contributed the most of the material to the wiki. He arrived at a view of the wiki as a tool for exploration of material through the process of construction of representations. This was, in his view, not the only use for a wiki, which could also be used as container for notes and as means for reiterating and memorising material. However, having previous experience with editing Wikipedia articles, he could see a deeper application for the wiki, and in the first interview he critiqued the way the wiki had mostly been used to gather factual information:

> …the wiki that we had was just facts […] there were bits about sources on there, but not so much, and it would be good if we could.. because […] the most important thing is the sources (James, CFS interview1).

In contrast to almost all other students he saw the wiki as a work in progress rather than a readily available resource and the learning value in constructing it, rather than seeing the writing process as a necessary step to arrive at the finished resource.

> … it did become very useful. Not only just looking at the stuff that myself and other people had written earlier, but this.. continually working on it.. (and elsewhere) Also to be able to keep looking over the same stuff and then change it as your thinking develops (James, CFS interview2).

Also as the only student he described hyperlinks in terms of construction rather than consumption. He talked about links not just as 'taking you' somewhere, but in terms of discovering connections in material which were not clearly marked before and delineating key terms and ideas:

> …you pick it out when you see it in there a lot and you think: well obviously, these two topics are quite related and you would want to explore.. the links between them and maybe write some more saying why there's a link, so if you.. keep writing about the same thing […] Key terms and key ideas that are maybe related to something you're writing about (James, CFS interview2).

This complex understanding of the wiki is clearly predicated on a high level of motivation to engage with the tool, as well as a confident familiarity with the course material. Furthermore James was a proficient user of technology and was familiar with the workings of a wiki having edited Wikipedia. But also his views of learning supported his take on wiki writing. James' view of linking as a tool for exploration of ideas are clearly mirrored in his view of learning as being emergent and changing:

> You'll have a different perspective on what you know at exam time if you know how it's changed.. if you've learned your thinking has emerged then.. you have a slightly different perspective on what you have at the end (James, CFS interview2).

Drawing upon this view, James appropriated the wiki to record his developing understanding and his iterative approach is visible in the way he often returned to edit a page multiple times.

7.1.2.9 'Rehearsing' ideas, representing their thinking, exploring emergent thinking

Another practice which was mentioned in the interviews with the most able students in both schools can be termed the 'rehearsing' ideas or the exploration of emergent thinking through creating representations of the material. In this context the students talked about how concept mapping could help them get to grips with their thoughts and actively make sense of the material through representing it visually.

A high achieving group at Park Hill School created two very different maps (see Maps 5 and 7 in Appendix 5). The first map was very large and full of an entangled web of links spanning multiple areas of the syllabus. The second was more akin to a diagram than a concept map, represented an outline of the events of 1917, and used colours and shapes cleverly to represent an argument. The students were very pleased with the representation they had achieved: "It was really simple [...] it was Russia to a tee" (Ewan, PHS Group 7A interview). However, as Laura realised the two maps were of a different nature and useful for different purposes:

> …the 1917 map […] you could see how that could turn into an essay (and elsewhere) it starts somewhere and it goes somewhere and that's how you want an essay. I wouldn't be able to plan an essay from something like [the first map] because it would be like where do you start and everything links and everything.. (and elsewhere) but you know, you can see that it all links together and you can see how chaotic it is (Laura, PHS Group 7A interview)

The exploratory and 'chaotic' nature of the first map was not a helpful tool to essay writing: "you need to reduce the complexity for the essays" (Geoff, PHS Group 7A interview). This distinction shows a rather sophisticated engagement with the mapping as well as a purpose to the task. Laura saw the first map as a reflection of their ideas, which were perceived as something dynamic: "that probably represents some of our ideas that were a bit rowdy and unwieldy, we hadn't quite finalised

them" (Laura, PHS Group 7A interview). She saw the mapping as being a good way of 'playing around' with the material and the computer as being supportive of that activity because "the nice thing about doing maps on the computer is that you can change it as you go" (Laura, PHS Group 7A interview).

At Clover Fields School James talked in a similar way about using mapping to enact his thinking. As opposed to almost all of his class mates, saw the process of creating maps as being more useful than studying them subsequently: "I think for the mapping it was definitely more the initial thinking of doing it opposed to the going back and looking at it later" (James, CFS interview2). He saw the mapping activity as being useful for creating an overarching representation of the course and gaining an overview of each of the key questions:

> …just being able to link all of the.. things together to show how the whole course hangs together […] So it was useful for drawing the key questions together (James, CFS interview2).

His language suggests an understanding of learning as requiring active construction – grappling with the information to give it shape and to come to an understanding of its structure.

However the students in Park Hill School pointed out that this style of working, which allowed them to gradually develop their ideas, was in conflict with their awareness of the up-coming exam. Laura felt that the explorative style the wiki and concept mapping work suggested were unsuitable for a course, which should be directed at getting a good exam result:

> I think it's such a shame that we had exams this year, because […] I was just getting to kind of.. get everything and enjoy it, but then it was like: this is all for an exam. If it was more relaxed […] you would be able to feel like: I can play around doing whatever I want.. kind of changing things around (Laura, PHS Group 7A interview).

Although most clearly expressed by this particular group in Park Hill School, this was an underlying concern for all students, and one which only few students managed to successfully reconcile with the ThinkSpace work. The revision group at Clover Fields School were the only students who came to see the ThinkSpace work as an addition to rather than a replacement of their regular work in history. This was possible because they were willing to devote extra time and attention to building their Revision Web, which suggests that they came to see the wiki and mapping activities as valid contributions to their overall work.

7.1.3 Summary

The ways students interpreted ThinkSpace are to a large extent illuminated by the activities in which students participate as part of their school life. ThinkSpace was understood by the students in light of

the goals it could serve and the activities it could feed in to - as well as the ways it disrupted habitual ways of going about learning. This meant that most of the goals embedded in the design of the tool were slow to be realised because they did not fit well with established learning practices. On the wiki, where it was taken up by the students, the prevalent target of the writing activity was to enable subsequent reading. The focus was on collecting, gathering and sharing 'what you need to know' for the course. Although there are some instances where the attention is shifted to recording developing understanding and constructing representations, the students see the wiki as being outside sense making activity. However, as shall be discussed in the next chapter, practices of gradual development of ideas and analysis of peers' understandings were emerging, and could potentially be expanded upon. Concept mapping, which overall was not resisted to the same extent as the wiki, fitted in better with practices of essay planning as well as trying to visualise and make sense of the study topic to various degrees of complexity. For a significant number of students, however, mapping represented a threat to the order they were trying to impose upon the material.

The students' views of learning, and in particular learning in history also played an evident part in the formation of their views of the tool. While some students, such as Alice, devote a lot of thought and attention to the ways they learn, many other students are less advanced in their thinking about their own learning practices or about school. Therefore there are certain characteristics of 'being an A-level student', which account for part of their views of the ThinkSpace work. The importance of 'getting things done' over 'learning' is one such characteristic, which tints the students' approach to any school work. Also the tendency to concentrate on form above matter (in the focus on walking while studying, writing notes on the bus or finding 'black and white text' off-putting regardless of its content) is important to the way students approach any innovation in the classroom.

The next sections will broaden the view of the students' reactions to the tool by including other influences in addition to the learning and study practices the students used to contextualise the tool.

7.2 Students' perceptions of the teacher's engagement with the tool

It is evident from the description of the classroom work in Chapter 5 that students' engagement with the project was very low in both the Park Hill classes (whereas it was higher, although far from unproblematic at Clover Fields). When showed printed collations of the material they had produced during the interview, most students at Park Hill expressed surprise: 'Did we make this?', 'I really don't remember doing that' – these were typical responses to seeing the results of their work. Hardly any students had used any of the material they had produced on the wiki for their revision and most did not know the web address where they could access their wiki, their login details or even which group they were in. Some of the low level of engagement with the ThinkSpace work the students put down to laziness, but also to the low priority the students felt was given to this part of the course. The

ThinkSpace work "felt like a side project" (Geoff, PHS Group 7A interview) with which the students were not strictly required to engage. It seemed to them to be separate from other teaching:

> …instead of having it more integrated into every other lesson, it would be like: oh, today is a wiki lesson […] And so we'd do that and he wouldn't teach in a way. (Ewan, PHS Group 7A interview)

Although completion rates on homework were generally perceived to be a problem - "It's nothing personal to you […] You've seen him trying to get us to do our work!" (Laura, PHS Group 7A interview) – work associated with ThinkSpace took on an even lower priority. On the few occasions where Allan did try to integrate the tool into the lesson without the researcher's presence, technological problems prevented him from doing so. As the year went by, the ThinkSpace work seemed still more remote: "[we] were given less and less things to do on the wiki, because Mr. Cunningham expected less and less over the year" (Jake, PHS Group 2A interview) – until it gradually faded from their memory entirely. In this case the lack of close engagement with the tool from the teacher's side translated into disengagement by the students from the project because they felt no need to participate.

7.3 Students' views of collaboration

One of the main facets of the ThinkSpace tool, which came through strongly in the way the tool was presented to the students and developed with the teachers, was the way the technology could support collaborative learning. This was one of the most difficult aspects to make work in the classroom, and instances of collaboration, in the sense it was defined in Chapter 2, were rare. These instances of collaboration and the role of the tool in supporting them will be discussed in depth in the next chapter. This section will engage with the students' attitudes towards collaborative learning and their understandings of what it means.

The sections above discussing students' views of ThinkSpace in the light of their learning practices, have naturally touched upon many issues of collaborative work and learning. Because supporting collaboration was one of the main goals in the ThinkSpace work, students' talk of collaborative activity is often inseparable from their talk about the tool. However, focusing more sharply on the students' expressed opinions and views of collaboration brings to the forth a set of issues, which are influential to the formation of their views of the tool, and are to some extent independent of the tool itself. These include factors such as student personality and confidence, as well as managing relationships in collaborative interaction.

7.3.1 Personal issues

The importance of personal confidence and individual students' views of their position in the class must not be underestimated. This issue has already surfaced in the discussion of students' perception of peers' work as being a helpful stepping-stone or as being off-putting. Personal confidence is perhaps even more important with regards to collaborative work, and in one group in Clover Fields School the contrast of views of the tool can be to a large extent explained by this factor. In this group Johanna and James did not see eye to eye with the ThinkSpace work, but whereas James did not ascribe this disagreement much importance, for Johanna the issue had great importance and was very emotionally loaded. She expressed her opinion in highly personal terms:

> …James and Ben think they're god's gift to history at the moment. I must admit they are excellent at history, but their heads are getting too big for them […] yes, you're both good at it […] but you've got to let everybody else get that time to grasp it, we've only been doing it for three or four months.. (Johanna, CFS interview)

In a conversation the teacher characterised Johanna as being a capable student who had done very well at GCSE, but was struggling to find her stride in the A-level work and whose confidence therefore suffered. Seen in this light Johanna's defensive attitude can be seen to colour her view of the collaboration:

> …he edited really silly little bits as well […] it was sort of like it's my mistakes, so if I've done it wrong, I'll pick up on it, I don't want you thinking you're better than me, I'm doing it wrong, so you're going to teach me how to do it (Johanna, CFS interview).

The understanding of the purpose and meaning of collaboration Johanna expressed in the interview was similarly defensive – she saw collaborative activity (mostly in terms of teacher participation) as being one step away from cheating and advocated 'fairness' in how teachers went about helping students improve:

> …I always get frustrated when teachers do other people's coursework, because I always have to get my own grades […] I think.. like helping people to learn - fair enough. […] But doing their work for them, I don't agree with because it's not a true representation of what you can do (Johanna, CFS interview).

On this basis she equated others' interference with her work on the wiki with 'cheating', rejected collaboration with James and quickly 'gave up on the wiki'. This 'personality clash' had a major impact on Archie's understanding of the tool. Being the third group member he came to perceive one of the wiki's benefits as being able to write it individually, whereas the map required the group to collaborate around the same screen, which was problematic in the group climate.

7.3.2 Learning as being personal

The view of learning as being something 'personal' was also expressed by other students, albeit in less impassioned terms. Caroline, for example, saw group work as something that was done in earlier years, whereas 'serious' A-level work required individual study:

> I think we do work in groups more when you're sort of like lower down the school […] You know, because A-levels is meant to be sort of independent learning, you do stuff by yourself (Caroline, CFS interview1).

Although she was not opposed to working in groups and enjoyed collaborating with her peers in the revision group, she was somewhat uncomfortable with the idea of sharing her work with others (although she reports eventually overcoming it):

> I preferred reading it to writing it because.. I didn't like that idea – I think it sounds a bit stupid – but I didn't like that idea that I wrote and then other people leaned from it (Caroline, CFS interview2).

This remark suggests that Caroline views learning firstly as something primarily personal, and secondly as a 'product' which can be transferred from one person to another. This view makes it difficult to engage in collaborative activity, except if it is understood as gaining access to material produced by others. Indeed, as discussed earlier, many students understand ThinkSpace primarily in those terms, seeing the learning as stemming from individual work and the role of 'collaboration' as being primarily cumulative: "I kind of learn more by doing things each individually and put it together as a collaboration" (Richard, PHS Group 2A interview).

7.3.4 Managing emergent collaborative relationships

The only notable instance of collaboration taking place on the wiki took place in the revision group in Clover Fields School between James and Ben. The two boys were good friends, both were high achieving students and the teacher described their relationship as having a degree of 'friendly rivalry'. These two students edited each other's pages on the wiki both adding content as well as changing each other's contributions. Neither of the two were averse to opening their work to others – in fact James, as opposed to Johanna, thought that it would be useful if others corrected his mistakes:

> …if you'd written an article and you've got a date wrong or something and nobody edited it then you'd be going away thinking that's what happened (James, CFS interview1).

This was, however, unlikely to happen because James' contributions were perhaps of the highest quality of all the students. Interestingly, Ben did edit some of James' work. Some of the small edits were in the competitive spirit: "Sometimes if I correct like tiny little mistakes he's made, it's a bit of

fun" (Ben, CFS interview2). However, if he made any additions or corrections of substance, Ben felt he had to communicate this to James: "I used to speak to him on MSN if I'd added anything just to check with him that it's ok" (Ben, CFS interview2). Thus he nominated James the group leader and felt that he needed to report to him on his activities on the wiki. In one of the revision workshops Caroline also expressed unease at the thought of editing James' writing.

This highlights an important issue to do with collaboration in the classroom. Even between close friends editing each other's writing is difficult and the students feel that it needs to be closely and sensitively managed. The separation into 'yours and mine', which this unease often leads to, will in most cases naturally lend a cumulative quality to the collaborative construction of the wiki - although in the case of James and Ben, the boys managed to direct their work collaboratively. Alternative norms of politeness and mutual respect would need to emerge if students are to feel comfortable with editing pages created by other students above and beyond correcting spelling or grammatical errors.

7.4 Role of students' attitudes to technology

So far it has been argued that largely it was the students' learning and schooling practices that guided their views of the affordances of the tool. This section will ask the question: what role does the students' general attitude to and proficiency with technology play in how they come to view ThinkSpace?

Firstly it must be noted that most of the students reported a low use of technology in both schools. Computers were mostly used by the teacher to present PowerPoint slides (and a few watch content online, reported Amber at Park Hill School, who was doing Media Studies). The in-school use of computers by students was usually limited to word processing or none at all:

> …we don't really use that much technology really. This is really the only lesson that I use the computer (Alfie, CFS interview).

> …in school you only use the basic Microsoft Word, Excel […] There's no new technology […] Ever since I've been here, it's all the same (Daisy, CFS interview).

> …the stuff you do from year 7 onwards, they don't teach you how to use the computer for revision […] its all about how to write a formal letter […] so in terms of that, it doesn't really help you a lot (Anna, CFS interview).

Perhaps unsurprisingly some of the students did not see a role for technology in any of their subjects, or could not imagine how technology could be applied:

> …the subjects I do, you probably wouldn't use [computers] Like I do English, Psychology and Drama [… there is] no real use for a computer I wouldn't say (Chelsea, CFS interview).

Thus the ThinkSpace tool for most of the students represented a new way of using technology for learning in that it was directed at the process of 'grappling' with material instead of a product, such as an essay, and in that it presupposed collaboration. Furthermore, almost none of the students were familiar with wikis (above and beyond reading Wikipedia articles). Because Thomas had been experimenting with mapping software in the classroom previously to the ThinkSpace work, many of his students had experiences with online mapping tools. However, Gliffy proved to be a bit of a challenge to many of them because the software was 'fiddly' and required concentration. Overall the technical proficiency of the students in both schools meant that they could operate both the wiki and the mapping software if they set their minds to it: "I think once you're on it, it's fine […] Because most people know how to use that sort of thing, because we're fairly media literate these days" (Amber, PHS Group 2B interview). However, for many of them the lack of engagement with the tool meant that they never learned to operate the software.

This, however, was not a universal rule – two students (one in Clover Fields and one in Park Hill) lacked access to the technology at home (no internet connection in one case, and a very old and slow computer in the other). Only one student can be said to have lacked the technological proficiency to operate the tool. Alice, who certainly did not lack the will to use ThinkSpace and was an active participant in the revision group, never got to grips with Gliffy and was unable to link concept on the map to wiki pages. She was not afraid of asking questions and received additional help throughout the year, however, this proved not to be enough:

> It took me a while to do it, in the end it was Caroline that was the one who just did all the stuff on the computer (Alice, CFS interview1)
>
> I think I accomplished it once.. but then I'd always forget what I'd have to do. I think I'd need like a pack.. this is what you do, step by step, because I really can't because I just forget the whole process (Alice, CFS interview2).

Her inability to operate the tool prevented her from using it to the extent she intended - but she was also the one to try hardest and one of the students to engage most actively with the tool. She contacted the researcher when doing revision asking for help to log in to Gliffy, but even with additional instructions gave up on using the mapping tool. Although Alice was the only student who was prevented from using ThinkSpace because of lack of technical skill, it highlights the fact that not all students can be assumed to be able to 'pick up' the necessary skill. Furthermore, had more students actively engaged with the tool, it is possible that more variation in technical ability would have become apparent. Overall, however, the students were proficient users of technology, who did not find operating the tool an obstacle and who were generally positive towards using technology.

Not all however saw the computer as a instrument for learning, and for some students the screen carried an expectation of entertainment rather than learning. Ewan saw computers as being mostly "for entertainment. The thing I use my computer for most is definitely music" (Ewan, PHS Group 7A interview). For Eve websites carried connotations of something colourful and light-hearted:

> …I didn't like the [wiki] site much. It was a bit.. it was all the same font and the same colours, you can't make colourful bouncy things. I just don't like the typing (Eve, PHS Group 4B interview).

This disassociation of computers from learning was described by some students at Park Hill as endemic to school:

> … as soon as they say: oh, we're going to use the computers.. it's kind of like, from then on you're not really going to do anything or sort of think that much (Richard, PHS Group 2A interview).

> I think some people just think they're above kind of doing this sort of thing […] because you know, maps.. and it's on computers and stuff (Jake, PHS Group 2A interview).

This association of computers with games, 'fooling about' and avoiding work coupled with a lack of experience of how technology can be used by the students to support their own learning, can go some way towards explaining why so many discounted the tool as a learning aid. This explanation, however becomes more powerful when coupled with the students' understanding of school learning as revolving around particular activities and practices, most of which include no technology. In this light, the computer, which is meant for entertainment, does not fit into their picture of what happens in school, and the activities conducted at the keyboard are seen in the light of a novel 'twist' on the familiar activity of note-taking.

The few students who did engage with the ThinkSpace work, primarily the participants in the voluntary revision workshops, did form multifaceted and sophisticated views of the affordances of the tool. However, for many, the ThinkSpace work remained a chore and a mostly useless one at that. As Grace summed up her own opinion of the tool:

> I like researching on the internet and stuff, because that helps me understand […] But this is so boring! You have to like.. work it out and everything (Grace, PHS Group 4B interview).

7.5 Concluding remarks

The most important lesson to learn from the analysis of the ways the students in the two schools engaged with the ThinkSpace work is, in parallel with the lessons drawn from the previous chapter, the importance of the students' understanding of their learning and study practices to the formation of

their views of the tool. Even though the students' attitudes to technology in general did crop up in the interviews, more attention was paid to the ways the activities students were asked to carry out with the wiki and mapping tool, did or did not fit with their existing practices of learning at school. ThinkSpace was mainly understood in terms of these practices and in comparison with other tools used to enact these practices. Thus the wiki was compared to note-taking on paper or in a word processor and concept mapping compared to essay planning routines or rejected because a student's habitual recording practice is in the form of lists.

The main purposes of the tool - to promote collaborative construction and elaboration of understanding - were foreign to many students. However, some students who were developing their own awareness and practices of such complex thinking, could contextualise their work with ThinkSpace in terms of these emerging practices. In a few cases, these students were beginning to appropriate the tool into these routines, altering and developing their learning practices in the process. The next chapter will engage with the questions about how ThinkSpace can come to be used constructively in the context of classroom practices of all kinds, and how the expansion of the repertoire of learning practices exhibited by a few students could be capitalised upon to potentially benefit their peers.

Chapter 8: Facilitation of teaching and learning practices in the classroom

The previous two chapters have formed the basis for understanding how the students' and the teachers' views of the ThinkSpace tool were constructed in the course of the project and how the tool came to be used in the two classrooms. Building on this understanding the present chapter will provide material relating to the third research question:

RQ 3: In what ways can the ThinkSpace tool be used constructively within school practices to support learning and teaching activities?

> RQ 3.1: Which practices involving ThinkSpace had begun to emerge in each of the two development studies?
>
> RQ 3.2: How can these practices be further developed to support teaching and learning?

To answer these questions this chapter will investigate the practices that emerged or were beginning to emerge through the use of ThinkSpace as observed in the classroom or reported by the students and teachers. The second subquestion about the further development of these practices in the future will be discussed in more detail in the next chapter.

Because of the relatively brief nature of the project, few practices in using the wiki and concept mapping could be termed 'established' by the end of either of the two classroom studies. However, some patterns of constructive practice were beginning to emerge, especially in the case of Clover Fields School, where ThinkSpace was used more extensively. Furthermore, the teachers' and students' views of the affordances of the tool help draw a picture of how the wiki and the concept mapping tool could be used to support teaching and learning activities in and out of the classroom.

The analysis presented here draws together the multiple threads of evidence gathered throughout the work in the two schools: views expressed in student and teacher interviews, records of the classroom activities and reflections in the field notes and not least 'digital traces' of the participants' activity on the wiki and the mapping tool. Whereas previous chapters concentrated mainly on the views expressed by the study participants in the interviews, here mainly episodes observed in the classroom will be discussed and to a minor extent supported by participants expressed views. Also the role the technology played in each of these episodes will be highlighted in order to focus attention on the contribution of the technological means to supporting teaching and learning practice.

8.1 Useful and intelligent practices

The ThinkSpace tool was designed to support particular types of practices. As it was discussed in Chapter 2 the initial purpose for introducing the tool into classrooms was to encourage collaborative 'grappling' with course material. Grounded in a particular view of learning as being intrinsically social as well as oriented towards mastery of conceptual tools, the design of ThinkSpace suggested particular types and sequences of activities, which should focus attention on collaboration as well as conceptual analysis of the material. However, the actual uses of the tool in the two classrooms, and the emerging potential uses, suggest a wider picture of its usefulness. This chapter presents the evidence for the range of uses of concept mapping and the wiki, which are supportive of teachers' and students' academic goals - in other words, where the tool was used intelligently and proved useful to the participants' learning. This broadens the focus from the original goal of collaborative and conceptual work with course material to any practice which can support students' and teachers' school life. The next chapter will take up the discussion of the lessons which can be learned from the list of uses detailed below.

The ways ThinkSpace could be seen to be supportive of classroom practice falls into four overall categories:

- Conceptualisation practices,
- Collaborative practices and peer learning,
- Teaching practices and
- Administrative practices.

The first two categories correspond to the original focus of the tool, although they are not confined to it. The two last categories fall outside the original intention and represent ways in which the teachers and the students appropriated the tool for other purposes than those originally envisaged by the researcher. All the uses presented below fall into the category of 'useful and intelligent' applications of the technology, although some raise questions about whether the technology could come to play a demotivating or deskilling role.

8.2 Conceptualisation practices

Supporting conceptualisation practices in and out of the classroom was one of the main purposes for introducing the ThinkSpace tool. 'Conceptualisation' is here used to mean practices which help the students to understand the material in more depth, create connections, gain an overview or reflect on the nature of their understanding - anything which allows them to be more in control of the material or more aware of the ways they approach their learning. In other words it designates a move from

following instructions as to the content and methods of learning to making their own decisions and judgements about what is known and why.

The kind of 'conceptualisation' the combination of the wiki and the concept mapping software was aimed at, was to prompt students to reflect upon the conceptual structure of their topic of study and to challenge them to connect this structure to the narrative detail of the material. Although it is difficult to to isolate 'instances' of conceptualisation because such practices form a part of wider teaching and learning practices, it is possible to pinpoint ways in which wiki and mapping were used to support student thinking.

8.2.1 Thinking about the structure of material through concept mapping

Both the teachers in this study expressed their motivation for participating in the ThinkSpace work at in terms of conceptualisation purposes. For Allan an important goal was to reorient his teaching - and the students' thinking - away from narrative and facts and towards the main concepts in the syllabus. For Thomas it was important to encourage students to form their opinions about the material, again through avoiding narratives learned by rote and through gaining an overview over the main concepts. Both teachers asked their students to reflect upon the material through creating concept maps describing it. It is important to look at the challenges presented to the students by this form of representation because they are indicative of the more general challenges in moving between narrative and conceptual thinking. The difficulties some students faced in creating conceptual representations are possible to detect by comparing the more confident and successful maps to others less so.

The finished maps reflect a wide range of achievement and ability in terms of representation of complexity and argument. As well as representing the students' level of engagement with and understanding of the task, and the amount of time they spent on it, the maps give an idea of the students' level of understanding of the course material. The maps represent a translation of the course content from one form (text, talk) into another (labels, links, spatial layout). It is the difficulties that the students faced in making this 'translation', that reveal the main challenges in the move between narrative and conceptual structures.

The main difficulties emerging from comparisons of students' maps lie in labelling the relationships between concepts and in extracting the essence or nub from the narrative in order to plot it on the map.

An example of the first is visible when comparing the course overview maps created by Group 5A with that of Group 7A.

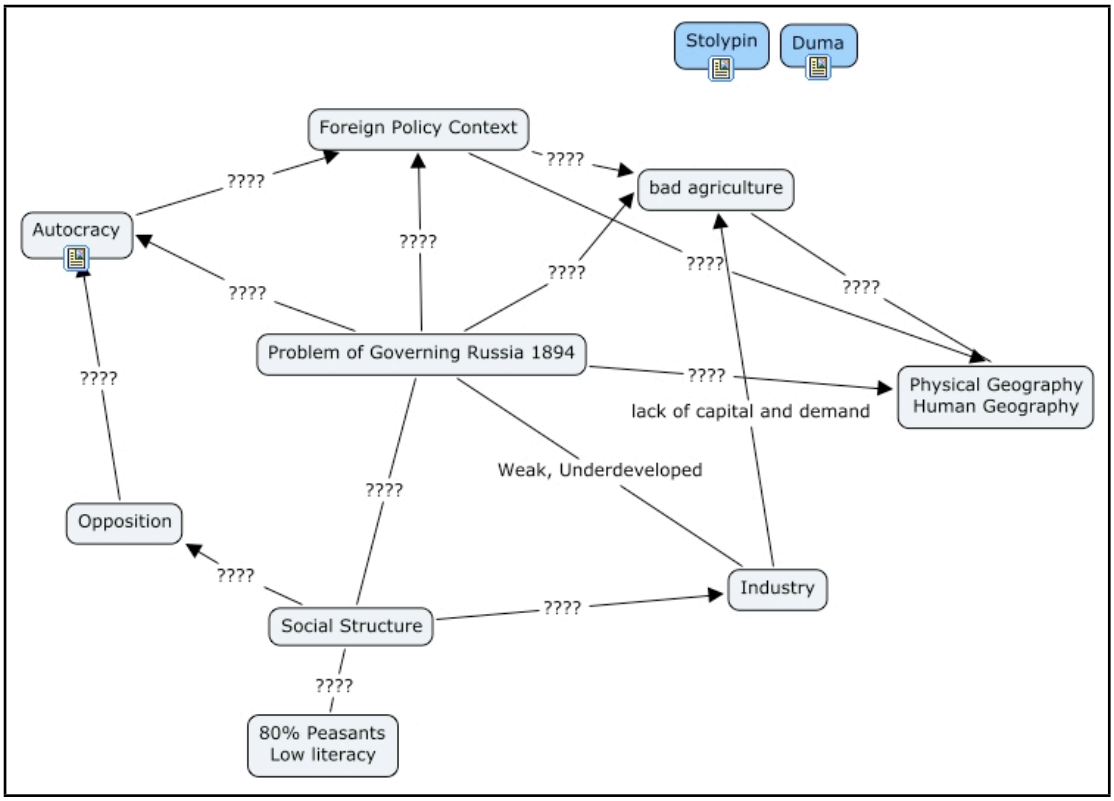

Figure 4. Overview map by Group 5A

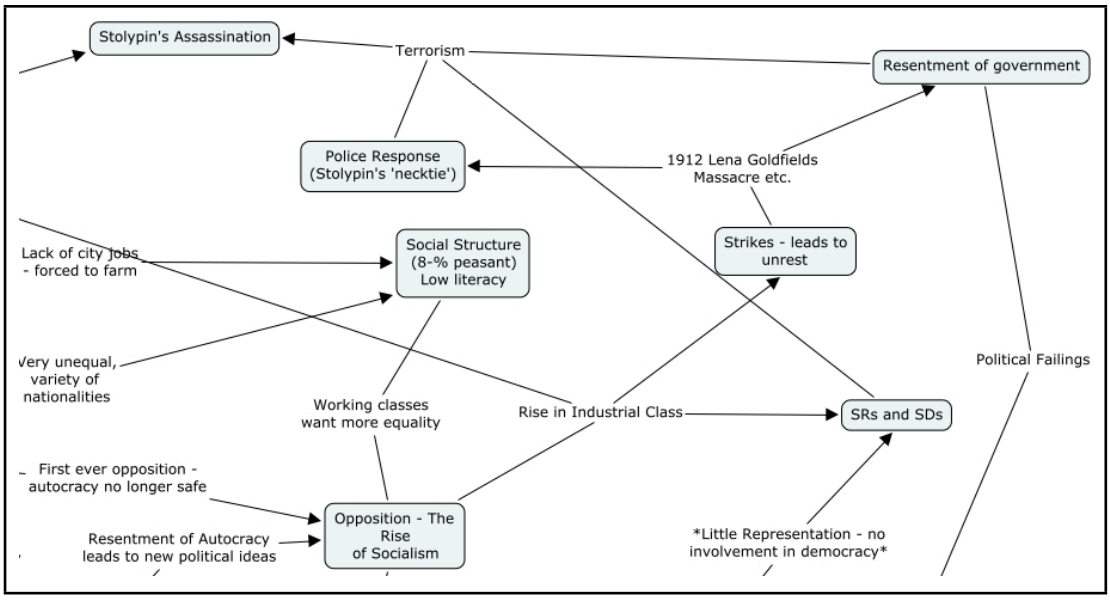

Figure 5. Excerpt from overview map by Group 7A (for full map see Map 5 in Appendix 5)

At first glance the size and complexity of the maps tell a story of the difference in the two groups' achievement. The other major difference between the two maps is that the first group have hardly named any of the connections between the concepts, failing to display an understanding of the structure of the topic above and beyond labelling the main issues which figure in the material

(although they have begun labelling a few links14). The second group have not only explained the connections between the issues, but have turned some of the links into 'hubs' for other incoming connections, thus explaining how interactions between the main issues were in themselves connected to other factors. Thus the Lena Goldfields Massacre is connected both to its causes (the strikes and the feeling of resentments towards the government) as well as to its political outcome (in the form of tightening of the 'necktie'). This second map blurs the distinction between 'concept' and 'link' which is suggested by the concept mapping literature, but corresponds well to the purpose of mapping in this study as a tool to explore multiple possible representations of the material.

Although any conclusions must be moderated by the fact that the amount of time and effort the students put in to creating these maps varied, the difference between these two maps (and others like these) suggests that the naming of the links was a challenge for some of the students. Conversely, most groups found it relatively easy to construct narrative wiki pages about the concepts.

The translation of textual representations of course content into a graphical and schematic representation also proved difficult to some of the students. These difficulties are especially visible in the two maps created by Group 4B and the 1917 map by Group 5B (see Maps 6,8 and 9 in Appendix 5). On all three of these maps the labels for links and concepts chosen by the groups themselves (rather than provided as part of the task) are long and have a narrative character.

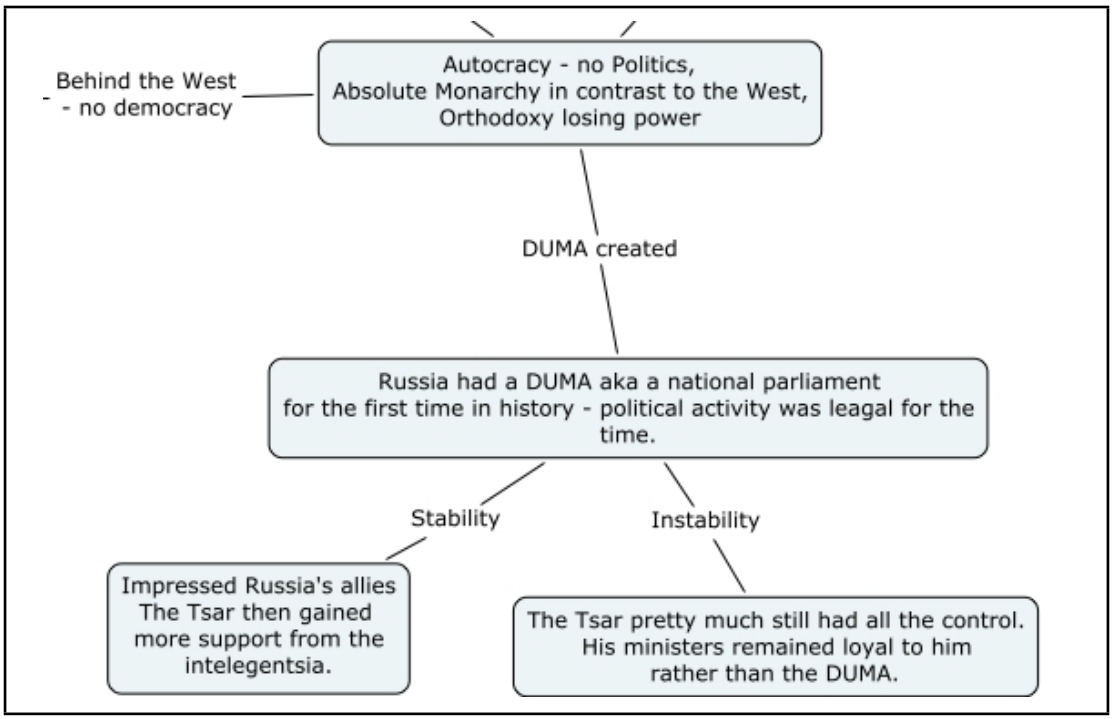

Figure 6. Excerpt from overview map by Group 4B (for full map see Map 6 in Appendix 5)

[14] It must be noted that the '????' notation is an automatic labeling of links provided by CMap Tools to encourage the user to name the links, rather than an expression of doubt by the students themselves.

All the concept labels visible in this extract are narrative in character, using phrases such as ‘then gained more support’ and ‘still had all the control’, as well as a sentence structure. Although the split into ‘stability’ and ‘instability’ reflects the discussions in class well, it closely follows the card-sorting activity, which preceded the mapping task and fails to transform the narrative form of this activity into conceptual terms.

The challenge some students faced in translating narratives into conceptual formats highlights the importance of Allan’s goals of reorienting the teaching towards concepts to enable the students to abstract conclusions from the facts and narrative. Although creating maps is far from the only way of achieving this, mapping can help to set this type of challenge to the students as well as serve as a good diagnostic tool.

A range of approaches and levels of achievement is also visible in the maps from Clover Fields School – although the students were less familiar with mapping here and more time was spent on understanding what mapping entailed. However also here the teacher used the mapping (as well as many other tools) to pursue one of his main focus-points in the course, namely encouraging students to express their judgement about the material, which also proved to be a challenge for the students. The first map, which was successful in this respect was the map about Mazzini created by the Marinari group (see Map 11 in Appendix 5). Here the group expressed a view about Mazzini’s importance by suggesting that the failure to include the peasantry meant that Mazzini was less important than he might otherwise have been.

The way in which a concept map can serve as a diagnostic tool thus prompting further thinking is illustrated by an episode in Clover Fields School. Here, in the same way as in the Park Hill classes, naming the links was a challenging task for the students. During the creation of their map of the 1848 revolution (see Map 12 in Appendix 5), the Marinari group named one of the links “links in with leadership and mismatch of strength“ instead of providing a concrete explanation. They were prompted by the researcher to expand upon their thoughts. The group were not immediately able to explain their thinking and a discussion ensued, which eventually lead to an expansion of the map with an explanation and further connections to the other concepts. They concluded that

> The Roman Republic invited other cities to join but they refused. As there was not a single aim of unification there was no united leadership front. These divided aims led to the mismatch of strength (Marinari 1848 map).

In this instance the mapping task gave an opportunity to question the depth of the students’ understanding because the map provided a condensed and abbreviated representation of the students’ ideas, which was easily visible on their screen to the teacher and the researcher. Thus questions could be directed at the points in their reasoning that seemed to need elaboration. Although the resulting

label is narrative in character and may need ‘distilling’ further to properly fit into a map, the discussion prompted in this episode was useful for furthering the students’ understanding of the material.

The role of the technology in this episode was minor. The public display of a visual representation of the students’ thinking could just as well have been carried out on a sheet of paper. Arguably the mapping tool made the editing of the map easier – however in this particular instance the students added to rather than substantially altered the map. Therefore the support of learning did not stem so much from the technology as from the visual affordances of concept mapping.

The technology played a more important role in the follow-up task to the initial drawing of the 1848 map, where mapping was used successfully to prompt the students to reflect upon the study material and to formulate their own opinions about it. The students were asked to represent an argument which could be used in an essay about the relative importance of the factors they had mapped. This was to be done either by using the spatial layout of the map to represent ‘opposing camps’ or by colour coding to show agreement or disagreement with the essay question.

All the groups chose colour coding – in fact, colour coding was proposed as a good means of showing an argument by the students themselves. Most of the groups achieved some representation of argument – a fact that the teacher could use to assess the students’ progress:

> The fact that they've got a coherent set of colours means that they've come to some sort of judgement about how these things are grouped […] if you look at these three maps which are the more successful, there's almost a confidence in them that leaps out of the page, that they've got an opinion about this. And it's not a learned opinion (CFS Teacher interview).

Thus to the teacher the maps indicated which groups were capable of making their own judgements, and which ones were still trying to repeat ‘opinions’ learned by rote. Again, the most advanced and clear map was produced by the Marinari group. They used three blocks of colour to represent factors in support and in opposition of the essay question – and created a legend explaining the colour coding. The blocks were labelled ‘To do with leadership’, ‘Not to do with leadership’ and, importantly, ‘We don’t really have a clue’ (Marinari 1848 map). Thomas saw the admission of uncertainty as an important step in the students’ learning:

> …this is brilliant: 'we don't have a clue' […] that's a really powerful learning point […] A kind of admission of not understanding something, this is the first step to having to go back and try to work out what it means (CFS Teacher interview).

In this instance the mapping tool was put to productive use by the teacher and the students in collaboration. The teacher outlined the task and the students then expanded upon the brief (proposing colour coding and adding a legend) in order to best get their point across. The map provided a

platform for reflection and gradual elaboration of argument, where layers of complexity were added across several lessons. The role of the technology was in allowing them to pick up the map which was created in previous lessons and flexibly edit, move around and colour it. Furthermore the online format provided easy access to student work, which might otherwise have been forgotten at home or lost. Finally it provided the teacher access to the maps so that he could evaluate students' work – although in this instance no written feedback was given on the wiki and it is unclear whether the teacher's thoughts were communicated to the students.

8.2.2 Recording traces of students' learning development

A second conceptualisation practice which the use of ThinkSpace gave rise to, was that of using the wiki as a recording device for tracing the developments of students' learning over time. This practice was much less prominent than the one discussed above - in fact it was more a potential practice than an actual one. However, with development and through dedicated activities it could become a useful part of classroom practice.

Both the wiki and to some extent the mapping provide a record of the gradual development of the content produced with these tools. Gliffy saves a version of a map every time the user clicks the save button, but this functionality was not integrated into the ThinkSpace work in any of the two studies. However the wiki's record of the page history was noted by James, who argued for the usefulness of retaining a record of his thoughts.

As discussed in the previous chapter, James saw the wiki as a potential space for exploring the material through constructing representations of it. He saw the gradual development of his thinking as being an important part of learning and was prepared to change his mind about the events he studied. He gave an abstract example:

> ...well actually what we thought wasn't that important at the time, if you look at what happened later on, actually this in particular was more important than we first thought. So you can sort of develop (James, CFS interview2).

He was thus aware of his thinking being in development and was not afraid to admit that he has gained a better perspective on the material. Being able to look at the record of his developing thinking was for him therefore an important part of building a better understanding:

> You'll have a different perspective on what you know at exam time if you know how [your thinking has] changed […] if you've learned, your thinking has emerged then.. you have a slightly different perspective on what you have at the end (James, CFS interview2).

He saw it as being especially useful to trace his ideas about the relative importance of the sources they studied in class and the different interpretations the sources assigned to the historical events:

> ...this is what we used to think […] this is what changed my mind, this piece of evidence […] So it helps with the source paper […] being able to constantly develop […] your own ideas on the wiki (James, CFS interview2).

In this instance the recording capability of the wiki technology allowed James to trace the changes in his thinking. By treating the wiki pages as developing artefacts and by being able to flip through previous revisions, he could identify the turning points in his understanding. In this way the wiki did support a complex and intelligent practice of this particular student getting to grips with the different interpretations of the events and positioning himself against those interpretations. This capacity of the wiki for tracing developments in thinking was, however, not evident to most of the other students. Furthermore, it can be argued, that James was an unusual student in his level of effort and motivation. Nonetheless it is possible that such complex practices of reflection could be targeted by the teacher through formulation of tasks specifically focused on such activity.

Thomas did in fact use the wiki's recording capability in connection with a classroom task where the students were asked to critique sources of evidence displayed on separate wiki pages. The students would use the comment box to record their interpretations of the sources. After the lesson, Thomas and I had a meeting (which was audio recorded) where we studied the students' work and Thomas decided to provide feedback to the students immediately. He used his comments to guide the students towards useful ways of writing about sources of evidence:

> I'm trying to model the way that I would use both other sources and events to back up what's going on. Which is a nice thing about this, really, because you can do that […] I might say it in class, and they will go: oh, that's a good idea, and then it's gone. But when they're writing their essays, hopefully, they can come back. (Meeting with Thomas, 8/12-09).

He saw the wiki as a more lasting record of insights that might emerge in similar activities during classroom discussion. Whereas targeted note-taking activities are possible during class, the exact methods, prompts and ways of thinking used to reach an important conclusion are rarely recorded by the students. Here the technology helped the teacher leave a more permanent trace of at least part of the logic of thinking about evidence, which the students could draw upon in their revision.

In neither of the two examples above were the recorded traces integrated systematically into classroom practice in the sense that there was no systematic way of returning to and using these recordings. Ways of doing this would need to be developed in order to capitalise on this capability of the technology. A further discussion can be had about the utilisation of the recording capabilities of the mapping

software which can produce striking visual representations of the development of the students' thinking, but which the software does not currently support very well. These discussions will be picked up again in the next chapter.

8.3 Collaborative practices and peer learning

Supporting and promoting collaborative learning was another important part of the the original focus for the design of the tool. This proved to be perhaps the most challenging part of the study – to introduce collaborative practices to students who mostly saw learning in school as an individual or even solitary affair. However, both the wiki and the mapping were in several cases used to support collaborative activity.

8.3.1 Collaborative wiki writing

As described in Chapter 5, the wiki pages and the recorded logs of student activity on the wiki underwent a separate set of analytical treatments, and the results of this analysis are drawn upon in this section. To trace potential instances of collaborative activity on the wiki an overview of the edit history was compiled for every wiki page created or edited by the students in the two schools. This overview made clear that instances of such 'multiple edits' were very rare in Park Hill School (4) and much more prevalent in Clover Fields School (54). In the next analytical process, each instance of multiple edits highlighted in the previous examination was scrutinised for its content. The differences between each version of the page were analysed and coded in terms of the type of change the student made to the page and its importance in terms of collaborative engagement with the material written by another student. This analysis highlighted two interesting patterns of collaborative editing activity in the data. The first one will be discussed here and the second pertains to the use of the tool for supporting teaching activities and will be taken up later in this chapter.

Overall, the analysis of the wiki logs showed that the students rarely altered material written by other students. Even though students at Clover Fields School edited each other's pages relatively often these edits were mostly minor corrections of spelling or page layout which did not alter the meaning of the material, or otherwise additions which showed little in-depth engagement with what was already on the page. In one case, however, a pair of students exhibited a relatively substantial pattern of collaborative editing of wiki pages. These two students were James and Ben, both of whom participated in the revision workshops. Drawing on their existing close friendship with perhaps a touch of friendly rivalry, the two students used the wiki as an opportunity to maximise the quality of their revision notes about the course.

The pattern was most often that James wrote the most substantial part of the content of the page and that Ben subsequently edited and added to this content. In some cases he added concrete examples to the general descriptions provided by James (difference from previous revision underlined):

> Again, the middle-classes such as Enrico Misley wanted constitutions so they had more say in what went on in their state (Revision Web, CausesOf1820And183Revolutions page, Revision 3)

> A final weakness was the poor communication between rebels. This meant that while there were many revolutions going on, none of them worked together to stand a better chance of succeeding. For example the revolution in Sicily was crushed because the Neopolitian revolutionaries wanted Sicily to remain part of their Kingdom. (Revision Web, ReasonsForFailureOf1820And1831Revolutions page, Revision 3)

In other cases, Ben's corrections of the material are intertwined with the text James had written:

> Austria intervened in Naples on the request of King Ferdinand (at Laibach), and defeated the revolutionary forces despite resistance led by General Pepe. Afterwards the scale of reprisals and arrests shocked even Metternich. It is clear that Metternich of Austria probably would have intervened elsewhere if required because he did not wish to see liberal regimes appearing in Italy. In Piedmont, Charles Felix appealed for support against the second in line to the throne, Charles Albert. With these troops he then defeated him at the Battle of Novara in 1821. (Revision Web, ReasonsForFailureOf1820And1831Revolutions page, Revision 3)

These revisions show that Ben carefully read the material provided by James, that he understood it and was able to enhance the level of detail. Elsewhere he provides references to sources and quotes historians' opinions about the relative importance of events and factors. Thus he engages in activity which is intelligent and certainly useful for practicing the skills he would need to display in an exam situation: namely connecting general historical narrative to particular examples of events and providing a judgement about the importance of events based on evidence.

In this instance the technology played a clear part in supporting this collaboration, in that the wiki allowed the two students to read each other's writing and edit it iteratively allowing for gradual improvement of the collective work. The iterative editing would have been difficult (although certainly not impossible) to achieve without the technical platform of a wiki. Also, as mentioned in the previous chapter, the wiki was certainly not the sole platform for this collaboration, and extensive personal communication was at the base of the relationship between the two students, which allowed them to freely edit each other's writing.

8.3.2 Mapping as support for argument and discussion

In comparison with the wiki, the concept mapping tasks much more often gave rise to collaborative activity. On most occasions where students engaged in mapping, there was some degree of group discussion and argument. Most of these occasions were not formally recorded in detail due to the researcher's role as participant, as well as observer. A few, however were captured, such as the episode of the Marinari group discussing an unexplained connection, which was described above. Perhaps the most successful recorded example of mapping being used to prompt discussion and argument took place in one of the revision workshops.

The students had previously voiced their concerns about not understanding the value of mapping and therefore it was decided to dedicate a workshop to constructing a concept map together as a group. The task was specifically formulated to promote debate in that it asked the students to rank in order of importance the contributions to Unification of different states and individuals (in correspondence with one of the key questions of the course). The relative importance was to be represented by the colour and thickness of linking lines.

After an initial brain-storming and plotting of the main actors on the map, the question was asked about their relative importance and this gave rise to a disagreement between James and Alice. Each presented their argument for the greater importance of their chosen actor and this debate led to an interesting and productive exchange. Alice was arguing that Britain was the most important contributor to the issue and James was arguing that Austria's weakness was. Listening to this exchange quietly, Caroline finally exclaimed: 'do you want us to argue?!'.

Although the debate between Alice and James could hardly be described as adversarial, Caroline felt uncomfortable with the fact that disagreements could occur. This enabled the teacher to emphasise to her that argument was in fact desirable and could lead to the improvement and refinement of ideas. After the lesson Thomas commented in a somewhat exasperated tone that he had been trying to get the students to argue throughout the year and that it was very difficult to get across to them that disagreement and uncertainty was a mark of sophistication rather than lack of understanding.

In this instance the mapping task had served to create a situation where disagreement could be voiced – although many other factors contributed to this, such as the relative comfort and familiarity of the small-group workshop setting and the teachers questioning style. The map was used as a 'canvas' where the argument could be visually illustrated and as a structuring principle to the task. The technology played a minor role in this case, although arguably it enabled a freer mapping style than would be possible on paper as well as making the map visible to all the students on the board.

During this episode the mapping became clearer for James, who commented later in the interview that the mapping grew on him after this workshop, although he was sceptical towards it in the beginning. He continued this map at home and expanded it significantly using colour and shape codes to draw forth particular features of the map. During the next workshop the teacher brought up this expanded map on the board and spent some time studying it with the students, which led to another episode where the map was supportive of discussion. Thomas was surprised at one of the link names James had created: he had named the link between the concepts 'Napoleon/France' and 'Villafranca' 'instigated', and Thomas had not thought of it that way. James then explained his position to the teacher and the other students (also having to define the term for some of his fellow students who had not come across it before).

In this instance the link name that James had chosen prompted reflection in the teacher as well as group discussion. The map supported discussion in that it was a condensed view of a complex argument which prompted a question and needed explicating whereby could serve as a basis for productive thinking, conversation and sharing of ideas. The technological element supported the fluent transfer of the students' work from the classroom to the home environment and back again and meant that the map could be edited and viewed at leisure.

8.3.3 Maps as basis for presentations

Mapping activities were in several cases followed by students explaining their maps to the class. One such occasion was particularly notable because the way in which the students chose to present their material was in stark contrast with their habitual presentation style. This happened in Park Hill School in the lesson with 12A where the students were asked to draw a map of the events in Russia in 1917 and the factors which contributed to the revolution. At the end of the lesson Allan projected the maps the students had been working on up onto the board and called some of the groups up to explain their maps. There was only time for a couple of these impromptu presentations and the most notable was that of Group 7A – the most able group in the class. The main format of the presentation was recorded in the field notes:

> "Where do we start? At the beginning. No, let's start from the inside out." They get a pointer. "We decided to split the main problems up in chronological order." They point and go through the map. Use words like 'links', 'leads to', and they refer to 'previous factors'. "The strength of the Bolsheviks is minimal, that's why it's only got two links going to it. It wasn't on the same scale as the other factors." And referring to the map: "We can see the progression." (Field notes 25/2-08)

This record shows that the students had made a conscious choice of representation of the events and that they saw multiple ways to talk about them. They used the map to support their argument referring

to visual characteristics of the representation, such as the use of large number of links to represent high degree of importance. Importantly, there was a clear purpose and thread of argument in this presentation which the students were trying to get across to their peers.

This focused and purposeful presentation style contrasted starkly with other presentations in Park Hill school, which the students had prepared in advance of the lesson and for which PowerPoint was used. I was present during a lesson where students presented material at the board and recorded that the PowerPoints were mainly good examples of non-thinking. Most were reading their presentations form the screen instead of using their slides as guides or additions to their argument. The information presented seemed badly chosen and in many cases pasted directly from sources. One girl stated:

> I don't know much about this, but I found the information, so I put it in. (Field notes, 3/10-07)

When the topic of presentations came up in the interviews, the students' views also reflected the generally poor quality of student presentations. Harry described them as consisting of "stuff from Wikipedia and some photograph they've got off Google images" (Harry, PHS Group 2A interview). Therefore the students saw little point in presenting material to each other:

> I just think it makes no difference because ultimately you do it at home and then there's no point in presenting it because you're just reading out what everyone can read anyway (Harry, PHS Group 2A interview).

> You never really can learn things from other students.. when you do presentations (Geoff, PHS Group 2A interview).

What comes out strongly in these quotes (and was also the prevalent feeling in other interviews) is that the students tended to equate 'presentations' with reading text from PowerPoint slides. Seen in this light, the impromptu presentations on the basis of concept maps that I witnessed in the classroom stand out as a more purposeful activity. Thus in this instance mapping served to break the stereotype of the student presentation as being a somewhat pointless exercise and give it purpose. The role the technology played in this episode was to enable the students' work to be made instantly public in class and to rapidly transfer between modes of work, making it convenient for the students to explain their thinking while it was still 'fresh'.

8.4 Teaching practices

ThinkSpace was primarily designed to support learners in their conceptualisation and collaboration practices. However, as is argued throughout this thesis, learning is not an isolated activity, and therefore the support of teaching practices is an equally important goal if the tool is to contribute productively to the activities that take place in the classroom. In fact, supporting the teacher in what he

does turned out to be potentially the most powerful application of ThinkSpace, especially in widening the teacher's options for providing feedback to the students.

8.4.1 Formative assessment and Q&A practices

As mentioned previously, two patterns showed up in the analysis of the wiki log data. The first one, discussed above, was that of peer editing of wiki pages by two students. The second pattern is that of communication between teacher and students. Whereas peer collaboration was almost entirely confined to James and Ben, the second pattern appears across all webs on the Clover Fields wiki.

This pattern is characterised by a student responding to input provided by Thomas on a wiki page. This input was typically in the form of a comment, added using the commenting box at the bottom of the page (rather than an actual edit of the main text). This made the teacher's input stand out from the students' work and easily noticeable, whereas edits of the main text on a page were harder to spot (because their original purpose would be co-editing the text rather than critique or feedback).

Thomas used the comments to encourage the students, to give them feedback on their work and ask questions probing their knowledge and directing them towards further and deeper exploration of the topic. For example:

> I very much like your explanation of the might of the Austrian Army. I'd love to see a bit of 'actuality' here - how did the Army prove itself to be decisive in the crushing of the revolts of 1821? (Marinari Web, AustrianArmy page)

Such feedback was often followed up by a student in the group who edited the page in response. The contents of students' edits were analysed as described in Chapter 5: every potential instance of collaboration was scrutinised for the importance of the student's contribution and the level of engagement with any previous content on the page. The analysis showed that most of the instances of collaboration that have been marked up as significant, came about as a result of Thomas' comments. Thus most collaboration on the construction of the wiki, with the notable exception of James and Ben's collaboration in the revision group, was in fact 'collaboration' between the teacher and the students.

Many of the teacher comments were made in connection with the commenting task described above. Whereas elsewhere Thomas' comments were generally directed at the whole group responsible for a web, in this task they were directed at individual students. Looking at the comments on the source pages, the teacher could get an idea of the level of understanding of each individual student because the comments were individually signed. He then provided targeted individual feedback on the basis of each student's achievement:

> So what I'm doing now is trying to draw out a bit of an opinion here because Alice is at the level where they are clearly quite confident and comfortable commenting on these things, and we now need to encourage that, to show that it's all right to actually put her opinion in here (Meeting with Thomas, 8/12-09).

In this case the wiki was used to support the teacher's practice by allowing him automatic access to the students' writing and providing him with a convenient overview of signed and 'packaged' student work. The technology can in a sense be said to have prompted the format of the task (by the easy availability of the comment field and signatures attached to comments), but it was up to the teacher's execution of the exercise to make use of this functionality in an intelligent way.

Following up on the discussion from the previous meeting, in the subsequent lesson Thomas directed the students to the comments he had made and allowed time to reply, and thus the pattern of teacher-student communication described above also held true for this task. This can be seen as an extension of the traditional question and answer practice, which teachers and students engage in on a daily basis, where the teacher gives feedback, probes and guides the students to help them reach better understanding of the material.

In the lesson some students took the opportunity to respond to comments directed at them or at others in their group:

> (Thomas, in response to a student's comment:) great points here Kayleigh - what else in the cartoon tells us that the Pope's actions are not popular with the artist who drew the cartoon? Why would the nationality of the cartoonist affect the message that he's trying to get across here?
>
> (Caroline, in response to the above question:) The use of the word "snuffing" suggests that the author thinks the allocution is a bad thing. The cartoon was published in Punch magazine, which was British. This means the cartoon is likely to be biased as Britain was anti-papal.

This episode exemplifies a way in which the wiki wiki can be used to allow the students time to think about the feedback and additional questions and formulate their answers. Here the wiki technology allowed the teacher to 'shift in time' his attention to each student, in that he was 'addressing' multiple students personally at the same time.

8.4.2 Engaging more students

As part of the episode described above, another purpose of using technology became apparent. As opposed to the other tasks using the wiki, this task was phrased as an individual assignment and the

students, although seated in their groups, were asked to provide individual contributions to the discussion. Each student logged on to their own computer and the comments were individually signed.

The source analysis task had followed a whole-class discussion of one pictorial source, whereafter the students were asked to reproduce similar thinking in their comments on other sources. In the subsequent meeting the teacher reflected upon the ways the task on the wiki differed from usual classroom practice and how it impacted on student participation in the lesson:

> Normally, we […] would have done what we did with the picture source as a group, but for all the other sources. I don't know whether you noticed, but there is actually only four or five of them talking […] when they are sitting in front of a computer on their own […] it's them doing the action, so them thinking about the task, and they can't sit there passively and wait for somebody else to come up with the answer and then write it down (Meeting with Thomas, 8/12-09).

In this light the technology can be seen to enable a blend of peer discussion (because comments posted by other students are instantly visible on the wiki pages) and individual work. Thus it is possible for students to build on the ideas expressed by their peers, while still making every student responsible for providing an individual contribution, which is perhaps more difficult to achieve in an oral whole-class or group discussion setting. However, this blend of features of peer discussion and individual work retains the quality of 'putting the student on the spot', which was visible in the students' initial hesitation to engage with the task and was also noted by the teacher. Thomas noted that as well as being a strength of the technology, the way it demanded every student to participate in a public way made some of them nervous and resentful of the wiki.

This was an unintended consequence of using the wiki as a public open discussion space, which had ambiguous connotations for the students. However, most students overcame their initial hesitation and engaged productively in the task – perhaps more actively than they would have engaged in a whole-class analysis of a similar type.

8.5 Administrative practices

A final category of practices ThinkSpace could potentially be used to support is administration. The term 'administrative practices' is here used in a broad sense encompassing a variety of practices that help teachers and students stay organised and achieve their tasks efficiently. Both for students and teachers administration of their teaching and learning is a concern. A few students did mention administration as one of the useful aspects of working with ThinkSpace:

> I've got terrible organisation with notes […] it's useful to have it all in one place, where it's not just going to get scrumpled up and thrown away.. I think that's definitely useful for people that aren't, you know, that organized (Harry, PHS Group 2A interview)

However the more prevalent view was that the wiki was an addition to the notes folder, rather than a substitution, and an often un-welcome one at that.

Arguably administration it is a more important, or at least a more complex, task on the teacher's part, an it is teachers' administrative practices which shall be discussed below. Although ThinkSpace was not originally oriented towards supporting administrative practices, it could nonetheless play a potentially useful role in administration of classroom practice.

8.5.1 Giving teacher access to student work

One of the immediately visible changes that moving students to work online brings is that the teacher has instant access to the work that students produce. This consequence of the ThinkSpace work was noted by both teachers and raised a number of questions about the benefits and drawbacks of working with technology.

Allan at Park Hill school saw the wiki's affordances for providing access to students' work as one of the main potential benefits of working with the tool. As was discussed in Chapter 6 one of Allan's major concerns was to ensure work completion by all students. Therefore the opportunity to gain a means of 'keeping tabs' on students' work completion was valued by the teacher. Allan saw this opportunity for access mostly as having administrative benefits, rather than expanding opportunities for formative feedback or providing alternative means of communication. He primarily saw the wiki as a way to ensure that the students' work was in order, which it evidently often wasn't. During a previous year he had done his marking on the computer:

> …[at] parents evening it was wonderful to have everything electronically. Because […] with.. dozens of students, you can't remember the particular points about their English style and what they got wrong, whereas if you have it on a single document, you can see exactly which bits of work are missing […] a strength of the wiki would be for parents' evenings, because you […] don't need.. to rely on the young person to bring their folder with them (PHS teacher interview 2)

This, however, raised two questions, one technological and one 'ideological'. The technological question is encapsulated in Allan's subsequent return to marking on paper after having computerised his work for one year. He found being bound to a computer reduced his mobility and flexibility as a teacher, which potentially negated the time and complexity management benefits the technology had given him.

> ..if you mark by hand, as I've done this year, you can do it in a wide variety of different places. Obviously you can take a bunch of essays with you and you can fit it into the time [while you are] waiting to pick your kids up or something, you can mark a few essays (PHS teacher interview 2)

For Allan the perceived flexibility and mobility benefits of paper outweighed the administrative benefits of marking on the screen and he reverted to his trusted paper-based system. This comment is interesting in that it is parallel to some of the students' comments at Clover Fields School about how technology could or couldn't fit into their learning routines. For some students the technology imposed restrictions which they saw as being detrimental to their learning. For both the students who mentioned this, the necessity of being 'bound' to the screen for ThinkSpace work, contributed (among other factors) to them rejecting ways of working with the tool, or rejecting it altogether. The question of technological mobility and the trade-offs that screen work entails is a complex one, and one which might change as technological habits change and as technologies become more mobile.

The 'ideological' question that is raised by using the wiki as an administrative device, is that of introducing further monitoring into the school routines. Allan himself referred to it – somewhat uncomfortably – as a 'police state', where all work is instantly visible to the teacher. Whereas the administrative benefits are potentially great, the connotations of monitoring, control and lack of trust must be taken into account. This is a question with no single answer, but one that must be answered on a case-by-case basis taking into account the characteristics and preferences of the teacher, the particular group of students and the nature of the teacher-student relationship.

Thomas at Clover Fields School also noted the wiki's administrative potential, but he saw it more in terms of gaining new ways of communication and opportunities to provide formative feedback to the students. He also gained more hands-on experience with exploiting this aspect of the tool because ThinkSpace was used more actively in this study (largely due to Thomas' continued engagement with the students through the wiki).

The best recorded example of Thomas' use of the wiki's capability for providing access to students' work was as part of the commenting task, which was discussed above. In the meeting where the teacher left feedback on students' comments he raised the issue of the trade-off between the benefits of such an activity and its practicality.

While Thomas saw the added benefit of technology in terms of personalised learning (because he could comment on individual students' contributions) he saw the main problem in the time it took to undertake such an activity. When asked whether he would usually have time to go into such depth with the work of one class, he replied with a resolute:

> No. It shows the strengths of the approach but also the way that we really need to think about what ICT actually means. It gives me an opportunity to really see which kids are learning what, but it also then means that I'm under the obligation, and have the ability and the means but not the time necessarily to respond to that (Meeting with Thomas, 8/12-09).

He later qualified the resolute 'no' with "It's feasible every now and then" – adding that a teacher needed to develop skills in building in time for such activities into his day. However, the important question raised here is about the ways technologies provide access to vast amounts of data, and how mere access does not ensure engagement with this information. Allan acknowledged that his proposed way of using the wiki to keep track of student progress would not shed light on the quality of student work. Thomas' example of qualitative engagement with the student contributions highlighted the ways such activities are dependent on a much broader range of factors than mere access to and engagement with technology.

8.6 Concluding remarks

The analysis of the ways in which ThinkSpace was put to productive use in the classroom reveals that the tool can potentially play a small, but important role in supporting teaching and learning in the classroom. Although the tool was resisted and rejected by many of the students, for some it was a useful addition to classroom practice and some students began to integrate the tool into their learning routines in interesting ways. However, it is important to remember that especially the more complex practices of conceptualisation and collaboration explored above were almost exclusively the preserve of the most able students in the class, and do not represent the way the majority of the students appropriated the tool. These emerging practices do nonetheless provide clues as to how teachers could work with wikis and concept maps to encourage such practices and ideas can be generated as to how these embryonic practices could be developed into more established classroom routines. The next chapter will pick up on some of these ideas in proposing ways working with wikis and concept maps could be developed in the future.

Part 4 - Conclusions

Chapter 9: Discussion and conclusion

The purpose of this study was to follow the principles of design-based research in order to both develop a useful tool to support classroom practice as well as generate theory which can be used to gain a better understanding of the viability of undertaking such processes.. As discussed in Chapter 4, theory plays an important role in design-based research, and the research questions posed in this study also speak to broader concerns than just the improvement of local practice in the two schools' practice. However, the practical component of the study was also very important and in fact formed the basis upon which any theorising could take place. The study was therefore structured following Andriessen's (2006) model for combining iterations of action research within a wider design-based research project and gathering conclusions from the 'practice streams' of the action projects into a common 'knowledge stream'. Having discussed the findings in the 'practice streams' of the two classroom studies in the previous chapters, this chapter will bring these together to aggregate these findings to the more theoretical 'knowledge stream'.

The conclusions discussed here speak to the three research questions and to the overall purpose of the study, which is to study the 'state-of-the-actual' technology use in classrooms and to explore the web of contextual factors which mediate innovation with technology in classroom contexts. The outcomes of this study are therefore substantive and methodological 'design principles' (van den Akker 1999) or reflections upon how innovation happens and should happen in classrooms in order to inform further research and innovation in schools.

The questions this study set out to investigate were:

RQ 1: What are the respective contributions of teacher and researcher to the shaping of the innovation?

> RQ 1.1: How did the teacher's understanding of what the tool had to offer develop during the course of the research collaboration?
>
> RQ 1.2: How was an implementation of the tool co-constructed in the dialogue between teacher and researcher?

RQ 2: What were the students' experiences of working with ThinkSpace?

> RQ 2.1: What uses of the tool emerged in the two classrooms?
>
> RQ 2.2: What did the students perceive the affordances of ThinkSpace to be?

RQ 3: In what ways can the ThinkSpace tool be used constructively within school practices to support learning and teaching activities?

RQ 3.1: Which practices involving ThinkSpace had begun to emerge in each of the two development studies?

RQ 3.2: How can these practices be further developed to support teaching and learning?

This chapter engages with each of these questions in turn, first discussing conclusions about the processes of innovating in the classroom with teachers. The second section will draw out the main findings with relation to the student experiences of working with ThinkSpace and the significance of these for future innovation design. The third main section will pick up on potential ways of further developing the teaching and learning practices surrounding concept mapping and wiki construction, which were emerging throughout the two development studies.

9.1 Processes of innovation in the classroom

The ThinkSpace study had an extensive practical component because it sought to investigate the tool by 'making it work' in real-life classrooms. Therefore it provided some valuable insights into the processes of working with teachers on collaborative innovation projects. Both the participating teachers were generous with their time and both were willing to take risks in their teaching by letting a research student suggest ways of changing and expanding classroom practice. In both cases the teacher-researcher collaboration resulted in a particular version of ThinkSpace being enacted in the classroom.

The iterative development of the tool took on different directions throughout the two classroom projects as the teachers' points of focus emerged and as they were seeking to use the tool to support their areas of interest. Although in retrospect the teachers' interests in and conceptions of the project became clear, they were far less evident at the beginning or during the project. It is unclear to what extent the teachers could have articulated their goals and dilemmas at the start. The day-to-day development of the uses of ThinkSpace was therefore guided by a complex array of conceptual as well as practical considerations trying to take into account both teachers' and researcher's views, students' reactions to the project as well as the curriculum demands. Therefore the ordered conclusions presented here to some extent represent a 'wisdom of hindsight' whereas the reality of the tool development had a messy and unpredictable nature. Acknowledging and working with the unpredictability and changeability of real classrooms is one of the main strengths of design-based research.

As discussed in Chapter 6, Allan and Thomas formed different views of the affordances wikis and mapping could have in their classrooms. The researcher's understanding of how the tools could be

applied was of interest to them - otherwise they would not have agreed to devote their time to the project - but this understanding was in both cases only partially consistent with their developing views of the utility of the tool. Thus I as researcher was trying to influence the teachers' perceptions of the affordances of the wiki and mapping through creating situations which could add new facets to their experience or 'Erfahrung' of the tool. To this end I created scenarios to exemplify potential uses of the tool as I saw it, drew example maps, held workshop with the teachers which were aimed at particular experiences with the tool or showed examples of previous work. However, as an outsider I could engage in this only in a relatively abstract way, leaving it up to the teachers to connect the proposed uses of the tool to the curriculum they were working with and to their understanding of how the subject should be taught.

The most important influence on the development of the teachers' view of the affordances of ThinkSpace was found to be their understandings of teaching and learning at school and of their own roles as teachers - in other words their personal understandings of the school context they were working in. Both teachers directly connected their attempts to introduce wikis and maps to their aspirations as teachers, their own perceived challenges and shortcomings and the directions in which they wanted to change their teaching. Thus Allan's ambivalence about his multiple roles and responsibilities as teacher reflected on his view of the affordances of ThinkSpace as being able to support both administration and 'control' functions as well as deep thought and discussion among students. Similarly Thomas' beliefs about the emancipatory goals of education were visible in his appropriation of the tool to develop students' judgement skills and encourage argument. This finding is consistent with the findings of John and Baggott La Velle (2004) who concluded that teachers' perceptions of the affordances of technology are closely bound up with both the subject culture as well as with personal theories and pedagogical styles.

The role of technical proficiency seems to have been less pronounced, although it certainly did play a part in the development of the teacher's ideas about how the technology could be used to further their goals. Thus Thomas, having a clear idea of the ideas behind wiki technology, was able to flexibly and independently develop uses for the wiki and to gain an easy overview of the students' work. Allan lacked the technical know-how, which could have allowed him to gain that overview, which made it difficult for him to follow up on tasks he set the students on the wiki. It was also difficult for him to connect the wiki to his teaching conceptually, which perhaps made the need for technical exploration of the tool less pressing.

With regards to mapping, while still lacking technical competence, Allan had a firmer conceptual understanding of the utility of mapping for learning, which stemmed from his own use of maps in his teaching. Therefore any difficulties he may have had in using the mapping software did not prevent him from generating innovative and productive ways for the students to work with maps. In Thomas'

case technical proficiency was certainly no obstacle, but throughout the study he was exploring mapping conceptually in order to find his own ways of integrating it into his teaching. Thus the two teachers were initially oriented towards the two different elements of the ThinkSpace tool due to their individual teaching styles and habits. While technical proficiency was important in enabling exploration of the affordances of the tool, the conceptual and pedagogical struggle with what collaborative wiki pages or maps could do for their students was more prevalent in the shaping of their uses of these tools.

In the analysis of the teachers' appropriation of ThinkSpace what becomes visible is the formation of what Mishra and Koehler (2006) term their 'technological pedagogical content knowledge' (TPCK). These authors draw on Shulman's (1986, 1987) work on 'pedagogical content knowledge' and extend it to include a technological component. TPCK is knowledge central to the teacher's work with technology and is an understanding of how to use technology for teaching particular content or implementing particular pedagogical strategies. This construct goes some way towards explaining the clear reflection of the teachers' pedagogical goals in their appropriation of the technology. TPCK is also useful for binding the teachers' thinking about wikis and mapping technology to their specific pedagogical practices within their particular history curricula. Some routines for working with technology were already (at least partially) formed in the two classrooms. For example Thomas had several pedagogical 'tricks' for working with computers, such as asking the students to put the screen covers over their computer screens when he wanted their attention to be directed at the front of the classroom (which is an example of TPK or 'technological pedagogical knowledge'). Allan, on realising the long log-in times on the classroom computers, reorganised the order of activities, asking the students to log in as they were coming in to the classroom to avoid delays later.

Other ways of operating with technology were emerging from the experience of working with ThinkSpace. Thomas, for example decided to try transplanting a mapping workshop from the revision group into the whole classroom. When the students' reaction to the task was hesitant, he brought in post-it notes to encourage the students to express their opinions privately and then transferred the contents of the notes onto the concept map. Similarly there was a development in Allan's TPCK when he decided to use the students' concept maps for unprepared presentations, which made the students adopt a different presentation style from their habitually restricted PowerPoint presentations.

However, as Ruthven (2009) argues, the practical challenge in integrating new technologies is the reconfiguration of the teacher's functionally organised system of craft knowledge (Brown, S. A. and McIntyre 1993), which is not reducible to the TPCK model. This model, while zooming in on the complex interplay between different types of teacher knowledge must therefore be nested within a broader understanding of classroom reality.

Ruthven (2009) provides such a broader view by identifying five structuring features of classroom practice which underpin the development of teachers' 'practical theories' (Deaney, Ruthven et al. 2006): working environment, resource system, activity format, curriculum script, and time economy.

- The change in the working environment refers to the practical and organisational issues technology entails, such as the change between habitual classroom and computer lab or the logistics involved in students having to manage their personal laptops.
- The resource system describes the broadening of the resource base which technology can facilitate, both in terms of informational and software resources. This category raises questions about the applicability and practicability of software packages build for other purposes than education within the classroom.
- The activity format describes the 'formats for action and interaction' which structure the flow of activities in the classroom, guide the contributions of teacher and students to particular activities and outline norms of social participation.
- The curriculum script is the 'matrix of professional knowledge' upon which teachers draw in deciding how to teach a topic and which has been acquired through education and experience. This matrix is guided by a 'loosely ordered model of relevant goals and actions' which directs the teacher's decisions.
- Finally, the time economy refers to the time demands technology as well as innovation itself place on an already tightly-timed curriculum.

In the case of this study the last three of these features are especially salient in understanding the gradual development of the classroom practices with ThinkSpace (although the first two were also of some importance). These last three features required the most reconfiguration and therefore presented the greatest challenges. The activity format was challenged by the introduction of more group work, which required a shared mode of responsibility, thus challenging especially the students' norms of social participation. The teachers' habitual 'curriculum scripts' were challenged in that they had to find ways of integrating group writing and mapping tasks with their habitual ways of teaching the curriculum and develop a vocabulary for describing new goals and opportunities to students. Finally, the time economy was evidently under pressure because not only were the teachers asked to contribute their valuable time to the project, but they had to find ways both in and outside lessons to balance existing curriculum demands with new opportunities provided by the technology.

While this exposition is tremendously helpful in understanding the challenges that the teacher faces in innovation projects, in the present case the researcher played an important role in how ThinkSpace came to be used in the classroom, which adds another layer of complexity to the framework of features influencing the development of the teacher's craft knowledge. The methodological approach taken here meant that the initial ideas and directions were provided by the researcher, who had

designed the tool from a particular standpoint with regards to the tool's potential to support learning practices. The research approach was however also highly flexible so that the researcher's ideas were expected to be modified by the teacher's understandings and practices. Therefore the resulting ways of using the wiki and the mapping software grew out of the combined input from the two actors and the researcher can be said to have played an important role in the formation of the teachers' craft knowledge with regards to the applications of ThinkSpace.

Tabak (2004) talks about the balance of exogenous and endogenous designs and the need to move away from a view of innovation as a prepackaged artefact merely being imposed from the outside, which is an underlying conception in much of the experimental innovation research, which quite often disregards the 'practical theory' involved in innovation. The co-construction of the uses of ThinkSpace in the classroom between the teacher and researcher/designer constituted such dialogue between 'insider' and 'outsider' perspectives and the resulting incarnations of wiki and map use were products of this dialogue.

The most important finding from this study with respect to this co-construction or dialogue was the importance of 'constructive tensions' between the teacher's and researcher's understandings of a particular task or tool. In Park Hill School such constructive tensions arose in the negotiation about the ways in which the students would be asked to use maps. In this negotiation both the teacher and the researcher achieved a better and more differentiated understanding of possible purposes of mapping and tried out a number of practical ways of connecting mapping to the curriculum. Also in Clover Fields School constructive tensions arose around mapping. These were centered less around the purpose of mapping in the curriculum and more about the techniques of constructing maps, such as defining the central question or concept and explaining mapping to students unfamiliar with the approach. This negotiation allowed the researcher to suggest new kinds of mapping tasks and the teacher to direct mapping activities with more confidence. In the case of Clover Fields School this negotiation took place during as well as outside lessons because of the close nature of the collaboration between the teacher and the researcher. In Park Hill School most of the negotiation took place in the planning stage of the tasks. In both cases this negotiation was enabled by the rapport between the collaborators and the good will and flexibility on the part of the teachers.

Tensions which allowed for productive collaboration and questioning were distinct from those where no negotiation was possible. The wiki use in Park Hill School was such a tension which was not overcome in the duration of the study. A balance between the teacher's and researcher's understanding of the purpose of the wiki was not achieved because the two approaches - at least within the confines of this study - proved incommensurable. Whereas the researcher's efforts were directed at creating a shared reflective space for the students and removal of strict distinctions between individuals' contributions, Allan saw the wiki as a mechanism for ensuring that every student completed a given

task and could be held individually responsible for their contribution. These two purposes of the wiki could theoretically be reconciled by providing the teacher with a very precise view of each student's contributions to a communal space. It is however questionable whether such monitoring could feasibly sit side by side with notions of collaborative work. In the case of this study, no such monitoring mechanisms were available and therefore no attempts could be made at reconciling the two approaches. Because the teacher was ultimately in control of formulating the classroom assignments, his concern for individual learning prevailed. It is open to discussion whether the researcher's view of the wiki's purpose was also too inflexible to allow for a more constructive tension. Consequently the wiki made no change to pedagogy or classroom practice.

Conversely, there were a number of situations where no constructive tensions were possible because of overall agreement between the teacher and the researcher. This was generally the case with the wiki in Clover Fields School. Here the teacher's and researcher's views were very much in accordance with each other, wherefore there was little conceptual development in the negotiation of its implementation.

These findings highlight the importance of tension and conflict in the development of technological innovation, but a tension which can be resolved. As Tjosvold (1997) argues, "positive conflict results in strong relationships, high performance, and mature and competent individuals, which in turn foster more effective conflict in a beneficial, reinforcing cycle" (:24). Such managed, positive tensions were one of the most important drivers of the development of ThinkSpace in both schools. The tension around the uses of the wiki in Park Hill School was not resolved and resulted in what Brown and Campione (1996) term a 'lethal mutation' "where innovations are interpreted in a way that circumvents the essence of their pedagogical intent, capturing only a semblance of the surface features of the original design" (Tabak 2004:228).

9.2 Altering classroom practice

The second research question in this study enquired to the students' experiences of working with ThinkSpace. The overall conclusion from the work in the two classrooms was that it was difficult to bring about change in the substance of what went on in the classroom and that many of the alterations were merely surface changes to practices which in essence did not change. The previous section discussed the ways the teachers worked with the tool in their attempts to incorporate it (or parts of it) into their practice. This section will engage with the ways the students reacted to working with ThinkSpace.

The findings about students' experiences with and attitudes towards working with ThinkSpace indicate that the tool did not fit well with their understandings of what it means to study A-level history. There was a tangible resistance towards the tool from the students and it was especially difficult (although in some cases possible) to obtain the goals of collaborative enquiry set for the project. It was found that

the students saw the affordances of the wiki and the mapping tool in light of their existing studying and learning practices and while they were willing to appropriate elements of the tool for those purposes, they rarely (with a few exceptions) extended their understanding of learning practices on the basis of working in new ways with the technology. In other words, the ThinkSpace project was not enough to set off a 'slippage' (Barley 1986, 1988) between the students' practices and the technology making way for a reconfiguration of their practices. As it was suggested in Chapter 7, the students' general attitudes towards technology played a relatively small role in the ways they appropriated ThinkSpace in the classroom and that, conversely, their understandings of learning and the practices of being a student governed their uses of the tool.

However this must not be taken to mean that students' learning routines or understandings of education are static or inflexible. A few of the more confident students were beginning to expand the repertoire of their learning practices and to reconfigure their views of learning with ThinkSpace. These 'early adopters' not of technologies, but of learning and study practices provide a direction for further research and potential development of wikis and concept mapping for learning.

9.2.1 Including students in the picture

In the literature on technological innovation the focus has most often been on the teachers as the adopters, the implementers or the 'barriers' to innovation; also the technological infrastructure has received attention in terms of students' and teachers' access to technology and pupil to computer ratios (Cuban, L, Kirkpatrick et al. 2001; Balanskat, Blamire et al. 2006; Deaney, Ruthven et al. 2006; Becta 2008). Less attention has been devoted to understanding the students' ways of incorporating technology into their learning practices. Because students were often seen as being highly technologically proficient, less attention was paid to helping them make transitions to new ways of learning with technology. A similar tendency has been noted about other types of innovations in the school system, such as the curriculum where: "Teachers went on training courses that justified and helped them to cope with the break from traditional ways of working; pupils had no such support and they could respond by using their collective power as a class to resist or subvert the innovation." (Rudduck and Flutter 2000:84).

This raises important questions about the ways students' views of technology and school practices interact. It has been suggested that young people's extensive use of technology would make them hungry to use ICT for learning, as in Prensky's (2001) view of them as 'digital natives' or other similar views (Oblinger and Oblinger 2005; Veen and Vrakking 2006). This stereotype has however been shown to be a gross oversimplification, as discussed in Chapter 1. Furthermore when looking at students' attitudes to technology with regards to A-level study specifically, many were found to be critical of the potential of ICT to enhance their learning. In Selwyn's (1999b) study about A-level students' attitudes to the introduction of ICT, computers were often seen as irrelevant to A-level study,

an ‘addition’ rather than part of the core purpose of the subject and directed at presentation of information rather than understanding. Furthermore in his studies, “Although they had been subject specialists for a relatively short period of time, students seemed very assured about the essence of their subject areas and the subsequent relevance of the computer” (Selwyn 1999a:35), many of them discounting computers as being useful in their subject areas, leading Selwyn to conclude that using computers was inherently at odds with their conceptions of being a student of a particular subject. This is a finding which is echoed in the interview data in this study, where several students expressed their view that computers would possibly be useful in some subjects, but not in the ones they were studying.

On the whole, in the present study, whereas the students were not dismissive of technology, they were critical or even suspicious towards the ThinkSpace project. Their attitude to and appropriation of the tool could therefore be best understood in terms of their already existing learning practices rather than in terms of their general attitudes towards technology.

Most students saw the tool as a means for enhancing their existing learning practices and making them more efficient, pervasive or comprehensive. An example of this is the view of ThinkSpace as enhancing the accumulation of notes, whether personal or collective (although some students saw it as being a superfluous addition to their existing note-taking practices). Another example can be seen in the view of the tool as providing access to simplified material written by other students and thus supporting the students’ needs for ‘bringing the material down to their level of understanding’. Further examples are the ways mapping was used to support existing essay planning and construction practices. Only very few students pushed the envelope not with regards to technology (since the wiki and Gliffy was new to most students) but with regards to their learning practices.

What most strongly came out of working with the students with ThinkSpace was a sense of caution towards introducing technology, which was expressed as a caution towards introducing new pedagogical approaches in the classroom. This ‘pedagogical caution’ was expressed in the following sentiments offered by the students:

- Handwriting is better than typing
- Learning is better with ‘traditional methods’ (i.e. listening to the teacher, taking notes, writing paragraphs of prose, bullet points rather than mapping or drawing.)
- Adherence to paper folders (which often have to be in a particular form or order)
- Nervousness at the lack of notes (in handwritten, paragraph/bullet-point form)

Often these sentiments were expressed as statements of personal preference and ‘what works best for me’, which suggests that the students themselves believed they have found the most suitable (for them) ways to deal with the requirements of studying - and arguably, this was indeed the case.

The students demonstrated a spread of beliefs about learning and knowledge, ranging from very sophisticated to rather simplistic, but all of them had reached A-level study, and were therefore arguably successful as students. Therefore, the ways these students approached studying, helped them in being successful, although some were evidently finding their approach insufficient after the step up to A-level from GCSE. It was clear that the students were adept in responding to the teacher's signals about ThinkSpace work and about learning in general. A good example of this was the case of Group 4B in PHS, where the students quickly realised the low priority of working with the tool and acted appropriately, and who were generally expressing their views on learning in very similar terms to those of the teacher. In terms of the writings on communities of practice (Lave, Jean and Wenger 1991; Wenger 1999) A-level students can be seen as being the core participants in the practice of 'being a student', or in Tyack and Tobin's (1994) terms, they are proficient practitioners of the 'grammar of schooling'. It is therefore very understandable that these students were cautious about propositions to approach their learning in new ways, especially when these innovations were proposed at such an important stage in their education career and especially (in the case of PHS) where the teacher was ambivalent towards ThinkSpace.

These findings agree with the conclusions of Sheehy and Bucknall (2008), who found that on the whole children's and young people's visions of future or ideal education are based firmly on their existing educational experiences and that it would be unrealistic to expect learners to invent transformative uses of technology. They concluded that "If we wish to move towards innovations in our use of ICT and to incorporate this into our imaginative blueprints for the future, then we need to equip learners with the conceptual tools to reflect on learning and how it occurs" (Sheehy and Bucknall 2008:111-113). This suggests that not only do we need to take students' understandings of learning into account when innovating in their classrooms, but that we need to give them experience of the kinds of pedagogy which the innovation is proposing. This means that innovation must necessarily be a slow and iterative process where the students gradually come to realise what this innovation means for their own personal learning practices, gain an understanding of the rationale behind it and adjust the fit between the proposed innovation and their practices in a meaningful way.

An element and a potential driver of this process of gradual enactment of innovative practices with the students could be the emerging understanding of new pedagogical practices of the most capable and confident students in the group. Whereas the general experience of working with ThinkSpace with the students was that of reluctance, a few of the most confident students in Clover Fields School, did begin to adopt new practices of collaborative learning as well as new visualisation practices.

In the revision group both the mapping and the wiki elements of the tool were used for collaborative learning activities in ways novel to the students. There were several examples of ways in which these

students began to gradually expand their views of the utility of the wiki and mapping on the basis of their confident participation in the workshop activities.

- Because James was prepared to sacrifice his time and take a 'leap of faith' in an attempt to understand the utility of concept mapping, he ended up reconsidering his view of the mapping. Having a clear understanding of the demands of the course and a good grasp of his own position in relation to these demands, he was able to ascertain how drawing maps could help him progress his thinking.
- Caroline, probably the least confident of the four revision group students, was driven to ask questions about the nature of argument, again by daring to put her thinking on the line, and potentially open herself up to ridicule.
- James and Ben managed to sustain a level of collaboration on the wiki and integrated it as one of the tools for supporting their existing practices of collaborative learning. Even though they had a very good relationship, they still felt the need to negotiate the rules of this new collaborative practice with Ben especially feeling the need to 'clear' any changes with James.

All these new practices and emerging ways of thinking were to some extent risky to the students, but the colloquial atmosphere of the workshops as well as the students' own confidence enabled them to take those risks. A question for further research, which must necessarily be of iterative and longitudinal character, is how the emerging practices and the willingness to experiment of these advanced learners can be capitalised upon to raise the confidence of other students to broaden their repertoire of learning practices.

Thomas made one attempt at drawing on the experiences of the workshops in a whole-class session when he repeated a workshop task with the whole class. As described previously, the students were very suspicious at my sudden presence and resisted participating in the task as far as they could. However, Caroline, who was the least confident participant in the revision group, was the most willing to contribute to the whole-class task, which was now more familiar to her. This suggests a potential for broadening the range of classroom practices 'from the inside', enabling the more confident students to be the forerunners of pedagogical innovation and create models of new practice for their less confident peers.

From these reflections a conclusion emerges that if we want to think about technological innovation as involving alteration of social practices and not a mere technologically determined process of human adaptation, we will need to think more carefully about supporting the students and not only the teachers through the pedagogical changes that some technological innovations endeavor to put into place.

9.2.2 Collaborative writing

The most notable challenge to introducing ThinkSpace has been engendering practices of collaborative writing, which perhaps presented the best example of the impact of students' understandings of their learning practices on innovation in pedagogy.

In both the schools students were skilled at using certain forms of collaborative activity to enhance their learning, but, seemingly, not others. Classroom discussion or discussion in small groups was an important part of their daily repertoire (although some students did it better than others). Most students reported enjoying learning from others, sharing ideas, discussing issues in groups etc. This picture changed when students talked about producing written material in collaboration with their peers. Students were protective of their own writing and very cautious about editing the writing of others. They could be moved to comment on each other's writing (although critiquing the work of others was also difficult), but would hardly ever 'take an axe' to a fellow student's work.

The students often expressed their feelings about writing together in impassioned terms. In Park Hill School, for example, Group 4B talked about their heated arguments over the exact form their writing should take. The girls would argue over the exact wording of each sentence and the task would suffer. In the case of the source analysis task they quickly decided to split up the sources between them in order to avoid argument. In Clover Fields School Johanna spoke passionately about her negative feelings at her peers' meddling with her work. It was clear from the way she spoke that her group peers had - albeit inadvertently - threatened and hurt her personally. Where collaborative editing of wiki pages did happen, it most often bore the character of division of labour in order to save time and effort. This was the case, for example, in Park Hill Shool where students in Group 2A chivvied each other to complete their bit of the assigned wiki page. Only rarely did the nature of collaboration on writing correspond to the definition of the 'target' mode of collaboration outlined in Chapter 2 as 'situations where learning partners are working together closely in pursuit of common goals and have a high degree of synchronous and interactive communication'.

The difficulties in making collaborative writing work are not surprising in light of the findings of previous work on wikis in education (Grant, Lyndsay 2006; Lund and Smørdal 2006; Forte and Bruckman 2007; Lund 2008). All these authors identify a mismatch between the collective ownership practices presupposed by wiki writing and the individual ownership of writing cultivated throughout the educational system. Because written work is used in school to assess individual attainment, it is both risky and 'unfair' to allow others to participate in your written creation. However, such a cultural mismatch between institutional literacy culture and 'wiki culture' seems to have an even deeper and personal significance involving students' personal identities, which underscores the importance of including the students into considerations about innovation.

In the last few decades literacy has come to be seen as being deeply embedded into and indeed defined in terms of the social practices of which it is part (Scribner and Cole 1981; Gee 1996). Rather than being a fixed set of skills universally applied to text in any given context, literacies are seen as being context dependent and closely intertwined with cultural values and practices. Thus 'schooled' literacy practices have particular meanings, and are bound to the particular purposes and value systems on which schools operate. This kind of literacies are different from a variety of other literacy practices bound to other, perhaps more practical, contexts and associated ways of being and acting. For example the audiences to a letter-writing task in school and in the job market are different (for example teacher vs. client) and the purposes of these activities are different (for example demonstrating command of the letter form vs. promoting a product or service). The two products of these literacy practices, while looking similar, have different outcomes, and therefore, different things are at stake (for example being judged insufficiently literate by the teacher and getting a bad grade vs. losing an important contract). As Barton argues, literacy is laden with moral and social values which generate attitudes and feelings which affect how people act: "writing is not just a cognitive activity, feelings run through it" (Barton 1991:11). The ways we communicate in writing therefore reflect our beliefs about culture, knowledge and each other and changing our writing practices may well involve a change in identity (Gee 1996).

Students' reluctance to 'open up' their writing to the participation of their peers continues what Lunsford and Ede (1991) argue is a deeply seated tradition in education of understanding composition of written text as something personal, attributable to individuals, sometimes implying 'genius' or even mystical qualities of individual minds. Although this paradigm in education has been continually challenged by Dewey and subsequently many others, they argue that it mostly remains in place. Arguably it is this view of writing that constitutes parts of the students' identities and understandings of themselves as learners and 'knowers'. It implicates their understandings of ownership of ideas, of plagiarism, of 'cleverness' and of their own self worth. Proposing to expand the existing set of writing practices with ones that do away with the strictly individual ownership of the written word therefore challenges the students deeply. This explains why some students felt particularly vulnerable in exposing their writing to their peers' critique. As Johanna from CFS passionately put it: "it's my mistakes, so if I've done it wrong, I'll pick up on it, I don't want you thinking you're better than me".

This deep connection of literacy practices to identity raises questions about whether collaborative writing is a 'special case' when it comes to technological innovation in schools, and indeed in work institutions and other places where writing takes place. Innovation then becomes a matter of not only changing what people do, but what they are - their perceptions of themselves as experts, knowers, communicators, empathisers and so on. Also, these questions relate not only to purposeful innovation by researchers, developers, managers and others. They touch upon the innovation which is happening when we more broadly appropriate novel communication technologies and post our news of Facebook

for others to re-use, link to others on Twitter or remix YouTube material. In the current study these new literacy practices had little influence on the way most students perceived the challenge of the wiki. James in Clover Fields School was, however, drawing on his previous experience with editing wikipedia to start gradually expanding his view of school writing, and perhaps, in time, the views of his peers too.

9.3 Developing teaching and learning practices with ThinkSpace

This section attends to the third research question in discussing the potential for development of classroom practices with ThinkSpace. During the two school studies a number of practices started to emerge which suggested ways of thinking about developing ThinkSpace further to support teaching and learning. Even though few of these were entirely successful in their current form, the ways students and teachers appropriated the tool and the interactions this gave rise to in the classrooms, point to directions for further development.

9.3.1 Access to student thinking for guidance and formative assessment

One of the most powerful ways in which ThinkSpace was appropriated in the classroom was to support formative assessment of student progress. Originally this was not one of the target practices for support by the technology because the tool was focused on primarily being used by the learners. Formative assessment became an important issue when Thomas in Clover Fields School appropriated ThinkSpace to give feedback, motivate and communicate with the students. Indeed it has become clear that without the teacher's continual engagement with the student work on ThinkSpace students are not likely to sustain activity on the wiki or the map (a finding which has emerged in other work with wikis in education (Cubric 2007)). A few practices related to feedback were beginning to emerge in the classroom and more were suggested in the interviews, but never taken up with the students. These emerging practices can give direction to future research and some of the routines trialed by Thomas can potentially be replicated in other classrooms with few changes.

The literature on formative assessment clearly indicates that ongoing and student-focused questioning and feedback make for improved learning (Fuchs, Deno et al. 1984; Black and Wiliam 1998b, a) and that successful students are adept at monitoring and assessing their own performance (Brookhart 2001). Especially in the Clover Fields study, the wiki and the mapping showed potential as tools for supporting these aspects of classroom practice. Three main claims have been made with regards to the potential of ThinkSpace for supporting formative assessment practices:

- that the map and the wiki conveniently display students' understanding to the teacher, thus providing the teacher with opportunities for deepening that understanding through questioning and probing,

- that the wiki can serve as a communication platform for written formative feedback, thus enabling the students to iteratively improve their work in response to the teacher's comments,
- and that the wiki can serve as a device for recording the feedback and guidance in a more permanent form than it would usually take in the classroom, thus allowing students access to the guidance at a later stage, for example at revision.

The first finding responds directly to discussions of formative assessment in the literature. It has been found that a key issue in using cycles of assessment to improve student learning is that of communicating to the student what the learning aims are that they should be working towards and what the criteria are for judging the quality of their work. This communication is not a straight forward 'transmission' of the desired standards of quality to the students, on the contrary, as Sadler argues, "knowledge of the criteria is "caught" through experience, not defined" (Sadler 1989:135). He suggests that students gradually gain such knowledge through authentic evaluative experience, in other words, through continually and practically encountering the quality criteria in application to their work. Torrance and Pryor's (2001) work also points towards the importance of making quality criteria explicit to learners, placing this at the centre of teaching practices involving questioning, observation of student process and products and providing feedback and judgement. They conclude that "expression of quality criteria in particular had to be accomplished more by interaction with individual students through questioning, rather than by articulation to the whole class" (Torrance and Pryor 2001:624).

In direct connection with this, this study found that both the mapping and the wiki components of ThinkSpace can be used to support the teacher's questioning of individuals or groups of students:

- The mapping can function as a means for making the students' developing thinking explicit to the teacher. The mapping presents this information in a condensed form and questions can arise about why particular forms of representations were chosen by the students. The last revision group session at CFS was an example where this happened: Thomas questioned the meaning of a linking term added to a map by James, which led to a discussion of both the teacher's and the student's understanding of the issue.
- The wiki can provide insights into the students' levels of understanding, which the teacher can capitalise upon in providing targeted and individual feedback, as was the case when Thomas commented on individual students' source critique.

ThinkSpace served in the first case as a prompt and in the second as a medium for 'interaction with individual students through questioning'.

The other two claims pertain to the role that technology can play in formative assessment by supporting access to feedback and communication about it. Using technology for these purposes opens up new possibilities with regards to scaffolding students' learning which would have been difficult without the technological support.

Firstly the technology provided a convenient means of written communication about the student's work, where the teacher's feedback was instantly visible to the student and where the student had the opportunity to respond to the feedback within the same medium. The instant accessibility of this communication is different from what can be achieved on paper and makes more iterations of feedback feasible. Thus introducing a technology-based communication platform such as the wiki can help achieve one of the criteria for effective formative assessment: that it should provide opportunities for closing the gap between current and desired performance (Nicol and Milligan 2006). Naturally this opportunity for increased communication between teacher and student is entirely dependent on the participation of both parties, which may not always be feasible, especially on the part of the teacher. In order to develop practices of iterative written feedback it is necessary to think carefully about ways in which teachers can find time to integrate these practices into their daily routines. Thomas suggested that this could be achieved by assigning students in other classes to student-led activities, such as individual written tasks, thus 'stealing' the time to give feedback on the wiki. Whether in this or other ways, the potential for developing complex practices of written feedback raises questions about how to incorporate such activities into the teacher's busy schedule.

Secondly, as was pointed out by Thomas, ThinkSpace can be used for restructuring classroom tasks in a way that ensures that teacher's guidance and feedback are recorded in written form. Whereas oral Q&A practice may be highly detailed and formative in shaping students' ways of thinking, it will inevitably suffer from the impermanence of any oral activity. The wiki could potentially serve as means of recording some of the insights from such interactions because its malleable and electronic form is conducive to short exchanges more akin to Q&A practices than other exchanges of written work (such as feedback on essays) may be. Thereby oral exchanges with a few students in the classroom may be supported by further approximations of such exchanges out of class with other students. Furthermore the records of such exchanges may be accessible by the same students as well as their peers later in the course, and enable them to revisit the methods for thinking suggested by the teacher earlier. In order to capitalise on this potential, again, the issue of teacher time arises. In addition practices will need to be developed to bring to the forth the methodological clues left by the teacher and focus the students' attention on generalising methodological features of, for example, source analysis.

9.3.2 Ensuring broader participation

Another potentially useful direction for development to come out of the commenting task at Clover Fields School was that of using technology for widening student participation in the in-class tasks. As Burns and Myhill (2004:37) point out, whole-class discourse can suffer from a quantitative imbalance of contributions, a lack of reciprocity in the exchanges, and imbalance in control, or power relations. Both the teachers in this study were aware that few students were actively participating in the whole-class discussions: Allan confessed that he was communicating best with the most able students in the class, and Thomas pointed to students who were inactively 'going through the motions' of listening and taking notes while only few of their peers were actively participating.

As an extension of the thinking on providing formative assessment, ThinkSpace has been found a potentially useful tool for widening student participation in classroom discussion - albeit in a written rather than an oral form. In the commenting task source analysis procedures were modeled for the students in a whole-class discussion with, as Thomas noted, the usually low participation rate, whereafter students were asked to individually comment on subsequent sources. The wiki came to support a two-way written communication between the students and Thomas which could in some respects be likened to the question and answer practices which take place in whole-class discussion. The students answered the questions posed by the teacher about the sources and the teacher in term responded to individual students with further questions, encouragement and guidance. Students responded to those questions in turn. In this instance there was really only one iteration of communication, but this sequence indicates a potential for developing practices which extend Q&A practices outside the classroom. The reciprocal communication seen in this task is different from traditional written assignments, which do not involve repeated cycles of communication about the written product of the student efforts. The main question with regards to this potential of the technology is whether the practicalities of the classroom can be made to allow for such extended written dialogue with individual students on a regular basis.

9.3.3 Metacognition and gradual construction of knowledge

Metacognitive practices is another possible direction for development of the ThinkSpace tool, which perhaps represents a precondition to making practices of gradual knowledge construction achievable in the classroom. In his interview James was the only student who mentioned the wiki's recording capacity and its utility for recording the various states of his developing thinking. If we know how our thinking developed, he argued, we have a better idea of what the endpoint of our knowledge means, implying a better performance at exam time. Although James was the only student who overtly talked about engaging in metacognitive activity of this kind, this provides inspiration for a further look at metacognition as a guiding concept for further development of ThinkSpace.

Metacognition is knowledge about cognitive phenomena - a learner's understanding of how and what she learns. Flavell (1979) suggested that metacognitive knowledge falls into three interconnected categories. These are knowledge about:

1. the person (knowledge or understanding of yourself and others as learners)
2. the task (understanding of the task at hand, its difficulties and challenges, and of what is necessary to achieve the task goals)
3. and the strategy (knowledge about how to go about achieving the task goals).

It has been widely argued (see e.g. Brown, A. 1975; Bielaczyc, K, Pirolli et al. 1995; White and Frederiksen 1998) that learners are more successful when they actively monitor their own cognitive activity (i.e. are metacognitive) and metacognition has been linked to intelligence and expertise (Sternberg 1984, 1998). Flavell further posited that metacognitive experiences (i.e. instances where the learner becomes aware of her own learning and understanding), are most likely to occur in "situations that stimulate a lot of careful, highly conscious thinking" (Flavell 1979:908) rather than appearing spontaneously. This has since been confirmed in that prompting metacognitive practices has proved to be an effective way to attain better understanding. For example Chi et al. (1994) found that actively promoting self-explanation helps learners incorporate new information into existing knowledge while reading, and Berardi-Coletta et al. (1995) concluded that explicitly forcing learners to adopt particular self-monitoring strategies improved their problem solving, whereas such strategies were rarely adopted spontaneously. Indeed it has been found that systematic metacognitive activity is not only unlikely to appear spontaneously, but that some students may even resist instruction in metacognitive strategies if habits of passive reception have been acquired in school (Gourgey 1998).

In order to successfully foster metacognitive practices, they must not be seen as add-ons to existing learning practices, but rather as "*habits of mind* for developing a balanced cognitively and socially competent learner" (Lin, X. 2001:37; emphasis in original). Lin argues that to achieve this, metacognitive activities must be designed taking into account both of the two major directions in metacognition research: strategy training and the creation of social environments which foster metacognitive practices. Only if the two are coordinated can an environment be created where the overall learning goals and community values support productive metacognitive strategies. If the two are aligned, both the learners' knowledge about the domain and about themselves as learners can be enhanced.

These ideas about metacognition are helpful in thinking about how ThinkSpace can come to assist in creating such 'metacognitive learning environments'. Both the wiki and the mapping provide recording capabilities which could potentially be used to revert to earlier representations and thinking because all earlier versions of wiki pages and maps are automatically saved. However, because such

reflection upon own progress is unlikely to arise spontaneously, classroom practices need to be created to support it. This would involve both pedagogical and technological developments.

Firstly, technological developments would be necessary to make the changes in thinking more visible to the users of the tool. Currently it is a laborious and cumbersome process to compare different versions of maps and wiki pages, which must be improved if ThinkSpace is to support metacognitive practices. To this end developers could draw on the work of Larusson and Alterman (Larusson and Alterman 2007; Pierroux, Rasmussen et al. 2008) on the WikiDesignPlatform and the WikiPlayer which enhance wiki functionality to support better awareness of wiki changes. Alternatively web analytics applications such as Woopra[15] could be employed to track wiki activity. The idea of 'playing back' the development of the wiki to learners could be a powerful tool for supporting student reflection upon their progress towards their learning goals and the development of their knowledge and understanding.

Pedagogical developments would need to take place both on the level of tasks or activities which would prompt reflection and teach strategies, as well as on the creation of a social environment where the gradually constructed nature of understanding would be acknowledged and the processes of reflection accommodated and valued. The ways most students appropriated ThinkSpace in this study suggest that the current classroom environment is for many learners not supportive of such introspective practices. An interesting question to ask in this regard would be whether introducing metacognitive practices in some ways could be a precondition and a driver for introducing tools for gradual knowledge construction and conceptual engagement. It could be argued that if students acquire strategies of monitoring the progress of their own thinking and learn to ask probing questions of themselves and the state of their knowledge, this could make more meaningful to them the gradual approach to constructing knowledge and engagement with concepts that the wiki and map aim to develop. In this way metacognition can be seen as being closely related or perhaps even a precondition to adopting innovative pedagogical practices by the students. The concept of metacognition could therefore be used both to help with designing the nitty-gritty of wiki and mapping activities, by including the well-researched metacognitive strategies, and could also contribute to promoting a thoughtful and reflective atmosphere in the classroom.

9.4 Limitations of the study

9.4.1 Methodological limitations

The main challenges to this study have been inherent in the chosen methodology. The design-based research approach was challenging in terms of balancing my roles as designer of the tool, as participant in the classroom and as researcher. As discussed in Chapter 4, achieving objectivity or

[15] http://www.woopra.com/

generalisability was not the main goal, because early on it was evident that being actively involved in both the design, implementation and theorisation of the ThinkSpace tool would not allow for claims of detachment and precision. Instead I chose to embrace the messiness of the roles I necessarily played in this research project and to be honest about the resulting personal nature of the findings. However, to ensure maximum internal validity of the data and conclusions it was necessary to eventually step back from what happened in the two classrooms.

Andriessen's (2006) model of distinguishing between the overall design-based research project and the subordinate development studies has been helpful to disentangle the complex set of my roles. However the most powerful tools for distancing myself from the passions and stresses of the classroom studies have been the passage of time between the end of the studies and the formulation of the conclusions as well as the repeated and gradually more distanced and analytical re-reading and re-sorting of the data.

Reconciling the evidence from the many data sources has been a challenge, but having access to the multiple perspectives on the same events has added to the robustness of the findings and allowed for triangulation. Evidence emerging from one source often led to further re-examination of others and sometimes re-interpretation of seemingly clear evidence. However, because of the multifaceted nature of the study, the evidence was - and must necessarily be - incomplete. It is not possible to capture the full complexity of what goes on in a classroom when students are presented with new technologies and pedagogies. There are therefore many gaps, insufficiencies and omissions in the data, which in retrospect are begging to be filled in. Many tough decisions had to be made about the data collection. Some were arrived at through careful consideration - for example the decision to not use video recordings to capture students' interactions with the wiki and the mapping software. Others had to be made 'on the fly' - for example when technical problems in the classroom prevented careful observation and note-taking during the lesson.

All these necessary restrictions on the multifaceted and to some extent improvised data collection in the classroom make the conclusions of this study no more than a snapshot of what one designer-implementer-researcher captured in two classrooms. This snapshot does, however, raise interesting questions and points to directions for further enquiry.

9.4.2 Limitations due to assumptions of the study

The second source of challenge has been the assumptions inherent in the study design. These have been assumptions on my part, as researcher, about what would happen when teachers and students were asked to work with wikis and concept maps. From reading about previous experience of working with these tools in the research literature, certain challenges and potential problems could be gleaned,

however, assumptions still had to be made, some of which were challenged in the classroom, which in turn has raised important questions for further research.

One such assumption was that student cooperation would be a natural consequence of teacher participation in the project. That this assumption was inherent in the design became evident in retrospect, when student resistance to the project emerged as an important theme in the data. In retrospect, more attention should have been paid to exploring together with the students what working with ThinkSpace would mean for their patterns of learning and collaboration. Both the students and the researcher would have benefitted from a better understanding of what kind of learning situation was being proposed and this in turn may have reduced the resistance to the tool exhibited by some of the students. However, this ambition to reflect upon learning processes in class must in reality be tempered by the time constraints of the course and it is doubtful whether it would have been practicable in this project.

Another assumption was that because the nature of A-level study, which calls for in-depth analytical engagement with course material, corresponded well with the perceived potential of the ThinkSpace tool, this was the best stage to start introducing it. A judgement was made that the fit of the tool to the purpose overrode the concerns about the exam pressure at this stage. However, exam pressure was an important influence on the two implementation studies. Had the tool been introduced at a different stage of school, it is possible that the students would have been more willing to experiment (as indeed was suggested by some students in the interviews). However previous work with wikis suggests that innovation meets similar difficulties with introducing collaborative approaches to learning at both lower and higher levels of education (Lund and Smørdal 2006; Cubric 2007; Forte and Bruckman 2007).

Other assumptions were made that are not explicitly explored in this report, for example that concept mapping can be a useful tool for representing historical events and analysis. Still further assumptions have yet not been framed as such by the researcher. The importance of uncovering these - in this study as well as others - lies in exposing the differences in thinking between researchers, practitioners and students.

9.4.3 Limitations due to practical reasons

A final source of limitation to be mentioned - albeit briefly - are the practical constraints of working in real-life classrooms. There is no space here to enumerate all the decisions that were made for practical reasons. Two main sources of constraint (and worry) however, must be mentioned.

The first is the available technology, where many factors limited what could be done - the available computers, the network systems at the schools, the classroom layout, the screen resolution and

projection quality. Also the development of ThinkSpace was very limited by the researcher's technological proficiency, which meant that the tool largely consisted of pre-existing technological solutions and no better solutions could be developed, which could have improved the functionality of the tool tremendously.

The second important factor were the time constraints, both in terms of what could be achieved in the classroom and in terms of the data which I could gather (interview timings, teacher time for meetings, time for observation in the classroom, for preparation of lessons). Working with the pressures of the classroom is, however, the very 'stuff' of design-based research, which attempts to make sense of truly naturalistic settings.

9.5 Conclusion

This study set out to investigate the overarching question set out in Chapter 1:

> **What processes and challenges are involved in designing and developing a new tool for learning in the context of classroom practice?**

This question was addressed by conducting a study of a new tool, or combination of techniques, in support of teaching and learning practice in the classroom and was operationalised as the three more concrete research questions discussed above.

The findings of this study largely pertain to the nature of innovation in school classrooms, but they will also apply to some extent to innovation in other organisational contexts. This study started with an awareness of the difficulty of innovating within classroom cultures, and aimed at an enrichment rather than a radical reorganisation of practice. Therefore the study design was premised upon a close collaboration with the participating teachers, and an iterative and open approach to innovation. This was done to ensure that ThinkSpace could be flexibly adapted to the contexts of the classrooms, to the curricula and to the teachers' needs and interests. However, this study did also involve the attempt to make a particular innovation work in the classroom - a tool invested with the researcher's ideas and understandings of learning. That was why a design-based research framework was chosen, to allow the study to maintain focus on developing the tool within the study contexts. Therefore, assumptions were necessarily made about the ways the tool would come to function in the classroom, and it is these assumptions which have turned up the most interesting insights.

The results of this study highlight the gradual and incremental nature of innovation in the classroom. The two iterations of tool development described here resulted in ideas about how practices involving ThinkSpace could be developed further, were the tool be trialled again in other classrooms. The ways in which a small minority of the 'braver' or more confident students adopted new practices, point to

the slowness of such developments, which may with time percolate through to other parts of the student body - through careful attention and work on developing these budding opportunities. This in turn raises questions about much short-term research into innovation which is carried out within the field of education, where 'effects' are often claimed on the basis of a few day's engagement with new technologies. The picture emerging from this study is that the 'state-of-the-actual' use of technology in the classroom is in fact very stable and that 'deep' innovation of classroom practice (rather than 'surface' excitement about new toys and tools) takes many iterations of slow and cautious development on the part of teachers and students.

A second important set of questions to emerge from this study pertain to another assumption which I made at the beginning of the study, and upheld throughout the duration of the fieldwork, and which for the most part has remained tacit. It is the assumption of the inherent good of open collaboration and communication which network technology can afford. Adopting the wiki as the platform for writing a 'collaborative encyclopaedia' of the curriculum and pursuing the goal of promoting open and honest collaboration between students as capable and conscientious peers was met with a great deal of resistance on the part of the students and to some extent the teachers as well. Thinking about the ways writing is connected to personal identity and how opening up writing to public view is perceived as a great personal risk has raised questions about the ideological stances inherent in the technology. Even though ThinkSpace does not advocate exposing personal or sensitive information, it is nonetheless based on principles of giving all interested parties access to the content of someone's writing. This may be a strategy that works for creating a collective encyclopaedia on the internet, but may not be suitable to the personal and emotional involvement of learners with their course.

These thoughts draw attention to the care and attention needed when transplanting technological principles from one environment into another and the need for creating technological solutions designed primarily for educational contexts. Ideas developed for different contexts, such as corporate environments or for social networking purposes, may not be easily transplantable into classrooms, and this may account to some extent for the high failure rate technology has experienced in education.

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Appendices

Technology

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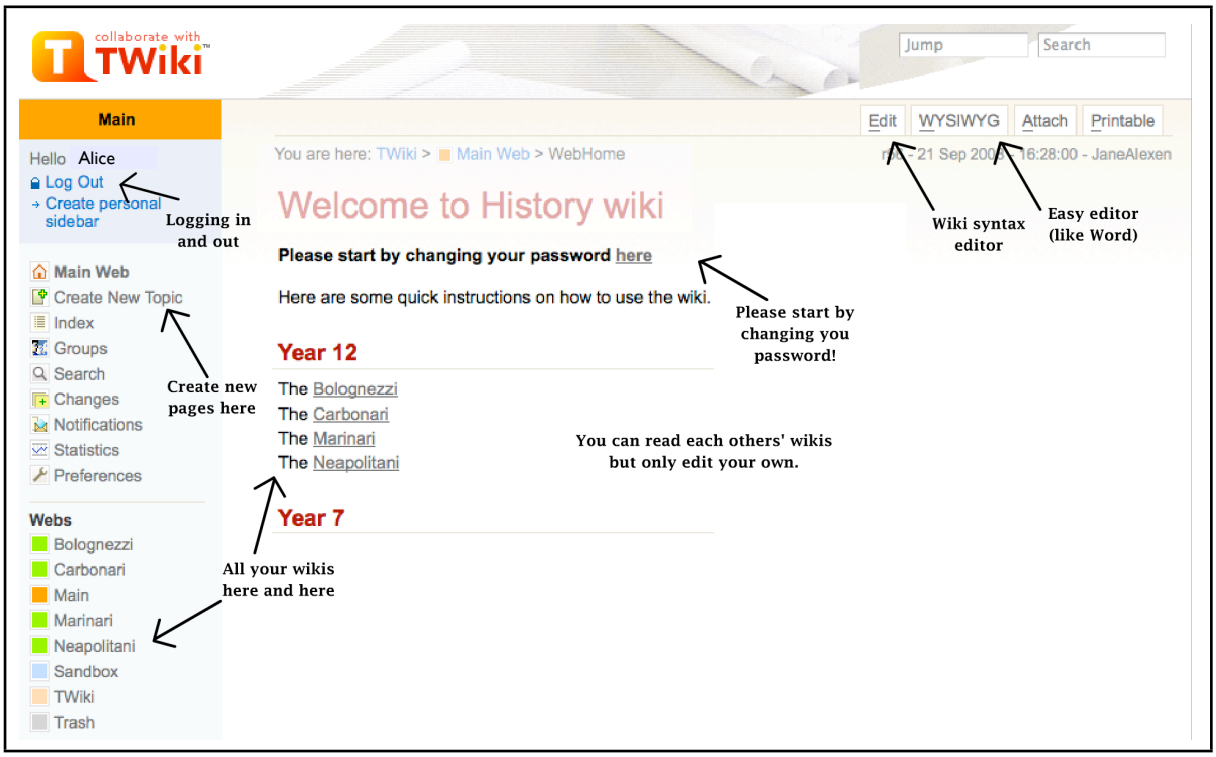
Appendix 15. Extract from wiki editing categorisation matrix

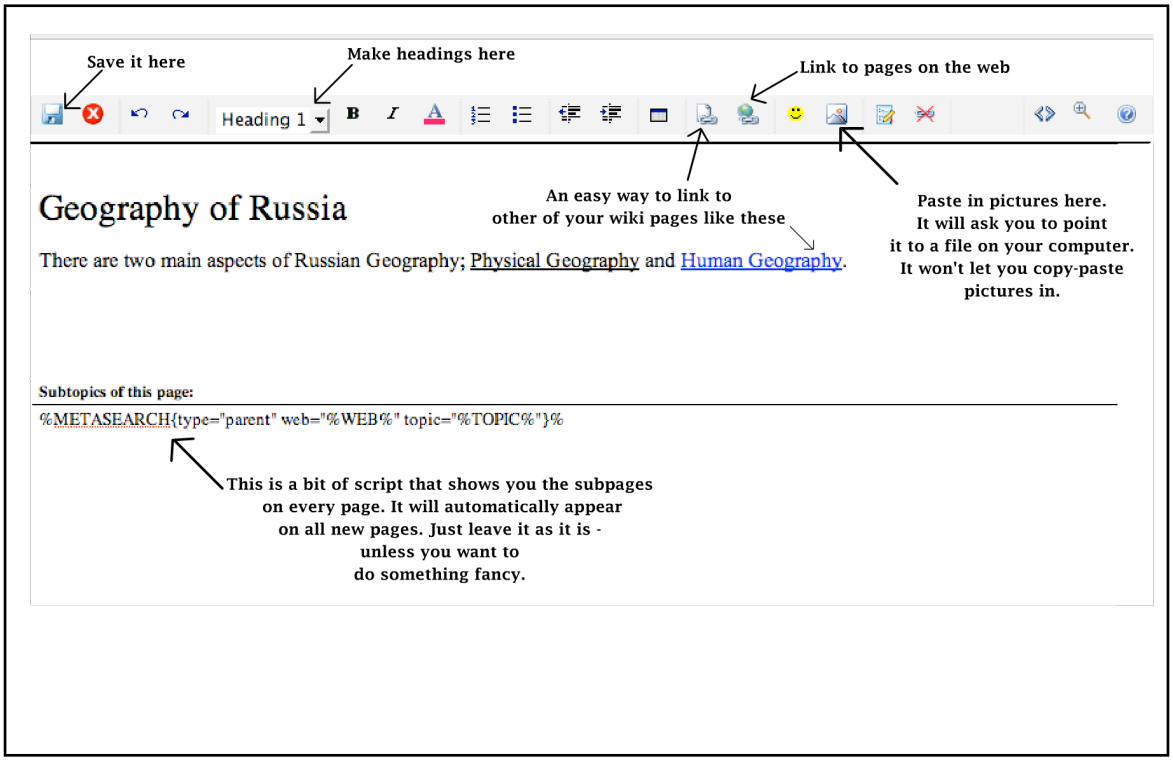
Appendix 1 - Technology ‘walkthroughs’

These ‘technology walkthroughs’ were presented to some of the students as help to find their way around TWiki and Gliffy. They also contain instructions on how to link a wiki page to an item on the map, thus providing a good idea of the functionality of ThinkSpace.

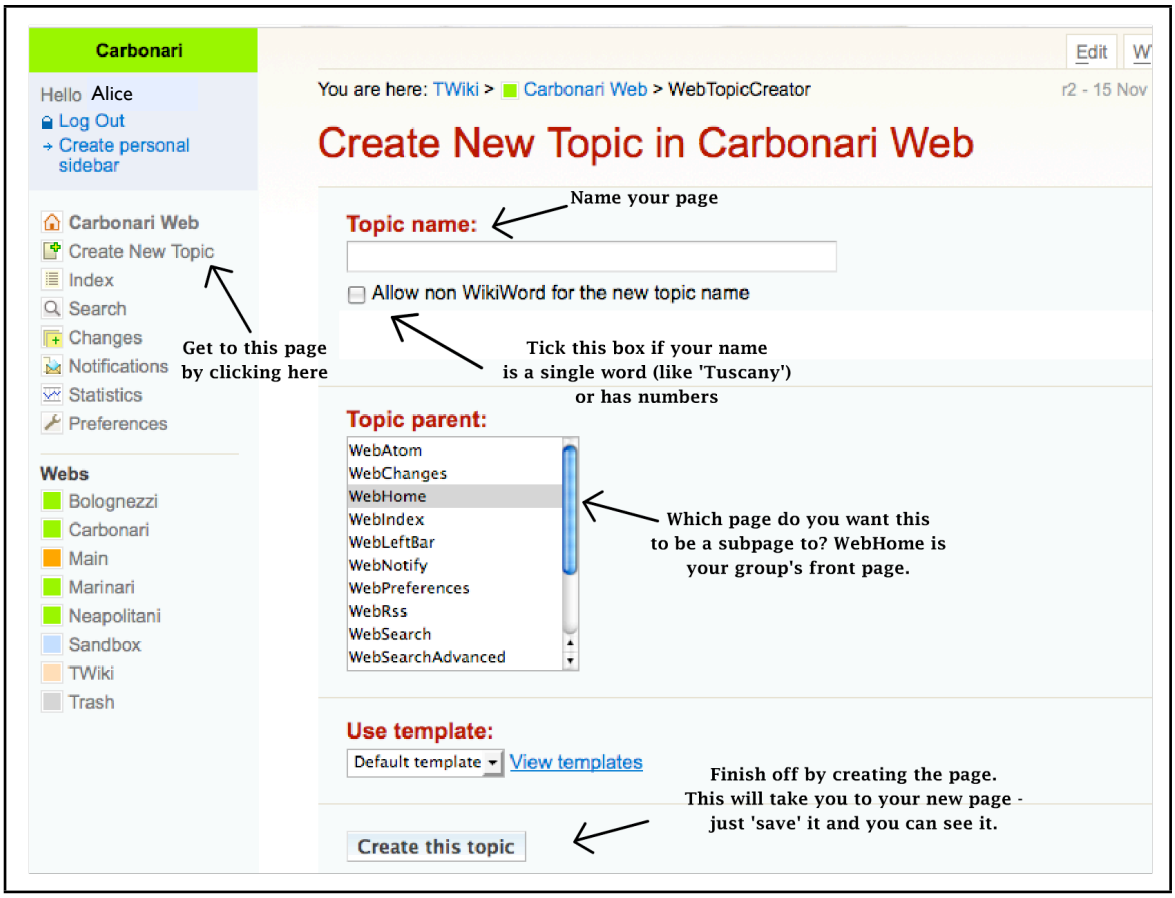
Wiki walkthrough



Editing your page in the WYSIWYG editor



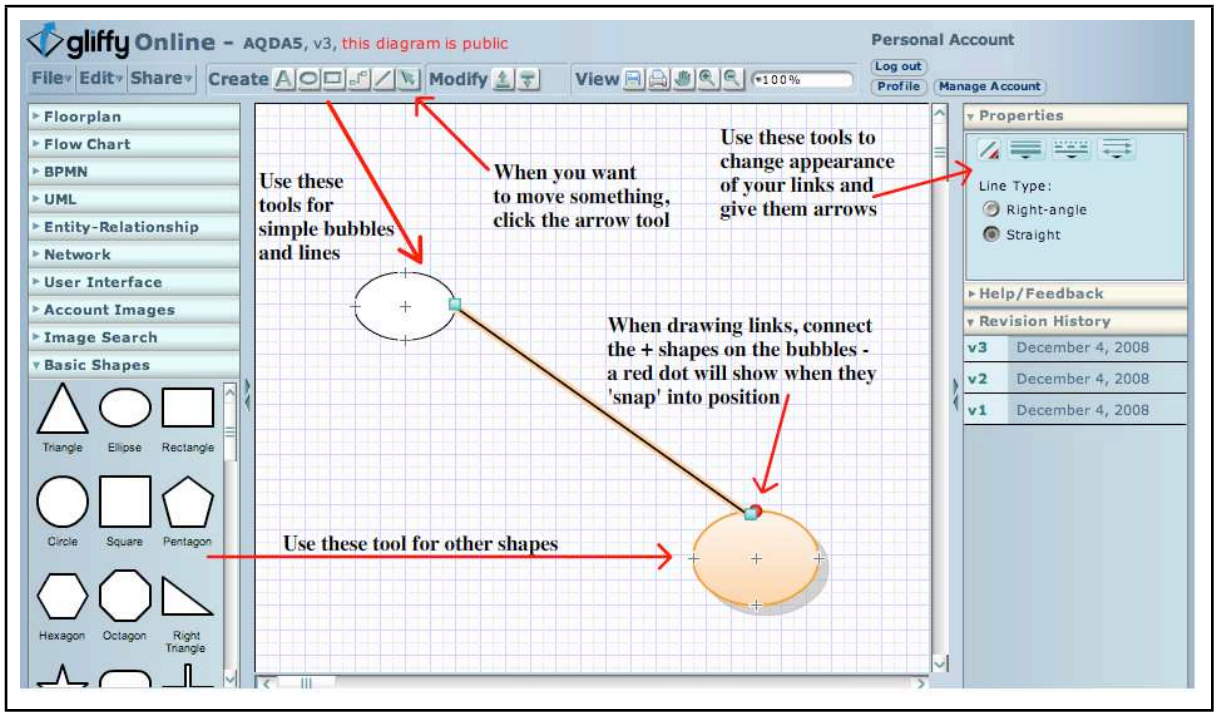
Creating a new page on the wiki



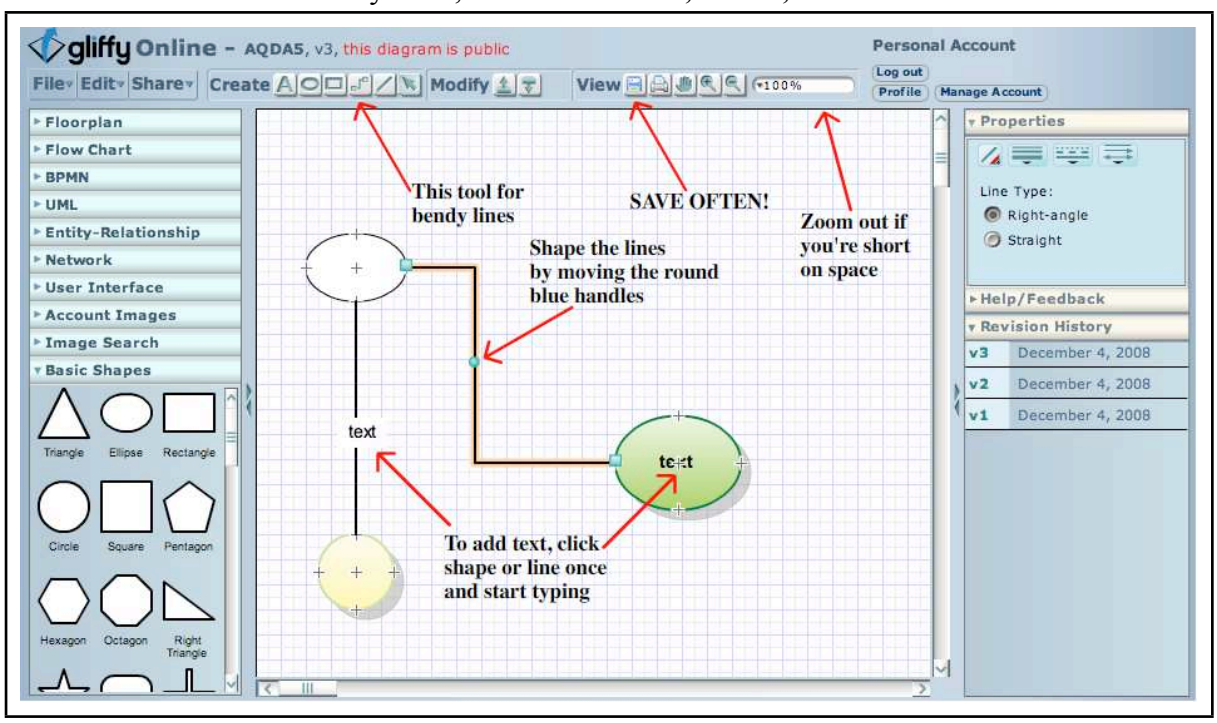
Gliffy walkthrough and connecting the map to wiki pages

Your Gliffy window – get here by right-clicking the 'Edit map' link underneath the map on your wiki page and selecting 'Open in new window'. You should now have 2 browser windows: one with your wiki and one with Gliffy.

Basic functions: adding basic shapes and linking lines

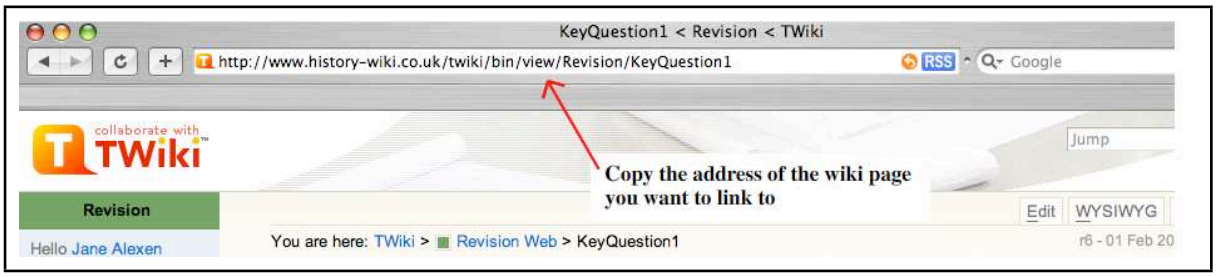


More basic functions: bendy lines, zoom and **SAVE, SAVE, SAVE**!!!

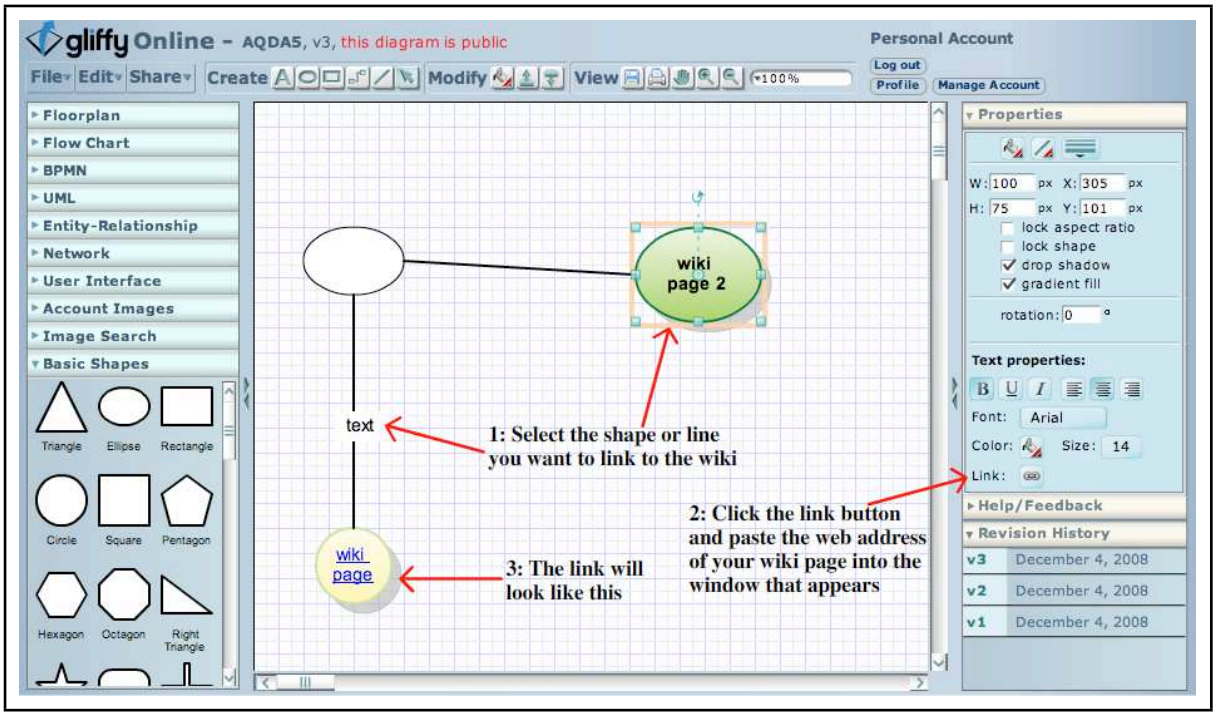


Linking items on the map to wiki pages – 2 steps

Step 1:
To link a wiki page to a shape or linking line on the map, first of all, you need to copy the address of your wiki page. In your wiki window, go to the page you want, select its web address in the address bar, right click and select 'Copy'.



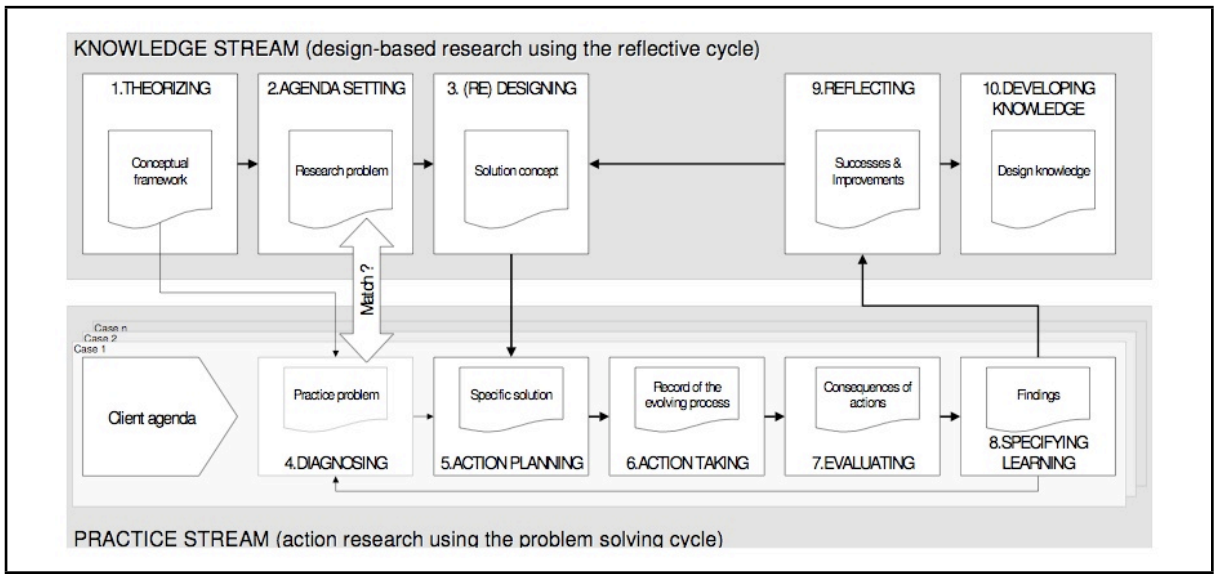
Step 2: Go to your Gliffy window and follow these steps:



When you save your map and refresh your wiki page in your browser, the map will automatically update itself with the new links and you can use them to navigate to the page you've linked to. Done!

Appendix 2 - Model of relationship between design-based research and action research

This model is taken from Andriessen, D. (2006). Combining design-based research and action research to test management solutions. 7th World Congress Action Learning, Action Research and process Management. Groningen, The Netherlands.



Appendix 3 - Example student consent form

Consent form

Study title: Investigating student interaction with ThinkSpace – a computer-based learning tool for A-level history

Researcher:
Jane Alexen Shuyska
Research student, Department of Education
15 Norham Gardens
Oxford, OX2 6PY
e-mail: jane.shuyska@education.ox.ac.uk

Purpose of the study:
The purpose of this project is to study A-level students' interactions with concept mapping and wiki software and to investigate how these influence their learning in history. The purpose of the interviews is to hear students' views on the impact the introduction of the technology had on their learning and to get their advice on further development of the tool.

I declare that I…

…agree to participate in a short interview
…understand that I can choose no longer to participate in the interview at any point before or during the interview by informing the researcher
…agree for the interview to be audio recorded
…am aware that the audio recordings will be kept safely where only the researcher can access them and that the data will be destroyed after the end of the project
…am aware that any data I provide will be used in anonymised form
…have had the opportunity to ask questions about the data collection and have received satisfactory answers to my questions
…understand that the project has been reviewed by, and received ethics clearance through the University of Oxford Central University Research Ethics Committee

Name of participant ……

Signature ……

Appendix 4 - Tabular overview of classroom activities

Appendix 4a - Development study 1: Park Hill School

#	Date	Meeting/ lesson nr.	Partici pants	Description
Phase 1. Curriculum topic: Problems of governing Russia Key concepts: Autocracy, Geography, Agriculture, Social Structure, Foreign Policy Context, Industry.				
1	17/09/07	Meeting 1	Allan, Jane	Discussed general scenario for mapping and wiki writing (work 'loops', length of 'loops', division of labour in groups)
2	27/09/07	Meeting 2	Allan, Jane	Discussed specific scenario for first round of mapping and wiki writing (group formation, specific topics). Central topic: problems of governing Russia. Problem areas: Autocracy, Geography, Agriculture, Social Structure, Foreign Policy Context, Industry.
3	28/09/07	Lesson 1	12A	Allan explained mapping. Jane explained TS. Groups were formed. Groups wrote wiki pages on 1 problem area each. Groups briefly used CMap to map out relationships between problem areas.
4	01/10/07	Lesson 2	12A	Students continued their mapping. Allan discussed wiki content with the groups and commented on wiki pages
5	01/10/07	Meeting 3	Allan, Jane	Evaluated the lesson. Decided on different scenario for 12B lesson (each group to write wiki pages on all problem areas)
6	03/10/07	Lesson 3	12B	Allan explained mapping. Students did PowerPoint presentations on Problems of governing Russia. Jane explained TS. Groups were formed. Tried to start with mapping, but CMap didn't work. Students wrote wiki pages on all problem areas. Students managed to construct small maps once CMap was fixed.
7	04/10/07	Lesson 4	12B	Extra independent lesson (teacher from other subject was absent) - students continued working on maps and wiki pages.
8	08/10/07	Lesson 5	12A	Students did PowerPoint presentations on Problems of governing Russia
Phase 2. Curriculum topic: Stability/instability 1906-1914 Key concepts: Industrial growth, Duma, Revolutionaries, Stolypin Reform, Foreign Policy (Russo-Japanese War, Rearmament, Involvement in Balkans)				
9	23/11/07	Meeting 4	Allan, Jane	Preliminary planning of the next mapping activity
10	30/11/07	Meeting 5	Allan, Jane	Further planning of the next mapping activity. Started creating concept map to support it.
11	03/12/07	Lesson 6	12A	Jane presented TWiki. Students did card sort activity. Homework: Note-taking on Duma, Stolypin, Worker militancy and SRs/SDs - to go on the wiki

#	Date	Meeting/ lesson nr.	Partici pants	Description
12	05/12/07	Lesson 7	12B	Jane presented TWiki. Students did card sort activity. Homework: Note-taking on Duma, Stolypin, Worker militancy and SRs/SDs - to go on the wiki
13	07/12/07	Meeting 6	Allan, Jane	Developed the map for use in on 10/12. Used map from 12AGroup4 as the core of the expanded map.
14	10/12/07	Meeting7	Allan, Jane	Put up mapping and wiki writing scaffold on front page of wiki (concepts/topics & page references)
15	10/12/07	Lesson 8	12A	Allan presented extended map on the board. Students extended their maps on CMap. Homework: write pages about new concepts
16	12/12/07	Lesson 9	12B	Allan presented extended map on the board. Students extended their maps on CMap. Homework: write pages about new concepts
Phase 3. Curriculum topics: Why were there two revolutions in 1917? Why were Lenin and the Bolsheviks able to seize power? Key concepts: Weaknesses of the Provisional Government, Mistakes of the Provisional Government, Strength of Lenin & the Bolsheviks, Social Structure, Impact of War				
17	26/01/08	Meeting 8	Allan, Sandy (intern), Jane	Evaluated last term. Discussed main concepts for next set of lessons. Jane proposed a source task, discussed source task structure. Agreed for Jane to draft source evaluation scaffold. Allan to gather appropriate sources.
18	04/02/ 08	Lesson 10	12A	[non-participant] Allan and Sandy presented new material to students
19	06/02/08	Meeting 9	Allan, Jane	Edited source exercise scaffold (drafted by Jane). Uploaded draft onto student wiki webs. Uploaded sources to webs
20	06/02/08	Lesson 11	12B	Source exercise
21	08/02/08	Lesson 12	12A	Source exercise
22	11/02/08	Lesson 13	12A	[non-participant] Chronology card sort. Whole class discussion. Homework: Allan handed out note taking task
23	11/02/08	Meeting 10	Allan, Sandy, Jane	Discussed the purpose of mapping for the next task. Created sample 1917 map on Gliffy together with Allan.
24	25/02/08	Meeting 11	Allan, Jane	Discussed debate task. Edited peer review scheme (proposed and drafted by Jane)
25	25/02/08	Lesson 14	12A	Allan brought up student notes on the board to show to the class. Students did 1917 map on Gliffy using some of the card-sort concepts. Allan initiated 'impromptu' presentations of maps
26	27/02/08	Lesson 15	12B	Allan brought up student notes on the board. Allan showed some of 12A's 1917 maps. Students did 1917 maps on Gliffy using some of the card sort concepts

#	Date	Meeting/ lesson nr.	Partici pants	Description
27	03/03/08	Lesson 16	12A	[non-participant] Whole-class discussion of debate topic. Group work on debate speeches. Homework: put individual speeches on the wiki and review others' speeches
28	05/03/08	Lesson 17	12B	[non-particpant] Whole-class discussion of debate topic. Homework: put individual speeches on the wiki and review others' speeches.
29	10/03/08	Lesson 18	12A	[non-participant] Debate
30	12/03/08	Lesson 19	12B	[non-participant] Debate

Appendix 4b - Development study 2: Clover Fields School

#	Date	Meeting/ lesson nr.	Particip ants	Description	Appen dices
Phase 1. Curriculum topic: How far did the Experiences of the 1815 to 1847 create support for Italian Unity? Key concepts: Restoration States, Revolutions (1820/21, 1831), Intellectuals					
1	19/09/08	Meeting 1	Thomas, Jane	Drew target map of Key Question 1. Outline planning of first task	19/9teacherMap
2	22/09/08	Lesson 1	YR12	Jane presented the wiki. Students wrote wiki pages about Key Question 1 concepts	
3	25/09/08	Lesson 2	YR12	Prize awarded to a 'wiki star'. Students continued writing wiki pages. Thomas introduced mapping spontaneously in a whole-class mapping activity. Homework: create wiki pages about concepts we drew up on the map	25/9Revolutions map
4	28-30/ 09/08	Emails 1	Thomas, Jane	Thomas pointed out that work was happening on the wiki. I asked what Thomas had done to make the work pick up and Thomas explained that he had looked through the wiki during a lesson and left comments on students' work	
5	10/10/08	Lesson 3	YR12	Jane introduced mapping and Gliffy. Students did maps about their choice of intellectual (Balbo, Mazzini) - one intellectual per group.	10/10 intellectuals map
6	14/10/08	Lesson 4	YR12	Students expanded the Mazzini map started by the Carbonari group	
7	16/10/08	Lesson 5	YR12	Students wrote wiki pages on concepts pertaining to Mazzini & linked pages to their maps	

#	Date	Meeting/ lesson nr.	Participants	Description	Appendices
8	20/10/08	Lesson 6	YR12	Students completed Mazzini maps. Thomas brought maps up on the board and studied them with the class	20/10 Mazzini maps
9	20/10/08	Meeting 2	Thomas, Jane	Post-lesson meeting. Evaluating our progress and trying to diagnose our difficulties.	
Phase 2. Curriculum topic: 1848 Revolution Key concepts: Leadership, Divided Aims, Mismatch of Strength, Papal Allocution, Lack of International Allies					
10	03/11/08	Emails 2	Thomas, Jane	Thomas evaluated the quality of the student maps	
11	25/11/08	Skype meeting 1	Thomas, Jane	Planning scheme for working with sources during the coming phase of lessons.	
12	03/12/08	Emails 3	Thomas, Jane	Proposed lesson plan from Thomas	
13	03/12/08	Skype meeting 2	Thomas, Jane	Finalising lesson plan	
14	08/12/08	Lesson 7	YR12	Q&A session about picture source. Then commenting task: students commented upon sources on the wiki	
15	08/12/08	Meeting 3	Thomas, Jane	Audio recorded meeting where Thomas evaluated and gave feedback on students' source comments.	
16	09/12/08	Lesson 8	YR12	Students read and answered comments left by Thomas. Students did a map about factors influencing the failure of 1848 revolution	
17	12/12/2008	Lesson 9	YR12	Students continued working with the 1848 map. They colour-coded the factors to show whether or not they supported an essay question about reasons for failure of 1948 revolution. Some groups wrote a short paragraph on the wiki summarising their argument.	12/12 1848 maps
Phase 3: Revision group. Curriculum topic: Revision					
18	6-8/01/09	Emails 4	Thomas, Jane	Setting up student interviews and volunteer group	
19	23/01/09	Workshop 1	Revision Group*	Discussed how to run the revision group: need for leader and distribution of responsibility. Discussed structure of the wiki. Decided on first task: to populate Revision Web on the wiki with material from existing group webs.	

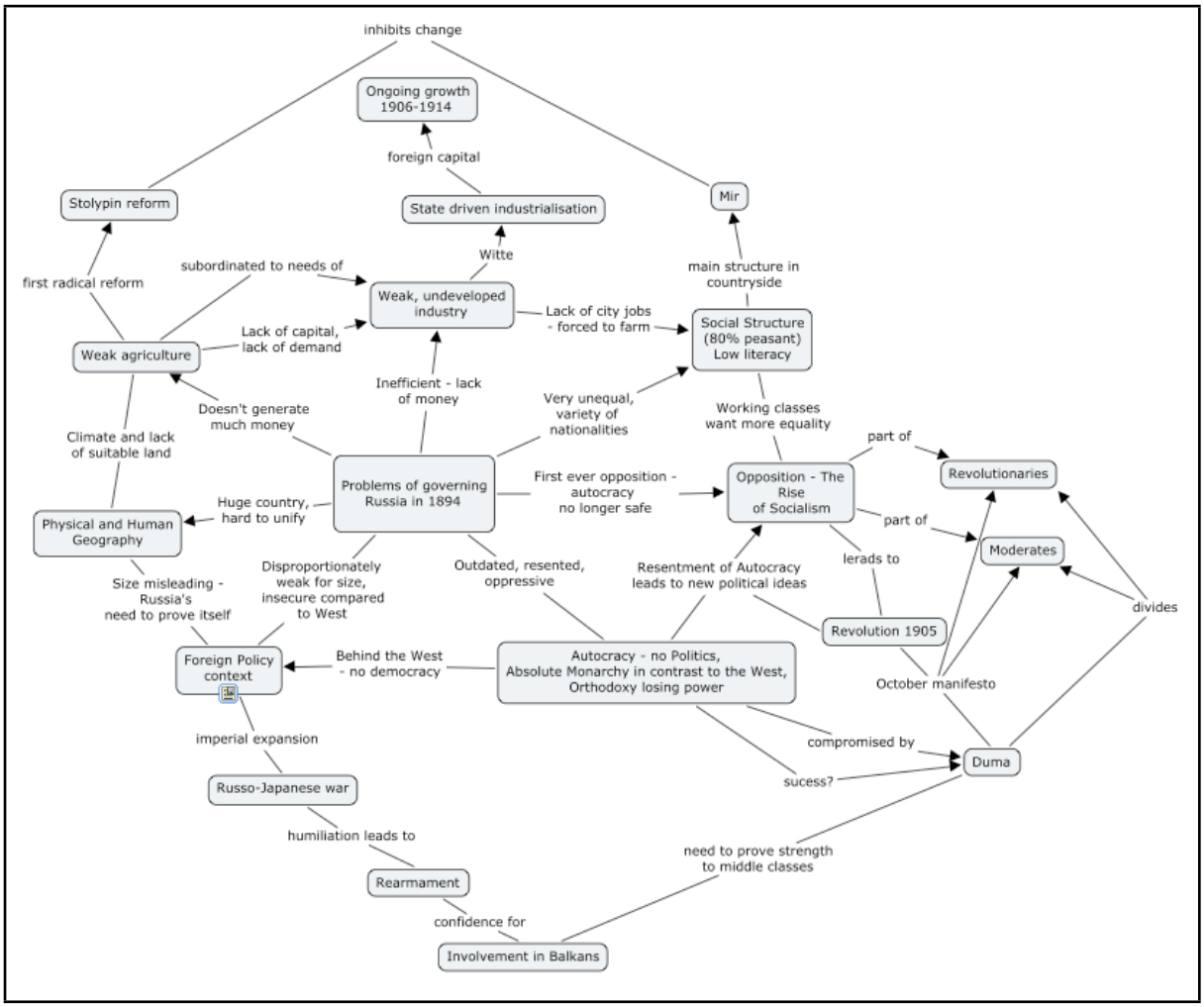
#	Date	Meeting/ lesson nr.	Participants	Description	Appendices
20	31/1-20/2/09	Emails 5	Revision Group, Jane	Various email communication with the group: Jane sent out login details to the students. Alice asked about a technical problem with the wiki. Jane sent out summary of progress on the wiki. Alice requested for empty maps to be set up on Key Question pages.	
21	02/03/09	Workshop 2	James, Ben	Discussed the utility of concept mapping. Alice had created a map of Key Question 1. Decided that it was worth giving it another go and that we would focus on mapping in next workshop.	Alice Key question 1 map
22	04/03/09	Emails 6	Revision Group, Jane	Informing the rest of the group about the content of meeting	
23	30/04/09	Emails 7	Thomas, Jane	Planning for workshop. Jane proposed a mapping task and Thomas agreed that it was a good approach to exploring mapping for revision with the students	
24	01/05/2009	Workshop 3	Revision Group	Mapping workshop on Key Question 3. James and Alice disagreed in their interpretation of an issue in the study material and had a productive discussion about it.	1/5 Key question 3 map
25	3/5 - 7/5-09	Emails 8	Thomas, Jane	Planning for workshop. Jane proposed shape of next workshop, but Thomas thought there was not enough time for all of it. He proposed questions we could use to structure next workshop and we settled on an outline.	
26	08/05/09	Workshop 4	James, Ben, Caroline	James had expanded the map from previous workshop - group studied his revisions (James subsequently edited this map during exam revision in June). Did another map on Key Question 1.	2 X key question 3 maps (both James revisions). + Key question 1 map
27	08/05/09	Lesson 10	YR12	After the meeting Thomas decided to improvise a whole-class mapping workshop after the template we had developed with the Revision Group. Whole-class mapping session of Key Question 4.	Key question 4 map
* Thomas and Jane were present in all Revision workshops. Revision group consisted of 4 students: Alice, Ben, Caroline and James. Where not all group members were present, the individual participants' names are given.					

Appendix 5 - Selected concept maps

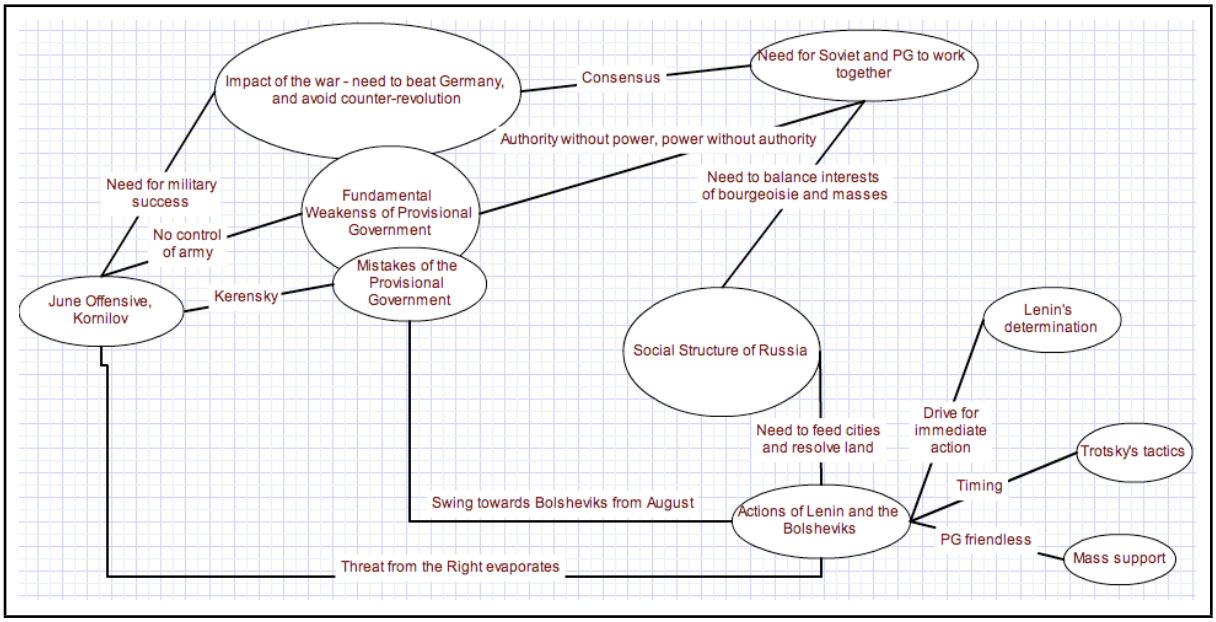
Appendix 5a - Park Hill School maps

Appendix 5a-1 - Maps created by the teacher

1. Map created in Meeting 6



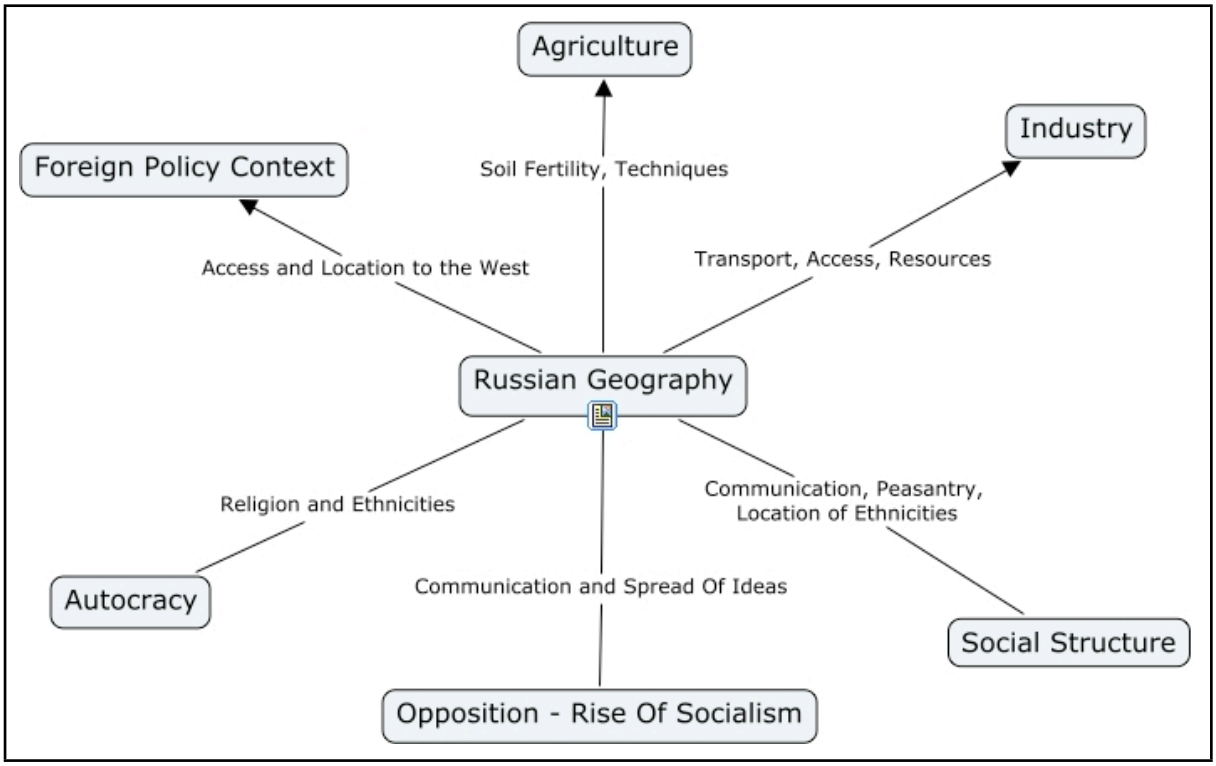
2. Map created in Meeting 10



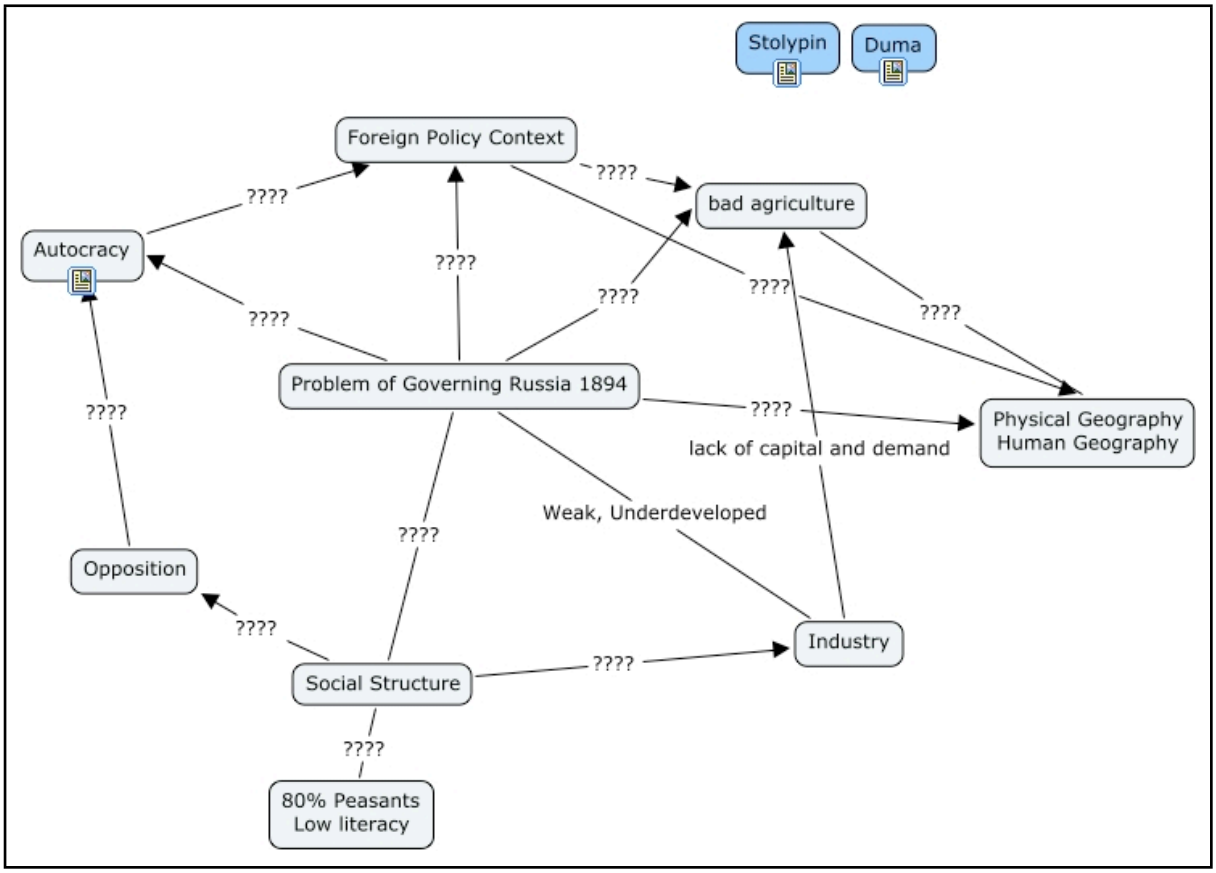
Appendix 5a-2 - Selected maps created by the students

This is a selection of maps created by the students at Park Hill School. These are the maps which are referred to in the main text of the thesis.

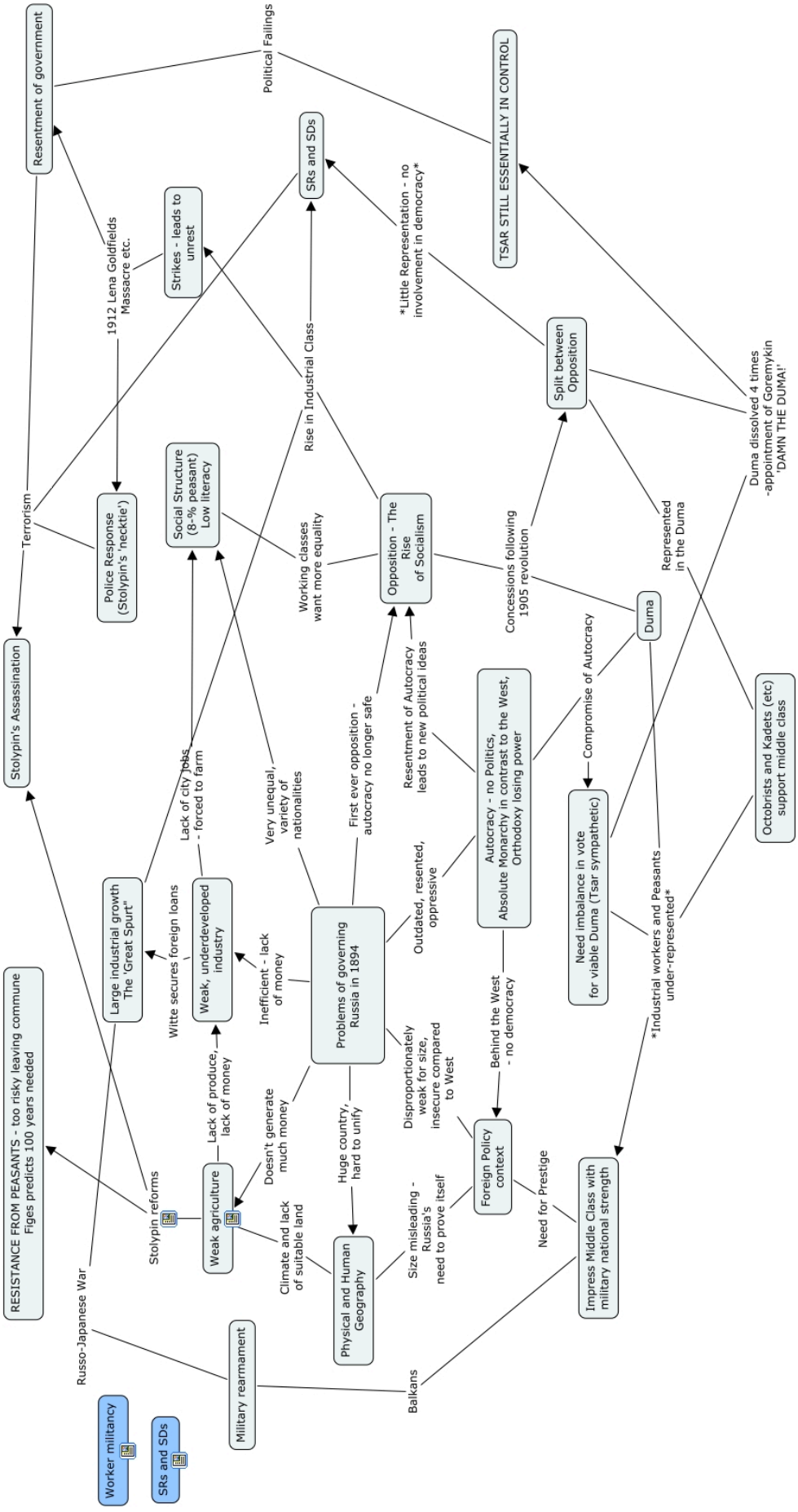
3. Overview map after initial round of mapping by Group 2A (Lessons 1 and 2)



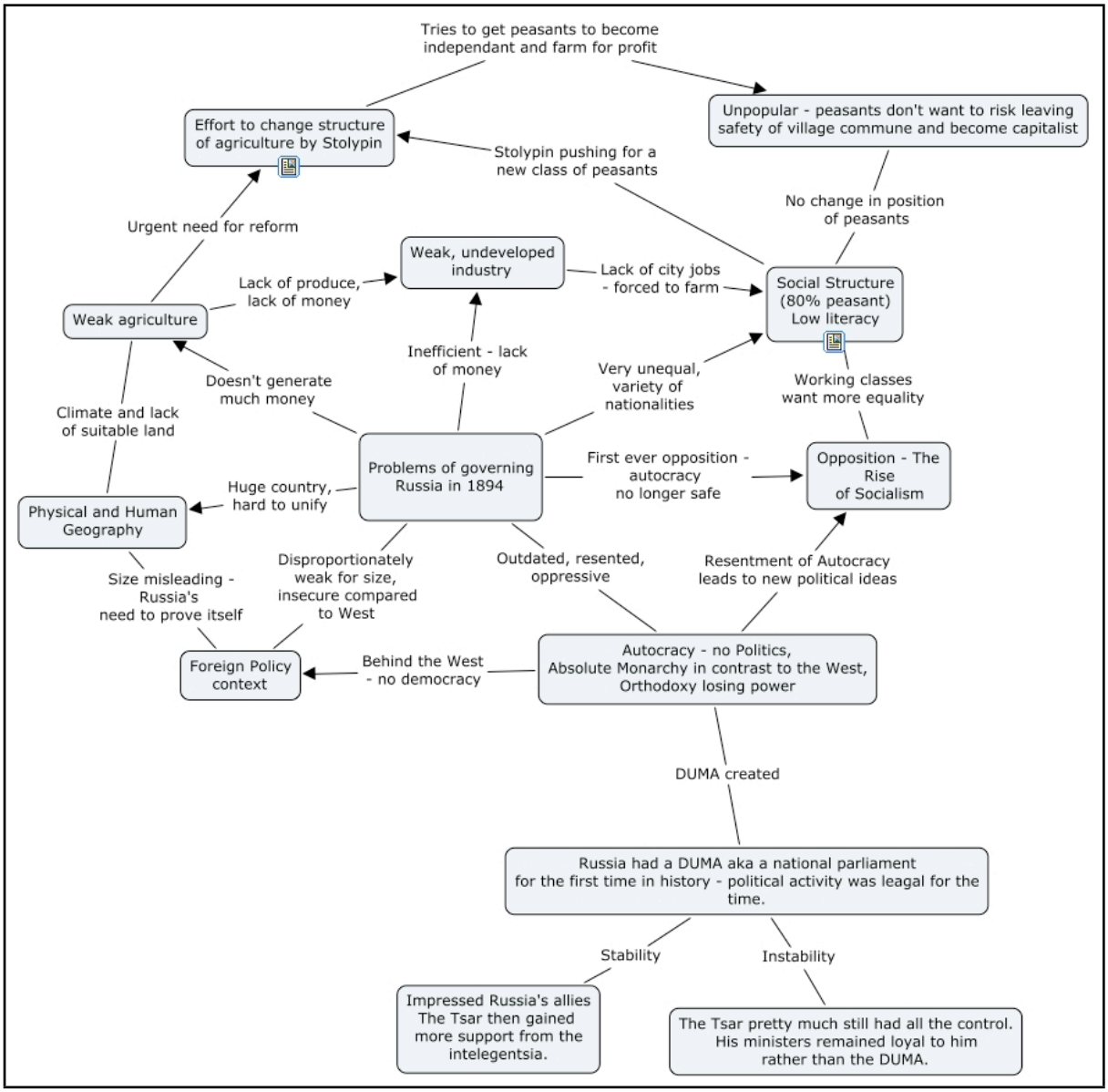
4. Finished overview map by Group 5A (Lesson 8)



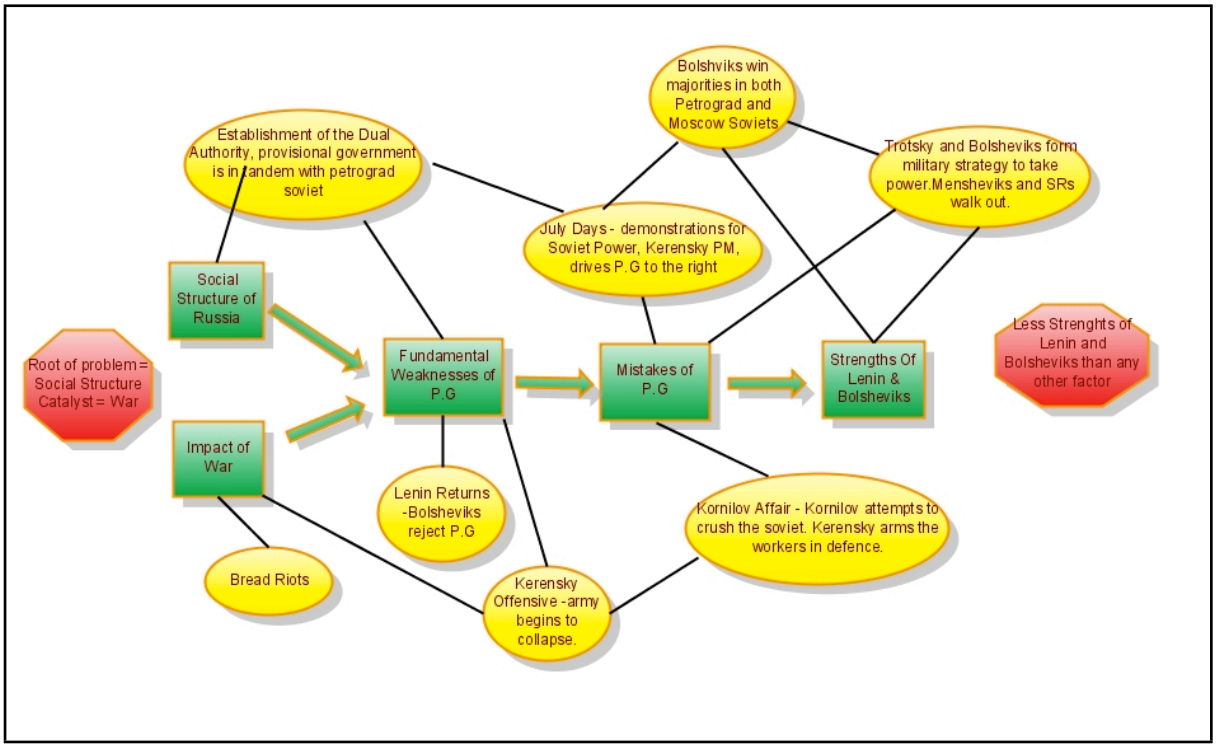
5. Finished overview map by Group 7A (Lesson 8)



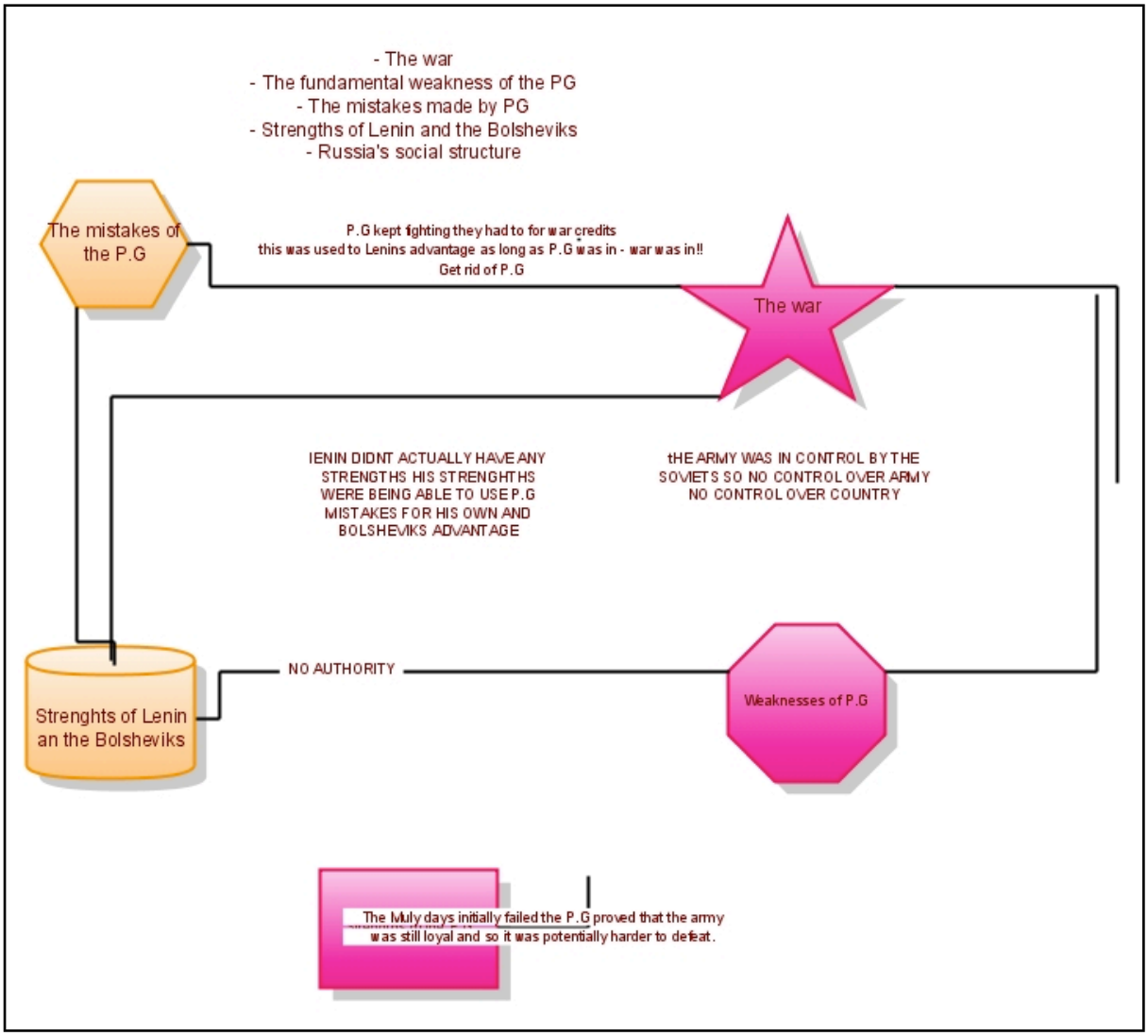
6. Finished overview map by Group 4B (Lesson 9)



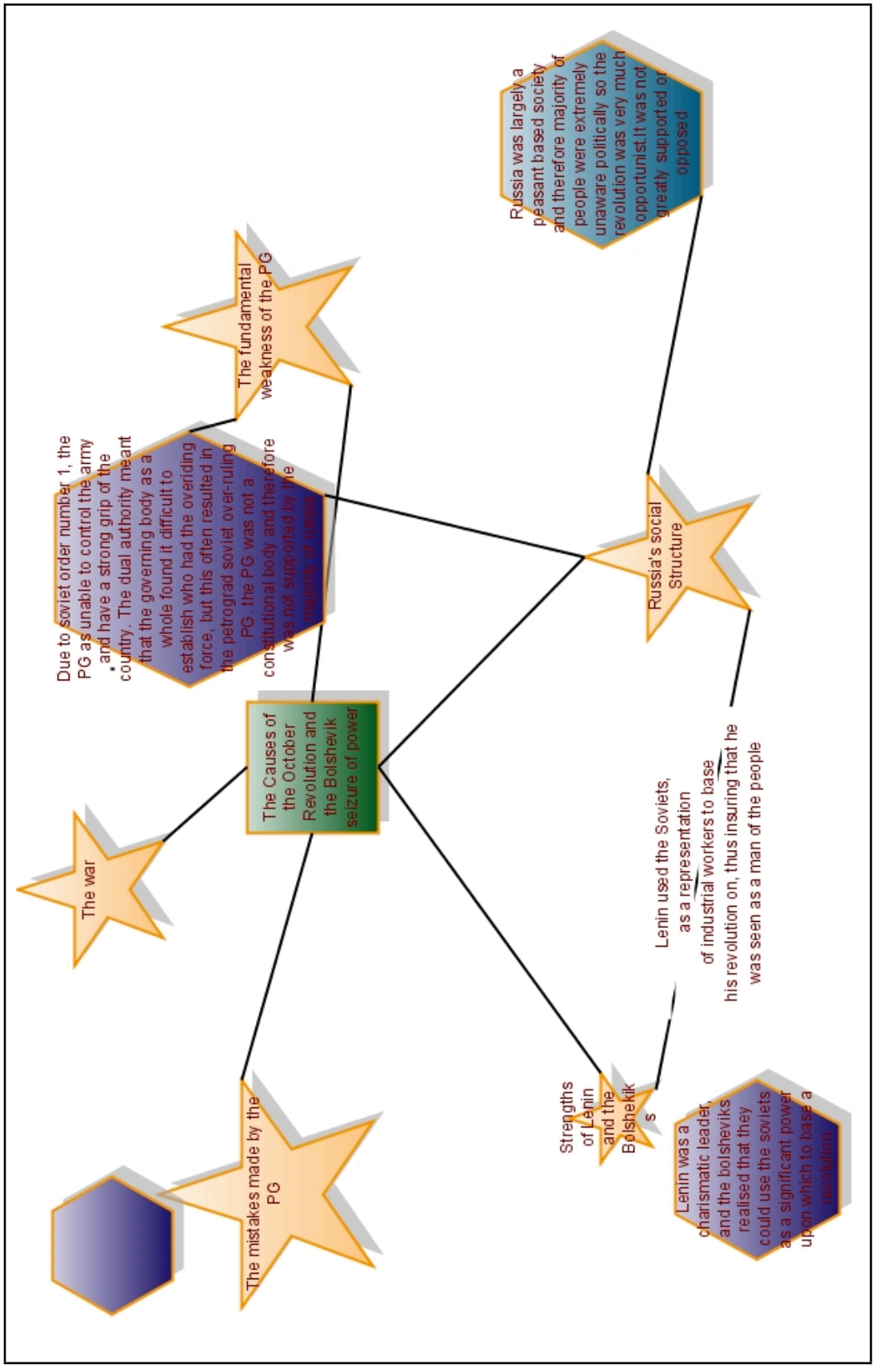
7. Map of the events of 1917 by Group 7A (Lesson 14)



8. Map of the events of 1917 by Group 4B (Lesson 15)



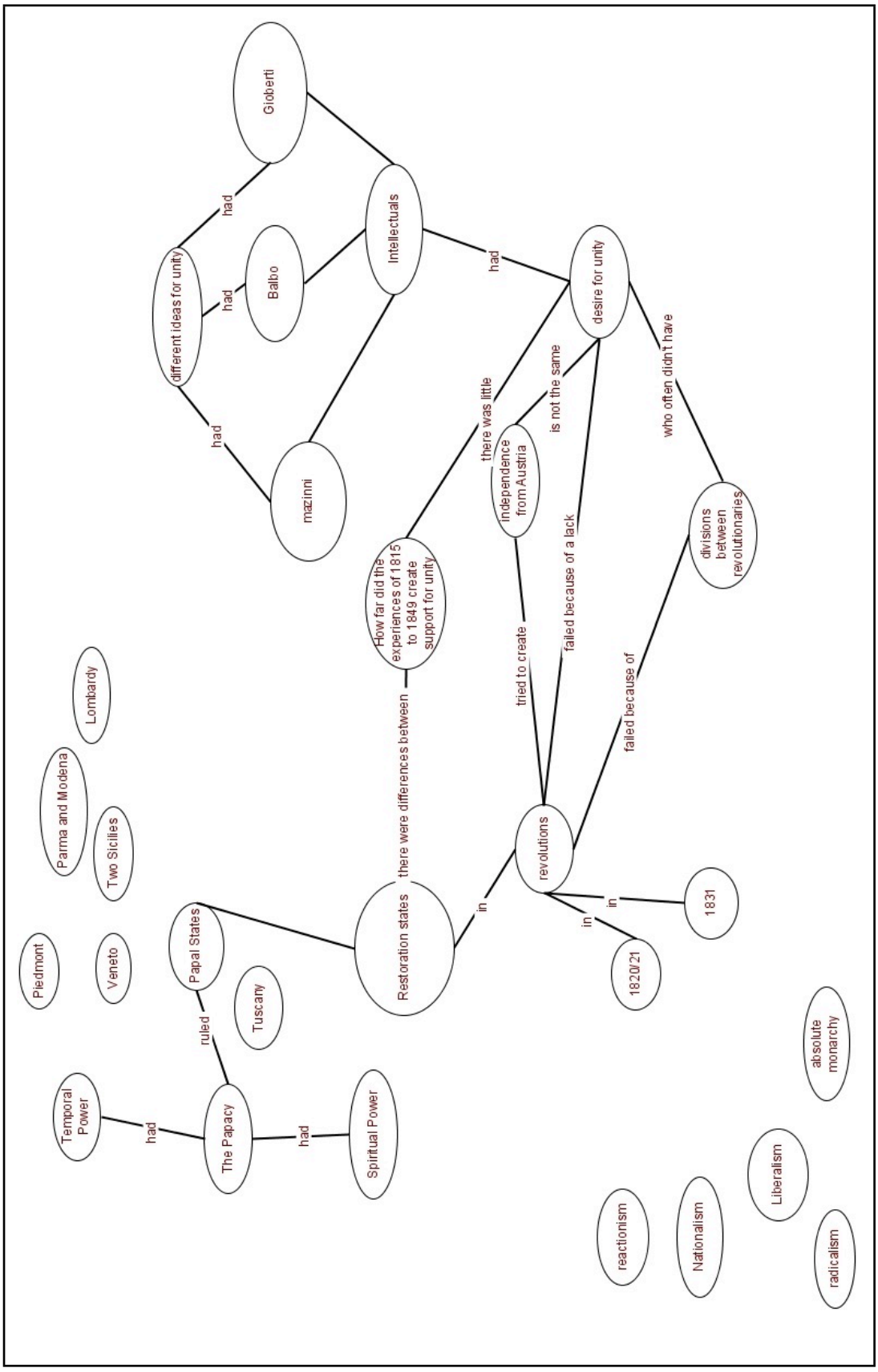
9. Map of the events of 1917 by Group 5B (Lesson 15)



Appendix 5b - Clover Fields maps

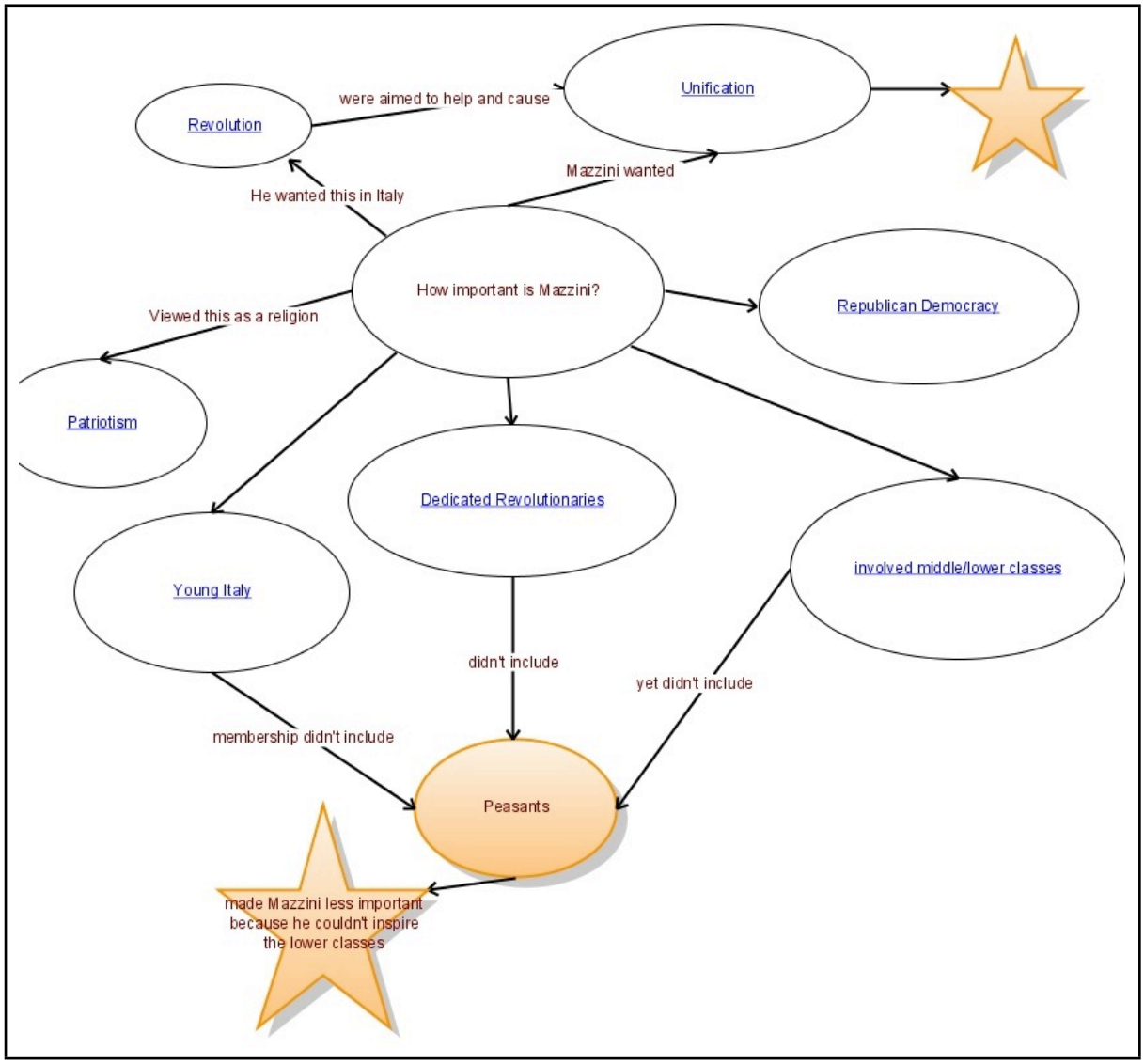
Appendix 5b-1 - Maps created by the teacher

10. Map created in Meeting 1

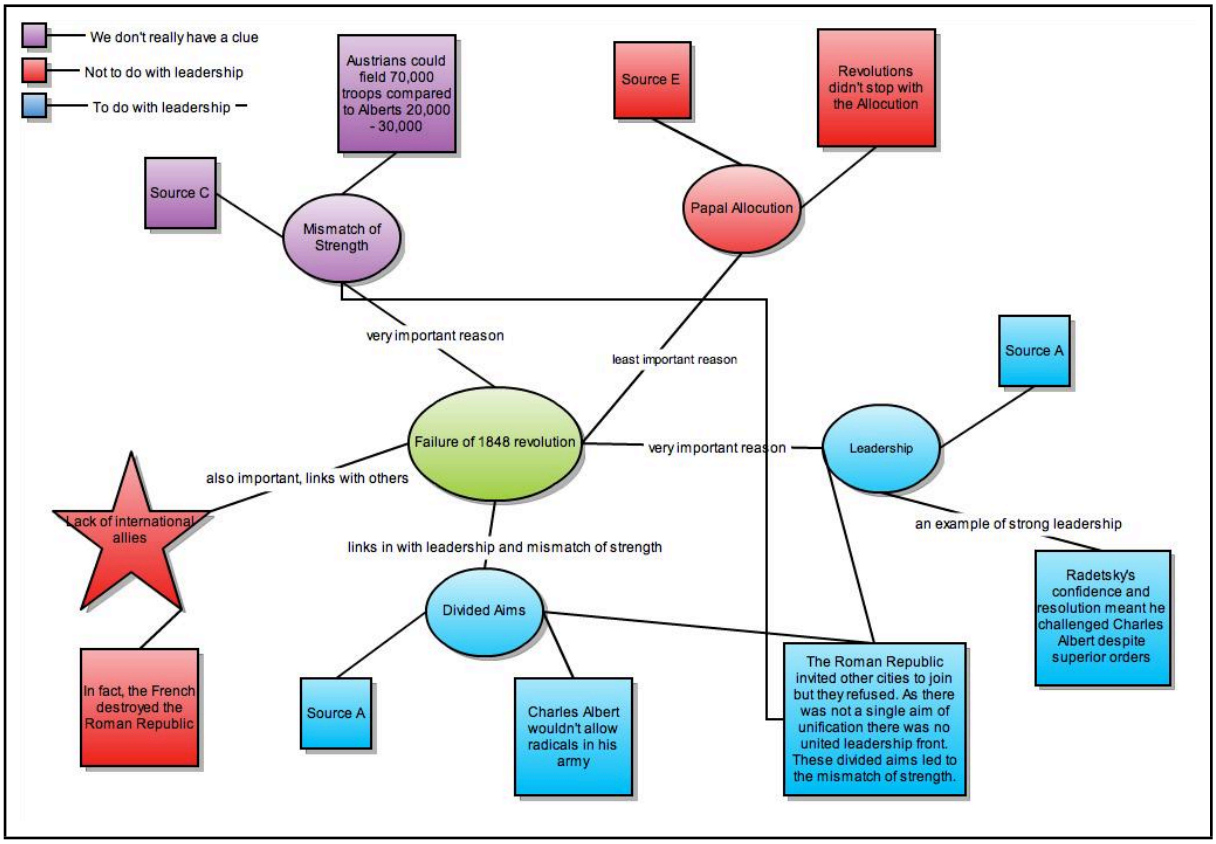


Appendix 5b-2 - Maps created by the students

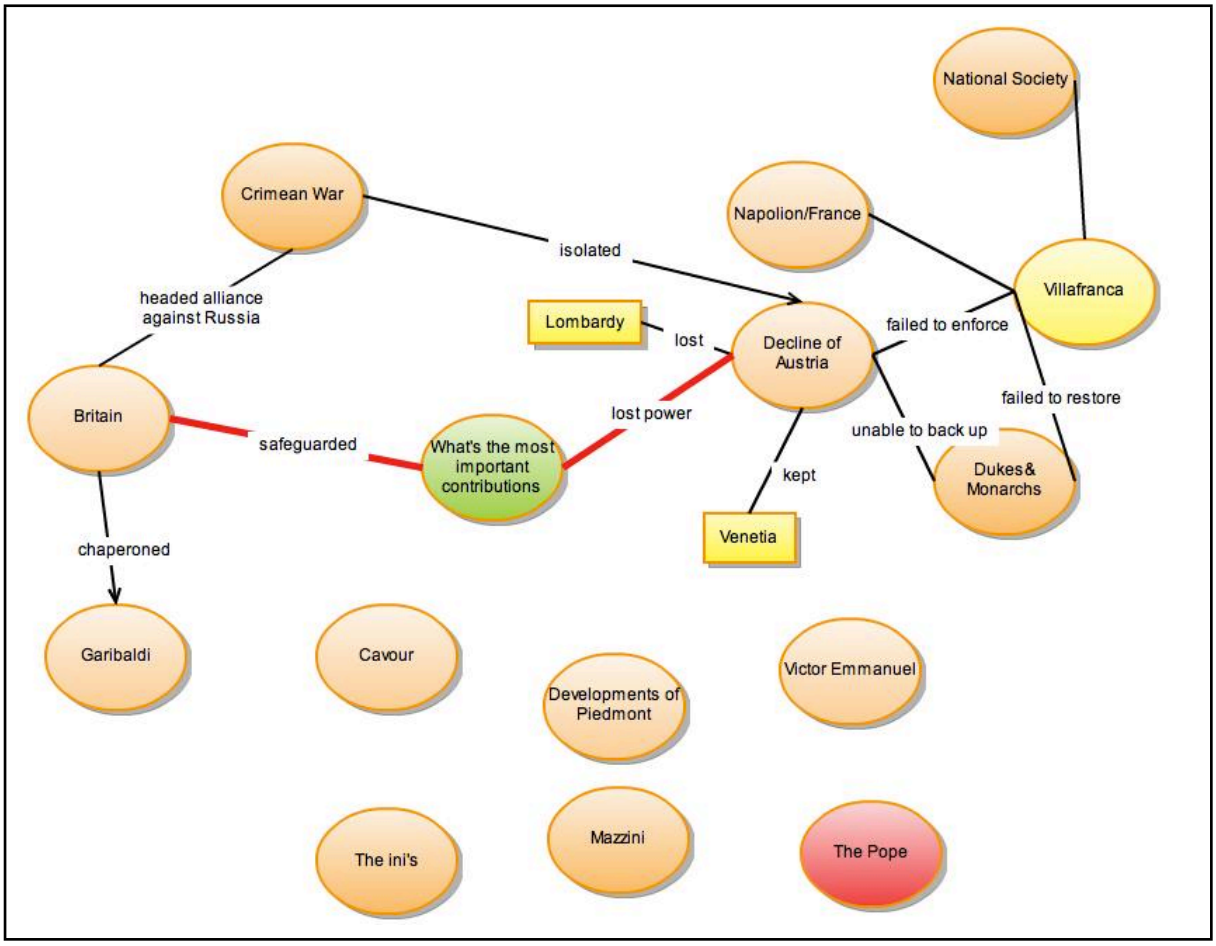
11. Mazzini map by the Marinari group (Lesson 6)



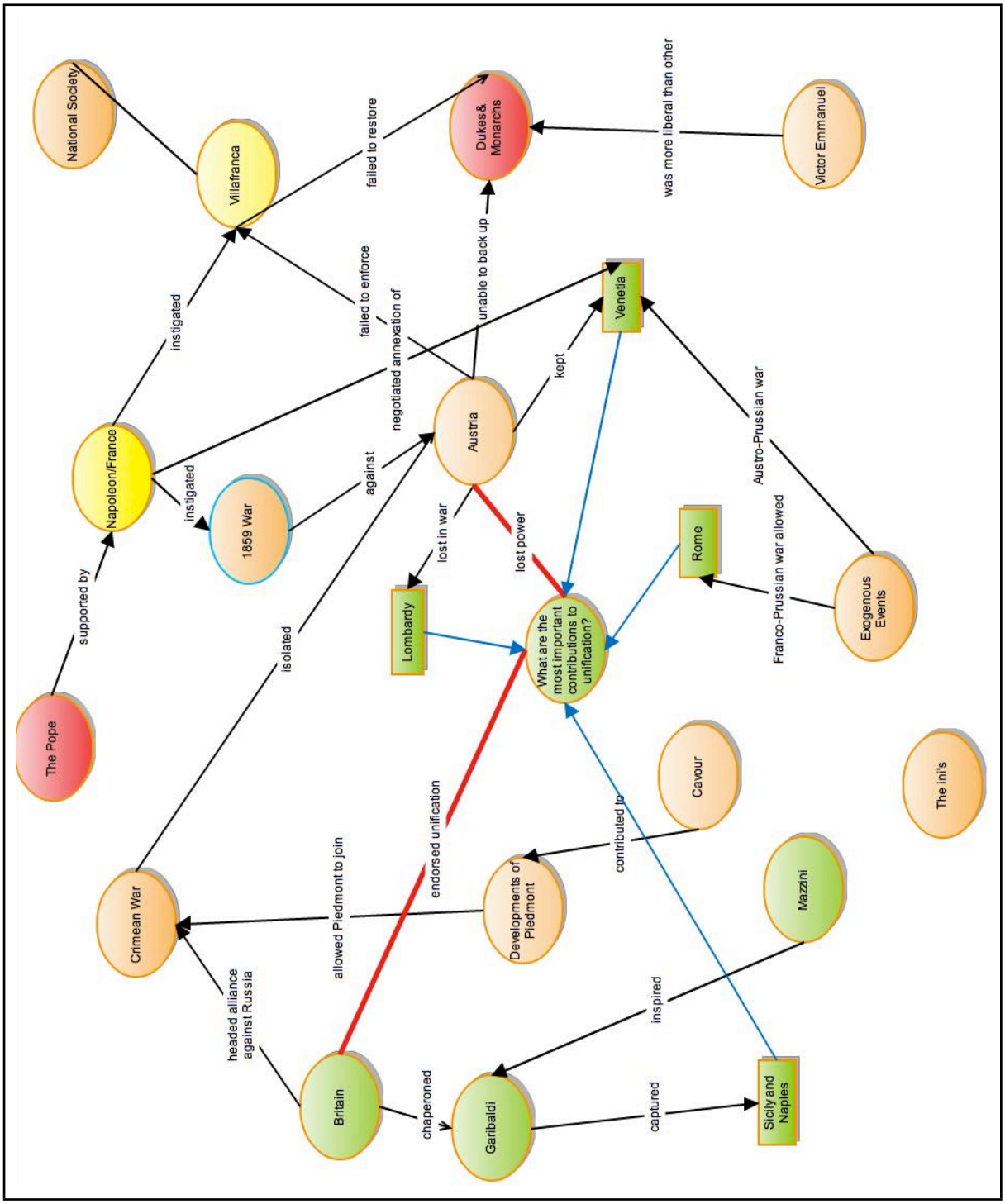
12. 1848 map by the Marinari group (Lesson 9)



13. Key Question 3 map by the Revision group (Workshop 3)



14. Key Question 3 map as edited by James (between Workshops 3 and 4)



Appendix 6 - Example wiki page

r3 - 28 Sep 2008 - 18:26:47 – Thomas
You are here: TWiki > Marinari Web > **InfluenceofAustria**

The Influence of Austria on the failure of the 1820 Revolutions.

Austria's importance in the failure of the 1820 revolutions cannot be underestimated. Their military intervention and poltical influence on the key reason the revolutions failed.

Poltical Influence

Prince Metternich's political influence had a great effect on the failure of the revolutions. It was him who convinced the Great Powers of Great Britain, Prussia and Russia that intervention was necessary and that these revolutions disturbed the peace. More information on Metternich's influence here.

Military Intervention

It was however Austria's military might that had the overwhelming impact on the revolutions of 1820:

Piedmont

- In Piedmont the legitimate ruler Charles Felix denounced the revolutionary leader Charles Albert as a rebel. Charles Albert fled, leaving the liberals to defend their new constitution. Felix appealed to the Austrian Prince Metternich for aid. The Austrian troops sent by Metternich along with those soldiers loyal to Charles Felix, defeated the Liberals at the battle of Novara? in 1821. For the next two years, Piedmont was occupied by the Austrian army, ensured no revolt would happen again.

Kingdom of Naples

- After the Neapolatain revolution, the King of Naples, King Ferdinand was invited to attend a meeting at Laibach, There he declared he had been forced into the new constituiton and asked Austria to help him retrieve his absolute rule. The Austrian army then entered Naples despite fierce resistance led by General Pepe?

Sicily

- Once the Kingdom of Naples, was once again dominated by the Austrian army, troops were sent to crush the rebellion in Sicily, which they did successfully.



Conclusion

The influence of Austria was essential to the failure of the 1820 revolutions. Whilst Austria's political influence, gained her approval from the Great Powers? , her military forces took part in the crushing of every uprising. Although the revolutionaries themselves, were neither well organised or backed with mass support, they may have been able to establish more poltical and military strength, had the Austrian army not been so quick and overwelming in it's reprisal.

Further Reading:

- Italian Unification 1820-71 Heinemann Advanced History
- The Italian Risorgimento: State, Society and National Unification (Historical Connections)
- The Habsburg Monarchy 1809-1918: A History of the Austrian Empire and Austria-Hungary

Comments:
Wow. This is great stuff Ben. How about a link to this on the Austrian Army page, when you explain its importance in putting down the revolts.
-- Thomas - 28 Sep 2008 - 19:26

Perhaps also a link on Austria's Military Might?
-- Thomas - 28 Sep 2008 - 19:26

Appendix 7 - Example interview guide

Guide for teacher interview with Thomas

- Why are you participating in this project? What do you think the tool is useful for? What is it less useful for? Have your thoughts about it's usefulness changed as we've worked with it over time?
- Are there any particular skills you are targeting with the wiki writing and the maps? Any particular ways of thinking? Are there skills you wanted to target and found it was unsuitable for that?
- What does doing mapping allow you to do? What does wiki writing allow you to do? How would you usually do these things without this tool?
- Do the maps encourage the students to think in a different way and answer questions differently? Does it move them on? Have you had to go about explaining things differently - or even explaining different things?
- Does wiki writing and creating links make the students think in a different way and answer questions differently?
- Does any of this make YOU think in a different way? How have you changed your teaching to incorporate this tool?
- How do you usually do collaborative work? Does collaboration matter? Why?
- (Do you think working with the tool has had any impact on the quality of the students' thinking?)

Tasks (see list of tasks below for reminder)

- What was the purpose of these tasks - could you give me a quick 'tour'?
- Which tasks did you think were successful? Which were unsuccessful? Why? Did different tasks benefit different students? Did some students not benefit at all?
- What do you think about the quality of the work on the wiki? What do you think of the quality of the maps?

- What do you think the ‘volunteer group’ are getting out of this
- How difficult has it been for you to stay in control of what was going on when the students were working is groups on computers? Did you have a feeling that you were loosing control?
- What is your general attitude to the use of technology in school - you’re working with it very actively - why? What is the value of using technological tools?

Tasks we did:

- Wiki pages about Italian states (in class and at home)
- Brainstorm reasons for 1820 revolution (whole class - first encounter with mapping)
- Wiki pages about reasons for 1820 revolution - at home (you were commenting on students’ pages)
- Intellectuals map (groups picked different intellectuals)
- Wiki pages about Mazzini’s ideas (in class) - we gave all the groups Carbonari’s map and they were altering the map and writing pages in class
- Mazzini map (in class) - finalising the map
- Source work - students commenting on sources - you commented back in the meeting we had
- 1848 revolution map - and a lesson with colour coding

Appendix 8 - Example interview transcript

This is a transcript of one of the student interviews at Clover Fields School.

Jane
So if we start with the wiki side of things, what did you think of working with that?

Chelsea
I don't mind using computers and things, but I think I find that if I did stuff by hand then put it on there.. I like being able to go home and being able to go on it.. because I like revising from the internet, I find that helpful, but I don't know whether I like working on the computer straight away. I'd rather do the work before hand and then..

Jane
And then upload it to.. Aha. Why is that? Why is that better for you?

Chelsea
I don't know.. because.. I don't know, I like doing work by hand, it goes in better. But then when I come to revising, I tend to revise on my computer anyway.

Jane
So do you then go and type up your notes or..?

Chelsea
Hmm.. not usually, but if I would use the wiki, then I probably would do the work first and then add it on there somehow.. I don't know, scan it in or something, I'd find that easier. More useful.

Jane
So it simply goes in better because.. of the motion of the.. That's really interesting, lots of people say that and.. I'm just wondering why.. I mean I love writing.. That's funny.. So how did you find the technical aspects of it? Was it difficult to use at all?

Chelsea
No, pretty straight forward. I didn't find it confusing or anything

Jane
So the technical bit was pretty..

Chelsea
Yeah, pretty straight forward. Once you know what you're doing.. obviously.

Jane
Did you find this sort of.. the way that you could links things to other things and make these multiple pages, was that of any use?

Chelsea
Yeah.. like if we did have like a map or something.. and then you could click on something and read further on about it.. it's helpful. Instead of having to like go to a completely different page.

Jane
Yeah, I can see what you mean. So having the map was sort of what you.. The reason I'm asking about the links is that that's the sort of thing you maybe can't do with paper.

Chelsea
Yeah, that's true. I don't know..

Jane
But if it's not the way you're thinking then it's no use at all.. I'm just wondering what your preferences are and what you think is more beneficial to learning stuff.

Chelsea
I don't know.. Eh.. I don't know really. I just know that I..

Jane
They are really difficult questions.

Chelsea
I like writing things down in lessons and I like talking about it.. But when I come to revision I like having it on my computer and being able to read it in that kind of way.

Jane
Mhm. Ok. So what about the mapping side of it, what did you think of working with that?

Chelsea
It was alright.. I don't know.. I kind of.. i guess I kind of found it hard.. getting all the information and doing it all on the computer I think.. I found it more difficult. But..

Jane
In what way?

Chelsea
I don't know.. I can't explain it..

Jane
Doing the maps?

Chelsea
Well.. like.. when we were up at the computer, I found it easier to get distracted from doing.. instead of writing it out and everything.. so.. I don't know. i don't think I ever really went in properly whenever I was doing it, i think.

Jane
Hm, that's really interesting, so why.. what was the distraction, where was the distraction coming from? Was it because you were at the computer, was it because you were in groups?

Chelsea
Because of the environment at the computer I think. Like.. especially in that room, you're just sat in a row, it's not like.. if we were in our groups and we were all sat round the table, it would be more of a discussion thing, and I'd probably understand it better and be more into the subject.

Jane
Yeah, I can see what you mean. Definitely. So it's simply the setup with the computers.. just not very good?

Chelsea
Its' just like when you're at the computer, it's like your own little environment thing.. instead of like being able to communicate with other people, I find that really..

Jane
Do you use computers at all with Mr. Edison and with other teachers?

Chelsea
No, not really.

Jane
Really? Cause I was wondering whether you would usually use the computers individual or in groups or.. however that would be..

Chelsea
I don't use them in any of my other subjects

Jane
Is it really that rare?

Chelsea
No, I don't know.. well, the subjects I do, you probably wouldn't use them in... Like I do English, Psychology and Drama in my other subjects, so they're not really.. no real use for a computer I wouldn't say.

Jane
Ok. That's really interesting. Back to the mapping. Is it.. a way that you usually think, I mean, do you do maps? Or..

Chelsea
I'm quite a.. list kind of person.

Jane
So how did you find doing it now?

Chelsea
Ehm.. I don't know.. I like to.. I prefer to just list any ideas that I come through under headings.. I'm not very good at doing the whole brainstorming map thing. I'd never do that on paper, I don't like doing that.

Jane
No, no. No it's a very valid point, because I think there's.. sort of.. people who just don't do it. Cause I think in maps all the time, I can't help myself and others just don't see the point in it. Could you.. because you said that you could sort of see the use of having a map and then navigating down to the information. If it wasn't a map, but a list of topics, would that be as good? Or would that be better in fact?

Chelsea
If there was like a list of topics which all had links to go to, I think I'd find that easier to understand.

Jane
Yeah, rather than a map.. Ok. I've got a question as well about.. what is history about for you. I mean, different people have different approaches, why do you study it in the first place?

Chelsea
Cause I enjoy learning about the past really. I rally enjoyed it at GCSE, I find it a lot harder now.. very hard, but I still like.. I find it really interesting just knowing.. what has happened in the past.

Jane
So what does it mean to be 'good at history' - you say you find it really hard, what makes it hard to get ahead?

Chelsea
What do you mean.. like..

Jane
Well, can you describe what does it mean that you're really good at A-level history? What is it you can do when you're really good?

Chelsea
Just have more knowledge about things. Just like... knowing things that other people's won't know.. because they're not interested in it I guess. I think it's a really good thing to know about the history of.. different countries and things.. Because I think it does have an effect on all things now, today.

Jane
Definitely. We've all come out of history

Chelsea
Exactly.

Jane
But you say you find it really difficult.. what is it that somebody who doesn't find it as difficult, what is it.. the sort of skills that they have.. what is the sort of thing that they can do that you find really difficult?

Chelsea
It's like.. with James or Ben in our class, I think it's cause they remember everything and they have really good memories and things and.. I'm not.. I have to keep going over and over stuff for it to sink in and with.. Because there are so many facts and different things.. Especially for the exam, I just find it really hard to like.. remember everything, all the little details and everything. It doesn't always stay in there.

Jane
So it's about the detail really? An is that what you need to sort of remember.. or to be able to do to do the exam then? I mean to completely trump those essays?

Chelsea
Yeah. The minor details that boost everything up a bit. With the essays that we've done recently, i feel like I've done them really vague and I haven't put enough detail into it.

Jane
Vague in the sense that you say sort of.. this happened, but..

Chelsea
But I don't go into more depth about it, about a comment that I make about something.

Jane
Ok, yeah. Do you then think.. I can understand that you didn't find this particularly useful. I'm just trying to understand whether this tool can at all connect with some of the things you need to know to be better at history, to be able to DO to be better at history.. Whether it at all can give you some of those skills and help you learn it in a way that you find useful. Or whether it.. sort of misses the mark a bit.

Chelsea
I don't know.. Ehm.. I don't know, because being able to remember, I don't know what technique to use to remember everything. So I don't know what would help me. I'm quite.. I don't know what kind of learner I am, whether I'm a kind of visual or..

Jane
I don't think it's really necessary to know that..

Chelsea
No.. Sometimes when I look at things, like when I do Drama, when I look at a script to memorise my lines, it's quite a visual thing and I remember where they are on the page, so I wonder whether that would help if I had it on a computer and I visualised it like that, but I don't know.

Jane
Yeah, but then I would think that maybe the mapping would actually be.. more interesting, because you can maybe picture it better.. but clearly you don't find it that useful.

Chelsea
I don't really find maps that useful, I never do them for revision. I don't like them.

Jane
Fair enough.

Appendix 9 - Example extracts from field notes

This is an excerpt from field notes from a lesson in the Park Hill Study.

Lesson 14: 25/2-08 - 12A

[...]
Then Allan called the students together for a plenary. He called up groups to the board to present their maps

The fluid move of the map to the wiki is good. Allan straight away brings a map up (from the first group finished - I think it was Group1) with the intention of using it for a presentation. Finally something works!

Group 6 are naming links as well.

The students seem to find a certain satisfaction in seeing their maps on the wiki. Finally the technology seems to create some sort of excitement.

The projector makes the map difficult to read because the colours are different.

Group 1 do a presentation with the help of the map. They do use the map and the presentation is good. They use the words ‘this links to that’ and point to the map. They use the map as a guide and keep their presentation going [Comment: These presentations were spontaneous - they were not prepared in advance - Allan just asked the groups to come up and explain their maps.]

Allan brings Group 7 up: “Where do we start? At the beginning. No, let’s start from the inside out.”
They get a pointer. We decided to split the main problems up in chronological order. They point and go through the map. Use words like ‘links’, ‘leads to’, and they refer to ‘previous factors’. ‘The strength of the Bolsheviks is minimal, that’s why it’s only got two links going to it. It wasn’t on the same scale as the other factors.’ And referring to the map: We can see the progression.

I think what the students have been lacking is a sense of ownership over their wikis. I think some of them might have got some of that now.

This is an excerpt of field notes from a meeting in the Clover Fields study.

Meeting 1: 19/9-08

We confirmed that we would have run one wiki for each group of 3-4 students. This is something we have discussed before and decided was a good idea because of technological limitations of Gliffy.

Drawing the map was very useful. We drew map for the first key question of the course on the Italian unification. Thomas had read the concept mapping paper I sent him and was quite clued up on what concepts are and that drawing concept maps is a skill.

When drawing the concept map we started out with a bunch of substantive concepts, but ended up not using most of them. The map was built by starting with one that seemed to fit into Thomas' thinking (and maybe also into the teaching scheme). We were also quite successfully naming the links also because Thomas had read the concept mapping paper.

Thomas said that the year 12 group will do the homework he sets —" they do the extra reading" apparently a frighteningly bright group.

I asked whether it would be a good idea that students would be working towards a product. And Thomas could see what I meant but he did not think this scheme of work lent itself very well to presentations or other types of products.

Then he proposed that we would introduce the wiki and the concept mapping separately in order to get to grips with the tools and then put them together at in the next Key Question unit. I agreed to this → if it makes more sense to Thomas, I'm game! Also I can see why this would make sense because the of pilot - with too many tools and tasks at the same time. Thomas said that we would tell the students: " well, you liked the concept maps and you liked the wiki, now you'll love it when we put the two together".

Appendix 10 - Extract from data display: overview of classroom study

	Date	Lesson	Class	Length	Lesson/meeting summary
July					
	17 Jul 2007				Initial meeting discussing technology and concept of TS as well as plans for the year
September					
	17 Sep 2007				Discussed general scenario for mapping and wiki writing (work 'loops', length of 'loops', division of labour in groups)
	24 Sep 2007				Correspondence about lesson plan for 27/9
	27 Sep 2007				Discussed specific scenario for first round of mapping and wiki writing (group formation, specific topics)
	28 Sep 2007	1	12A	Single	A. explains mapping. J. explains TS. Groups formed. Groups write wiki pages on 1 problem. Groups briefly use Cmap - not enough time or mapping
October					
	1 Oct 2007	2	12A	Single	Students continue their mapping. Wiki pages are not linked in to the maps. Allan comments on pages
	1 Oct 2007				Evaluated the lesson. Decided on different scenario for 12B lesson (division of labour in groups)
	3 Oct 2007	3	12B	Double	A. explains mapping. Students do PowerPoint presentations. J. explains TS. Try to start with mapping, but Cmap doesn't work. Students write wiki pages on all problems. Students manage to construct small maps

Lesson
Meeting
Email correspondence
Email from me to Allan
Email correspondence with students
Correspondence with parent

Appendix 11 - Extract from an overview of wiki activity

Neapolitani web

James, Johanna & Archie
Note: only latest revisions show!



TuscanyHolidayLocations	r2 - 26 Sep 2008 - 08:17	Archie
Tuscany So, Tuscany, lovely place in Italy, nice sunshine, a good holiday destination: lots of sun lots of restaurants lots of fun!...probably But more impotantly ...		
Jesuits	r2 - 25 Sep 2008 - 14:55	James
Jesuits A Jesuit is the name given to the members of the Society of Jesus, a religious order of the Roman Catholic Church. Today, they are engaged in missionary work ...		
ThePapalStates	r3 - 25 Sep 2008 - 14:55	James
The Papal States After Napoleon, The Papal States went back to being run by hard line popes, also known as the 'Zealots'. They had all the control over the education ...		
Piedmont-Sardinia	r4 - 22 Sep 2008 - 19:41	James
Piedmont Sardinia Population: 3.5 Million Capital/Main City: Turin Ruling Family: Savoy Piedmont Sardinia (also known as Sardinia, Piedmont, Genoa, Nice ...		

r2 - 25 Sep 2008 - 14:55:57 – James
You are here: TWiki > Neapolitani Web > Piedmont-Sardinia > **Jesuits**
NOTE: Subpage to Piedmont-Sardinia

Jesuits

A Jesuit is the name given to the members of the Society of Jesus, a religious order of the Roman Catholic Church. Today, they are engaged in missionary work, as well as working on social justice and human rights.

r2 - 24 Sep 2008 - 18:12:38 – Johanna
You are here: TWiki > Neapolitani Web > **ThePapalStates**
NOTE: 2 revisions by two different people
After Napoleon, The Papal States went back to being run by hardline popes, also known as the 'Zealots'. They had all the control over the education, politics, government and culture. They wanted to change everything back to how they believed it should be. They forbid anyone believeing in any other religion than Roman Catholics. There was an increase in religious persecution and Jews were treaten extremely harshly.

Nr.	Sub-group	Code name	Actor/ relationship /practice	Definition	Example
		RQ 1.1			
1.1-1		Teacher understandings of nature of teaching and learning	Teacher	Evidence of teacher's understanding of teaching and learning - at any given time. Includes possible contradictions or tensions in understanding	It's all about learning the language.. you could learn the language.. you could do this course by correspondence, you could do it just over the internet without any discussion at all, but.. I think on the whole.. learning to talk and to discuss is important (PHS Teacher interview1)
1.1-2		Teacher-student relationship and teacher assessment of students attitude	Teacher - Students	Evidence of the relationship between teacher and students as well as teacher's assessment of students' attitudes toward technology and their learning in general	The students say that the course & Allan has taught them not to concentrate on a single cause - are very aware of their learning. Again though, it is very much the back end of the class. (PHS field notes)
1.1-3		Teacher's reaction to critique of ThinkSpace from students	Teacher - Students	Records of teacher's reaction to instances of student critique.	Some students (namely Grace) expressed discontent about having to use computers. Allan's reply was that you can't be in his class and be a Luddite. (PHS field notes)
1.1-4		Assessment of student achievement or engagement with the tool	Teacher	Teacher's assessment of the students' work with ThinkSpace - includes both work quality, level of engagement and attitude	The Carbonari map. It looks like the least successful one to me. (CFS teacher interview)
1.1-5		Teacher purpose for using ThinkSpace or understanding of TS	Teacher	Evidence of teacher's expressed as well as acted purpose for using ThinkSpace. The expressed and the acted may be different. Teacher's understanding of what ThinkSpace can do and assessments of what it does.	It's the blankness of it, I think. I quite like the fact that there is nothing there. And then.. therefore they have to construct.. everything. (CFS teacher interview)
1.1-6		Retrospective view of ThinkSpace	Teacher	Retrospective vision/assessment of ThinkSpace as expressed in the post-work interviews	I'd almost like them to have an individual wiki, which is kind of a web-based collation of all their notes, and then I'd like on parents' evening to call up.. (PHS teacher interview1)
1.1-7		Retrospective understanding of mapping	Teacher	Retrospective understanding of the purpose, success and future usefulness of mapping - expressed in the post-work interviews	I think it's very good at fostering them talking to each other. it's very handy that you can call it up on.. it's very handy that you can manipulate it.. of the tasks that we set them, I thought the map work was the task that was much the.. done much the best. (PHS teacher interview1)

Nr.	Sub-group	Code name	Actor/ relationship/ practice	Definition	Example
1.1-8		Retrospective understanding of the wiki	Teacher	Retrospective understanding of the purpose, success and future usefulness of the wiki - expressed in the post-work interviews	I was quite glad to see all the comments.. the beauty of the wiki is that you can see everything that has been done or not done. (PHS teacher interview1)
1.1-9		Teacher engagement with technology and the tool in general	Teacher	Evidence of teacher's engagement and proficiency in the use of technology. Includes both teacher's expression/assessment and recorded instances in the classroom/ meetings.	Allan acknowledged in the meeting that he was entirely dependent on me technologically, but expressed hope that this would change once he gets a chance to use the wiki for next year?s preparation. (PHS field notes)
1.1-10		Previous/other engagement with technologies and similar issues	Teacher	Teacher's accounts of engagement with technologies for support of teaching and learning practices and technology-related issues - outside of ThinkSpace work.	Thomas used Google docs to quickly type up some notes he would then put on his blog. He keeps a blog recording what happens in the lessons and the students seemed to be aware of it and familiar with it (CFS field notes)
		RQ 1.2			
1.2-1		Researcher's expressed purpose of ThinkSpace in tasks	Teacher - Researcher	Researcher expressing purpose of ThinkSpace through formulation of practical tasks	I think it's really important to have a reason to use the wiki for this - above and beyond storage capability (although that obviously plays a role too) (Jane, Skype meeting with Thomas 25/11-08)
1.2-2		Teacher's expressed purpose of ThinkSpace in tasks	Teacher - Researcher	Teacher expressing purpose of ThinkSpace through formulation of practical tasks	Allan wants them to write a speech each. I proposed that they could do it in groups, but he'd rather do it individually because the speeches in a sense are instead of essays - i.e. part of assessment. (PHS field notes)
1.2-3		Consensus on task formulation	Teacher - Researcher	The consensus reached on plan or task formulation which is the outcome of negotiation - includes task formulations that were not necessarily carried out in the classroom -only the ones that were agreed - the plans may have changed during lesson.	Students will continue reworking and expanding the concept maps that they did in previous sessions. We thought about starting on new maps, but decided not to chuck what had already been done. (PHS field notes)

Nr.	Sub-group	Code name	Actor/ relationship/ practice	Definition	Example
1.2-4		Communal task formulation and conceptual engagement	Teacher - Researcher	Collaborative engagement with conceptual planning in meetings (as differing from presentation of plan or purpose).	When drawing the concept map we started out with a bunch of substantive concepts, but ended up not using most of them. The map was built by starting with one that seemed to fit into Thomas' thinking (maybe also into the teaching scheme). we were also quite successfully naming the links also because Thomas had read the concept mapping paper and was definitely trying to construct propositions very carefully. (CFS field notes)
1.2-5		Teacher's expressed purpose of ThinkSpace to students	Teacher - Students	Records of teacher's explanation of the ThinkSpace tool to students - includes general purpose as well as practical tasks	Thomas also mentioned the collaborative element when he reminded them of their homework: "the strength of the wiki is" … that you can edit each other's work. And "if you find that something is missing and needs to be added to a page - go ahead and do it!". (CFS field notes)
		RQ 2.1			
2.1-1	**Classroom climate**	Atmosphere in class	Student	Students' comments that give insight into classroom life and general atmosphere in the class	Yeah, I was just going to say, Mr. Cunningham likes to play on competitions in order to [..] or like a surprise at the end. (Laura, PHS Group2 interview)
2.1-2		Students characterisation of the teacher	Student - Teacher	Students' comments about the teacher - also in comparison to other teachers. Assessment of teaching style and student-teacher relationship.	I don't like being horrible to him, because he's a nice person.. I just can't understand him. (Grace, PHS group4 interview)
2.1-3		Attitude to and engagement with the project and school work in general	Student	Expression of attitudes towards or assessment of level of commitment to school work in general and the TS project in particular	Jane: That is everything you did, yes. Printed and collated. Geoff: Did we make this? (PHS Group2 interview)
2.1-4		Energy save	Student	Talk about minimizing effort and taking shortcuts. Both in relation to TS work and more generally.	And it took me a while to like.. if I thought about it and I thought: oh, no, that's going to take me a while and that kind of put me off it a bit, if you know what I mean. I preferred to like read over theirs. (Caroline, CFS interview2)

Nr.	Sub-group	Code name	Actor/ relationship/ practice	Definition	Example
2.1-5	**Teaching and learning**	Understanding of nature of teaching and learning	Student	Evidence of students' understanding of the nature of teaching and learning both in terms of school and non-school learning - also both in the context of TS work and more generally. Includes possible contradictions or tensions in understanding. Also includes students' understanding of their roles as learners in a school context.	And also if you're writing it down by hand, you kind of learn it more. It gets into your brain more by writing. (Amy, PHS group3 interview)
2.1-6		Understanding of learning in history	Student	Evidence of students' understanding of the nature of teaching and learning in history both in the context of TS work and more generally. Both assessment of learning in history in itself and in comparison with other subjects. Includes possible contradictions or tensions in understanding.	You learn to analyse as well. Which you wouldn't do in sort of maths and science. And it's a useful skill sort of.. looking at notes and finding books and.. trying to find quotes and things. (Richard, PHS group1 interview)
2.1-7		Difference between courses	Student	Students comparing or contrasting the two history courses they do in nature, content, method and approach. Both in application to TS work and more generally.	I think Russia is like a step back kind of looking at it, more summarizing view, then kind of Britain ..(?) more sort of dates and months and everything [...] Russia's more like opinion and links and things rather than just cause and effect. (Richard, PHS group1 interview)
2.1-8		Student presentations and PowerPoint	Student	Students' views and understandings of student presentations in general and PowerPoint presentations in particular. Both assessment of quality and usefulness and understandings of purpose.	Yeah, because all the time people will go and present and it's just.. you know.. you're listening and people present it (?) and people might take notes so when you get it printed off, it just makes it seem a bit pointless, you know, it's the same exercise just putting notes on the wiki and then someone's reading it later. (Harry, PHS group1 interview)
2.1-9	**Collaboration**	Attitude to and experience of collaboration	Student	Expression of attitudes to collaborative learning in and out of the classroom. Expression of their experience of and opinions about collaboration around the TS project.	Some people weren't here sometimes. Some people.. you didn't have the same opinions. We were all trying to construct one mind map and then, people had different opinions. Some people did more work than others, some people didn't bother (Daisy, CFS interview)

Nr.	Sub-group	Code name	Actor/ relationship/ practice	Definition	Example
2.1-10		Sharing ideas	Student	Instances where students talk about 'sharing ideas', 'exchanging opinions' and similar formulations. Created to focus on the meaning of these utterances.	When you're working together on one thing, I think it's a hindrance, but when you're working separately and then you can look at everyone's opinions, then I think it's a help. (Daisy, CFS interview)
2.1-11		Previous/other experience with collaboration	Student	Students' experiences with collaborative learning outside of TS work. Both assessments of quantity of collaboration in school/different subjects and descriptions of collaborative work.	He'd normally say, someone takes notes from these pages and someone else from these pages. Or this book and this book and this book. And then you put them together and all make sure you all learn them and then you'll all get tested on them and then it's the group that comes out of it the best (Laura, PHS group2 interview)
2.1-12	**Think Space**	Students' reaction to working with ThinkSpace	Student	Records of students' reactions to working with ThinkSpace - both reaction to the technology and to tasks with the tool more generally.	The students seem to find a certain satisfaction in seeing their maps on the wiki. Finally the technology seems to create some sort of excitement. (PHS field notes)
2.1-13		Expressed purpose of ThinkSpace from researcher to students	Student - Researcher	Records of the way ThinkSpace was presented to the students by the researcher. Includes purpose of the tool and more practical direction.	Then I gave a quick tour of the wiki. In the presentation I emphasised how reading and editing others? work is useful for getting better at writing. (CFS field notes)
2.1-14		Understanding of ThinkSpace	Student	Utterances about ThinkSpace as a whole or its components in isolation which provide evidence about students' understanding of the purpose and usefulness of the tool, or the role it played in their learning practices.	when you went home, there was the stuff that you did in the lesson, you could look at. Sort of just look over to get some idea of what you'd done in the lesson, so you know what you did and understand it. (Alfie, CFS interview)
2.1-15		Attitude to and understanding of mapping	Student	Expression of understanding of the purpose and utility of concept mapping/maps as well as expression of attitudes towards mapping/ maps.	Yeah, it did make me think about it a lot more. Yeah again, I'd prefer.. rather than having thick lines I'd rather have just a list of different factors ranked in importance because I'm not very good with mind maps. (Ben, CFS interview)

Nr.	Sub-group	Code name	Actor/ relationship/ practice	Definition	Example
2.1-16		Attitude to linking	Student	Comments about hyperlinking, usually initiated by researcher's question. Both in terms of mapping and wiki writing as well as reading maps or wiki pages.	I think linking is quite good, because it helps in your essays, when you write, you need to link the ideas together. So if you've got a page say on like the unification and then link it with other things, there's going to help you in the essays a lot, to do those links. (Alfie, CFS interview)
2.1-17		Previous/other experience with similar tools	Student	Students' accounts of previous/other experience with tools similar conceptually or technically to TS.	I like mind maps as well, cause if I do revision, I do a mind map, which helps me revise (Caroline, CFS intervew1)
2.1-18		Independent use of ThinkSpace	Student	Students reporting on using TS outside of the set work, either at home or at school and either individually or collaboratively.	Well when we came to revision for this one I thin kit was just the questions one and two that have been done and three and four weren't done. So I spent a lot of revision time doing those pages and.. going back to some of the older stuff and changing bits of it (James, CFS interview2)
2.1-19		Timing issues	Student	Issues of timing of the type of tasks the class did with TS, usually pertaining to the level of understanding students see as necessary to engage in TS tasks.	a lot of the overview stuff I might have got into later in the year, but we did do less things by the end of the year [...] it's only near the end of the year that you get the whole timeline in your head and you start grouping everything together. (Harry, PHS group1 interview)
2.1-20		Confusion and difficulty	Student	General code: Instances where the technological or conceptual nature of the tool led to confusion or difficulty in understanding or using the tool.	I don't know, like.. just seems really complicated for me and.. I know what it is, but it's really hard to explain, I don't have the words. All the little links just make it really complicated for me. (Jade, CFS interview)
2.1-21	**Technology**	Attitude and access to technology	Student	Expression of opinions about using technology in the context of learning. Includes statements about other purposes of technology use when it sheds light on its uses for learning. Talk about levels of access to technology and how it related to its use for learning.	It's better than just writing down, it's more interesting going on the computer and stuff like that, than just sit down and copy stuff out of a textbook. (Alfie, CFS interview)

Nr.	Sub-group	Code name	Actor/ relationship/ practice	Definition	Example
2.1-22		Role of technological proficiency/confidence	Student	Students' expression of their levels of confidence with technology or assessment of technological proficiency and the way this made them approach TS work.	Yeah, when I get to know it, I'm alright, but when I first go in, I get a bit like.. stunned, like: what do I do? (Daisy, CFS intervew)
2.1-23		Use of technology in school	Student	Students' assessments of use of technology outside the TS work - both in terms of quantity, where and how it is used and the usefulness of technology elsewhere in school.	it's not great and also the stuff you do from year 7 onwards, they don't teach you how to use the computer for revision and things, its all about how to write a formal letter and things like that, so in terms of that, it doesn't really help you a lot. (Anna, CFS interview)
2.1-24		Technology and usability	Student	Students' remarks about technological nature of TS. Usability problems related to software design.	The problem with Gliffy though is that it's just one login per group. That's just the biggest off-putting part of it (Archie, CFS interview)
		RQ 2.2 & 3			
3-1		Discussing and explaining	Learning practice	Instances of students discussing, arguing, disagreeing etc. in the context of TS work. Also explaining their point of view to other students when questions arise.	The disagreement was very productive. Alice was arguing that Britain was the most important contributor and James was arguing that Austria?s weakness was. This argument was clearly prompted by my question about importance. (CFS field notes)
3-2		Forming arguments and expressing judgement	Learning practice	Instances where TS was used to support students' formation of opinion and expression of judgement. Initiated by teacher, researcher or used by students themselves.	[in context of mapping] The class was asked to read the sources that they had also studied in the last lesson asking them to look for reasons that contradicted the question whether it was Austria's weakness that led to the unification of Italy. (CFS field notes)
3-3		Preparing students for exam practices	Learning practice	Instances where TS use was directly aimed at supporting/rehearsing exam practices. Initiated by teacher, researcher or used by students themselves.	the whole exercise is directed at the way the students are required to think in an exam. For example the focus on factors is imposed by the curriculum (not to say that it is necessarily a bad focus). The writing of the factors pages should correspond to the type of analysis required in the exam. (CFS field notes)

Nr.	Sub-group	Code name	Actor/ relationship/ practice	Definition	Example
3-4		Separating concepts from narrative	Learning practice	Instances where TS was used to focus on main concepts and isolate those from overall narrative.	They all started out by making a parking lot (the task was formulated as finding the main concepts about one intellectual in a snippet of text they had read in class) (CFS field notes)
3-5		Thinking about conceptual structure or subject nature	Learning practice	Instances of students directing attention to the conceptual structure of the material (links, concepts, overarching issues) in contrast to focus on factual detail and narrative - this in the context of TS work.	We both noticed with Wilbur that he was thinking hard about how to name the links. So were Dawn and Jessica and Esme. (PHS field notes)
3-7		Formative assessment	Teaching practice	Instances of teacher's use of ThinkSpace for formative assessment and feedback on students' work.	So what I'm doing now is trying to draw out a bit of an opinion here because Alice is at the level where they are clearly quite confident and comfortable commenting on these things, and we now need to encourage that, to show that it's all right to actually put her opinion in here (Meeting with Thomas, 8/12-08)
3-8		Course and lesson planning	Teaching practice	Instances or teacher's expression of using TS to think about conceptual structure or gain overview of the course for himself.	Also - importantly - Allan has mentioned multiple times that the tool makes him think in terms of concepts when planning the lessons. (PHS field notes)
3-9		Making student understanding visible to the teacher	Teaching practice	Instances where the teacher uses TS to gain an insight into student thinking or levels of student understanding.	Right, so Alice has really cleverly found a couple of bits of knowledge, a couple of bits of her own knowledge, as we'd refer to when we're marking the exams (Meeting with Thomas, 8/12-08)
3-10		Requiring individual participation	Teaching practice	Instances where TS is used to encourage/ enable/force more students to participate that is usually the case in other classroom practice.	Normally, we [...] would have done what we did with the picture source as a group, but for all the other sources. I don't know whether you noticed, but there is actually only four or five of them talking [...] when they are sitting in front of a computer on their own [...] it's them doing the action, so them thinking about the task, and they can't sit there passively and wait for somebody else to come up with the answer and then write it down (Meeting with Thomas, 8/12-08).
3-11		Teacher guidance or QandA	Teaching practice	Instances where TS is used for continuing question&answer practices or providing guidance to students outside of normal in/ out of classroom practice.	Thomas sent to the students to log in as they came in to save time. Then he sent them to read the comments he had written. (CFS field notes)

Appendix 13 - Extract from interpretive summaries

This is an extract from interpretive summaries written from the Park Hill student interview data.

Attitude to and engagement with the project and school work in general	
[...]	
JAKE: We were probably given about the same and did about the same.. (??) .. we could have done more.	Did same amount of work on the wiki - it is not unusual to do little work
RICHARD: Theoretically I would have done more because it's sort of.. I prefer to do something on the computer.. sort of type... I find it easier. It's sort of nicer to read notes like that.. but I don't remember actually doing that much.. cause.. Mr. Cuningham would go: Oh, we'll do this on the wiki and then.. it'd be slightly low priority. actually going on and doing it. I'm not sure why.	He would have liked to engage more but the teacher made wiki work low priority, so he didn't
Park Hill student interview Group 2a.txt	
JANE: Yeah.. How about you Jake? Did you use it sort of more or less than usual?..	
JAKE: I think we would have done more work if everyone else had done more because then it would have been more kind of a class effort. And because, I don't know, over the year, we just.. were given less and less things to do on the wiki, because Mr. Cunningham expected less and less over the year. It was useful definitely for setting the task of kind of summarising.. making some notes.. But then.. it was kind of the same.. I just went through the text books and made more notes for revision rather than going back over them.	The wiki didn't become a communal effort and the teacher fased out its use over the year. Sees the wiki as a god place for summarising and note taking - but it was the same as going to the books for revision and taking notes elsewhere.

Appendix 14 - Extract from matrix display of student participation in wiki activity

	Revisions:	Alice	Kayleigh	Caroline	Jane	Thomas
ModenaAndNaples	6	1-3			4-6	
PapalStates	4			1-3	4	
Piedmont	2		1		2	
1820Revolutions	5	3,5		1	2,4	
WeakLeadership	2			1	2	
InfluenceOfMetternich	3	1		2	3	
DividedAimsOfRebels	3			1	2-3	
Metternich	2	1			2	
LackOfMassSupport	1	1				
Austrians	1		1			
Patriotism	4			1-2,4	3	
Peninsula	1		1			
UnificationMazziniMap	2		1	2		
Federal	1		1			
YoungItaly	1	1				
OrdinaryPeopleSViewsMazziniMap	1		1			
RepublicanDemocracy	2			1-2		
AllOfTheMazziniEssays	1	1				
Definitions	1	1				
IntroductionToStates	1	1				
SourceA	5	4	3	2	1	5
SourceB	3			2	1	3
SourceC	4	4		3	1	2
SourceD	2				1	2
SourceE	4		2	4	1	3
1848Revolution	4	4		3	1-2	
PapalAllocution	1	1				

Appendix 15 - Extract from wiki editing categorisation matrix

Page name	Edit1	Edit2	Edit3	Edit4	Edit5	Comments
SourceB	Jane	Caroline	Thomas			
Edit category	C	3	7			
Importance		-	-			
SourceC	Jane	Thomas	Caroline	Alice		Alice directly addresses Thomas' question - although she seems to have slightly misunderstood it
Edit category	C	7	3	3		
Importance		-	1	3		
SourceE	Jane	Kayleigh	Thomas	Caroline		Caroline directly addresses Thomas' question
Edit category	C	3	7	3		
Importance		-	-	3		