Teacher Researcher Programme 2003/2004

Mind Mapping in Learning and Teaching : Pupil and Teacher Perspectives

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How do Pupils and Teachers view the use of Mind Mapping in Learning & Teaching?

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Abstract

Mind Mapping, a visual tool developed by Tony Buzan to enhance note-taking, to improve memory and problem-solving, to promote creativity, to organize thinking, and to develop ideas and concepts, was studied in two S2 classrooms with 57 pupils, to evaluate its efficacy as a teaching and learning tool. Model mapping, a visual tool similar to Mind Mapping, was also explored. In both forms of visual mapping, a central focus or graphic representation of a problem or issue is placed in the centre of the page, and key words, connected to the radial image with lines, are used to represent hierarchies or categories of ideas. In addition to the classroom-based part of the study, research visits to Buzan Centres and Oban High School further explored views about mapping and aspects of classroom practice involving the technique. A majority of students perceived mapping to be an enjoyable, interesting and motivating approach to learning. Pupils believed that mapping had a variety of uses, and most reported that it had enhanced their learning in a range of ways. Teachers identified a number of benefits in using mapping, as well as reporting some difficulties in incorporating the technique into students' learning. Most teachers enjoyed using mapping and felt that it fostered pupil motivation and involvement in their learning.

How do Pupils and Teachers view the use of Mind Mapping in Learning & Teaching?

Keith Polson, G.T.C Scotland Teacher Researcher Programme 2003-2004

We live in a cynical world, and we work in a business of tough competitors, so try not to laugh...complete me.

(*Jerry Maguire*, 1996, TriStar Pictures)

1. Introduction

1.1 Background

We live in a cynical and a competitive world, just as Jerry Maguire said. As schools strive to help young people to acquire transferable life skills, the bottom line, as futurist Alvin Toffler contends in his book *Power Shift*, may be that: "The illiterate of the future will no longer be the individual who cannot read. It will be the person who does not know how to learn how to learn."[i] This quote, cited by Tony Buzan, the developer of the visual learning tool Mind Mapping®, perfectly illustrates that the test facing stakeholders in Scottish Education, in an increasingly complex, cut-throat, and fast changing knowledge age, is, as Resnick argues, "to develop educational programmes that assume that all individuals, not just an elite, can become competent thinkers."[ii] This is because all learners require these competencies. Now, more than ever, as the Organisation for Economic Cooperation and Development[iii] point out, the minimum requirements of schooling i.e. mastery of the 'basics' of reading, writing, mathematics, science etc., however well taught, are by themselves insufficient to meet the demands of education, the labour market and active citizenship. A broader range of competencies, redefined as 'higher order' thinking skills (e.g. problem solving, decision making, drawing conclusions from the information, determining cause and effect, and 'brainstorming' new ideas), is required because:

- Individuals cannot 'store' sufficient knowledge in their memories for future use
- Information is expanding at such a rate that pupils require transferable skills to cope with this growth
- Modern society requires citizens who can assimilate information from multiple sources, often in pressured situations, and make measured decisions

In light of this recognition, rote learning has become increasingly discredited[iv]. Accordingly, the focus of current education has shifted away from such methods towards an understanding that pupils need to acquire new skills and knowledge; both in the sense of learning new things and learning in new ways, and that teachers have to be equipped with the necessary expertise to facilitate this progress. Teachers are being encouraged to look at ways to help students become more actively involved in their learning, and to assist their metacognitive development – an approach where emphasis is placed on the processes of learning being as important as the outcomes.

1.2 This Research

With present and future regard to demands for ever higher competence levels, this research explores the possibilities of Mind Mapping, a visual learning scheme, as a means of assisting young people to develop transferable skills for school and life.

Mind Mapping, a graphic technique developed by Tony Buzan in the late 1960s and early 1970s to improve note-taking, to enhance memory and problem-solving, to encourage creativity, to organize thinking, and to develop ideas and concepts, was explored in two S2 classrooms as a pedagogical tool for enhancing history education. The author worked from September 2003 to February 2004 to:

1. Explore the nature of Mind Mapping as a classroom tool
2. Help S2 pupils develop the skill of Mind Mapping
3. Implement Mind Mapping in a variety of ways in the S2 history curriculum
4. Evaluate teachers' and students' perceptions of Mind Mapping after using it for an extended period of time

1.3 Aims and Objectives

The overall aim of this research is to investigate:

The ways in which Mind Mapping can be used as a teaching and learning tool (with particular reference to history education, and pupils' and teachers' perceptions of their uses and usefulness)

To generate a framework for reporting the findings of the enquiry, the overall research aim is broken down into specific objectives as follows:

1. To overview and evaluate recent developments in the use of Mind Mapping techniques in educational practice (with special focus on Thinking Skills and Constructivism)
2. To assess pupil perceptions of Mind Mapping, considering their outlooks in cognitive areas and in the affective domain
3. To ascertain teachers' perceptions of Mind Mapping as an instructional tool

1.4 Introduction to Visual Tools and Pupils' Learning

Today Mind Mapping is widely used in the academic and corporate worlds. Teachers and students

use a wide range of visual learning formats in the classroom for a variety of purposes. At one time

referred to as graphic organizers, visual tools is a term that has recently been adopted to reflect a

broader conception of what constitutes graphic representations and their uses[v].

In using Mind Mapping, the author adopted the guidelines for creating Mind Maps as outlined by the creator of the scheme, Tony Buzan, and updated by Ian Harris and Oliver Caviglioli (they call their version "model mapping", and although the structure and rules of model maps are almost identical to Mind Maps, the theoretical underpinnings and instructional menus for the former differ)[vi]. Both techniques are generically referred to as 'mapping' from hereon. Where schools use "Mind Maps" or "model maps", or the discussion highlights academic distinctions between the methods, specific terms are adopted to indicate this. *Appendix A* provides an example of a Mind Map that explains 'How to Mind Map', with a summary of the rules of Mind Mapping.

Visual tools include a wide range of graphic representations, such as concept maps, matrix diagrams, cross sections, time lines, fishbone diagrams, pie charts, and writing frames. Often collectively described as graphic organisers, many of these diverse tools, according to Merkley and Jefferies, stemmed from the research of David Ausubel in using advanced organisers or introductory prose passages to help learners to acquire new knowledge and improve their literacy skills[vii].

Over time, advanced organisers became known as structured overviews, to account for visual displays of information that were used not only at the beginning of classroom interactions, but also during, and towards the end, of lessons[viii]. Eventually, "graphic organiser" replaced "structured overview" as the favoured term of usage. After this, "visual tools" was the term adopted to reflect a wider view of graphic representations and their purposes[ix]. Visual tools have been applied in a variety of ways to enhance learning and teaching. Readance *et al*[x], argue that they can be used as in *Figure 1*:

Figure 1: Uses of Visual Tools
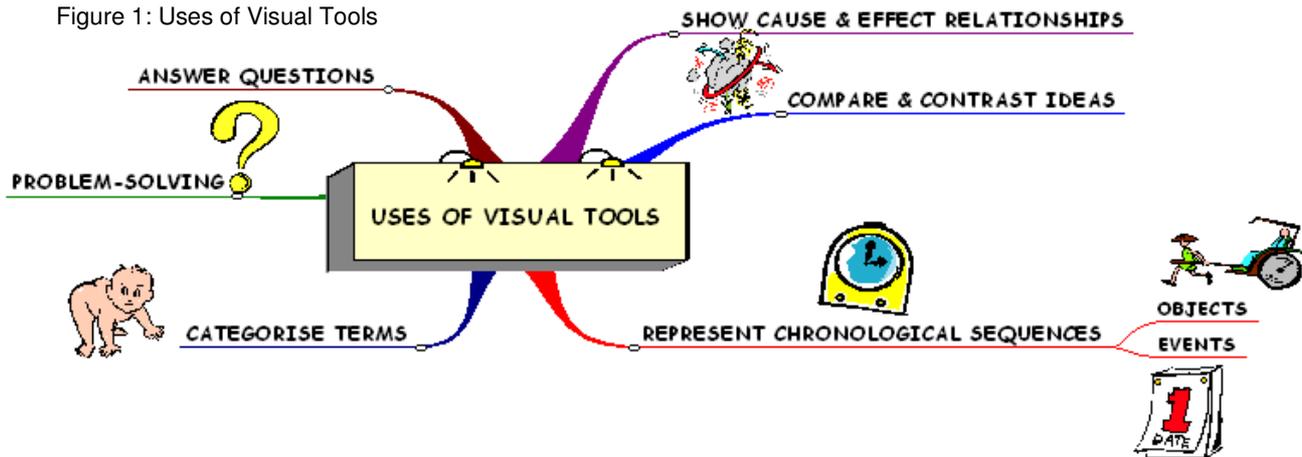
More recently, Caviglioli *et al*,[xi] have constructed what they call a 'lexicon' of over forty visual tools with wide-ranging classroom uses. They group these tools into fluid categories, according to their features and functions, which cover areas of application as diverse as structural, differential, representational, temporal, causal, numerical, organisational and individual.

Despite the plethora of visual tools available to teachers and students, little systematic study has been carried out to determine their effectiveness and their role in teaching and learning[xii]. However, some categories of visual tools have been shown to support pupils' learning in a variety of settings[xiii]. In the context of science education, concept mapping[xiv] has a considerable research pedigree as a tool for improving understanding (although concept maps vary from Mind Maps in structure and function, their use of a visual format to illustrate and develop thinking, and their use of spatial organisation to represent hierarchies of concepts are central features of mapping in general). In contrast, little evidence exists to describe how to effectively use mapping to enhance learning and teaching. Even less research exists to explain how, and under what circumstances, mapping should be used in the context of history education.

Although the research base to support the adoption of mapping as an effective teaching and learning strategy does not currently exist, the technique does seem to be consistent with several educational approaches and theories. These include: 'Teaching Thinking', Constructivism, 'Visible Thinking', 'Creative Learning' approaches, Gardner's Multiple Intelligences Theory, and Metacognition[xv].

1.5 Research Design
This interpretative case study[xvi] focuses on the perceptions of 57 students, aged 12-13, from two S2 History classes, after developing the skill of mapping and using it in a variety of ways, as they participated in a 5-14 Curriculum Unit investigating the Battle of Bannockburn. In addition, the study reveals the author's and other teachers' perceptions of mapping.

The author approached the study as exploratory in nature, there being so little research literature about the efficacy of mapping as a classroom tool. This exploration involved applying key research approaches outlined elsewhere[xvii]. Through the processes of inquiry, he was able to develop a greater understanding of the nature of mapping, and to evaluate pupils' perceptions of mapping as a learning tool. Ongoing cycles of action and reflection informed his planning decisions, and helped him to monitor and interpret the unfolding research. Self-reflective questions that guided the research included:

1. How can Mind Mapping be used to assist students in learning history?
2. How long will it take for S2 pupils to become competent 'mappers'?
3. Will learners feel positively or otherwise about using Mind Maps (accounting for their attitudes in cognitive areas and in the affective domain)?
4. How will teachers perceive Mind Mapping as an instructional technique?

1.6 Purpose of Study

Further to the concerns previously outlined, the author's interest in developing evidence-based research that relates directly to what happens in the classroom, represents one motivational strand that led to the implementation of this study. Others are:

- A strong research interest in how to teach children to think more effectively, and to find ways to enable them to develop skills and understanding in a classroom climate of enquiry (underpinned by constructivist learning principles)
- A desire to expand his teaching repertoire and to work cooperatively with other educators
- Professional and personal experiences that sparked a belief that mapping can help pupils to become better learners

These interests evidently extend to the wider educational community in Scotland[xviii]. Scottish interest in mainstreaming innovation has been reflected nationwide, indeed globally, with Mind Mapping and model mapping featuring in many initiatives across the United Kingdom and beyond[xix]. As a proficient 'mapper', who had successfully used the technique with a variety of age groups, the author's decision to pursue mapping as a focus for his work was a natural and an attractive one.

While many exciting developments in relation to visual tools are ongoing, the current research evidence concerning the effects of mapping in the classroom is limited, as previously noted[xx]. Therefore, it was felt that a small-scale case study "to provide an in-depth picture of a particular area of the educational world, chosen because it is relatively self contained,"[xxi] might help throw new light on potential uses of mapping techniques. By generating findings that may be generalisable across different school contexts and subject areas, this area of study could prove to be of value to fellow practitioners[xxii]. The research also aims to build on the findings of an American Case Study[xxiii] on the use of Mind Mapping in Grade 6 science classrooms (equivalent to P7 in Scotland), by examining the effects of mapping in an alternative subject area (history) with a different age range of pupils. The US research provides a basis for comparison with this study, alongside evidence gathered at Oban High School.

Helping students to bridge the gap between classroom activities and historical concepts has always been one of the most challenging aspects of the author's job. Combining visual, creative appeal through colour, symbols and drawings, while encouraging pupils to construct their own understanding through organising information, seemed to have potential for fostering pupil motivation and enhanced levels of thinking. In addition, previous experiences with mapping in classroom practice, which indicated that children enjoy the use of colour and images and the association of ideas inherent in the scheme, and they also find it great fun, reinforced this belief and generated more enthusiasm in the study.

Tony Buzan, who has championed the use of Mind Mapping in schools and businesses worldwide, writes: "Our brains tend to look for pattern and completion…this inbuilt tendency of the brain to search for completion is satisfied by the structure of the Mind Map." [xxiv] He calls this brain faculty *Gestalt* (whole picture or wholeness). In every case, according to various advocates of Mind Mapping, the net result of organising and arranging ideas on a Mind Map is to experience synthesis and perception of the whole[xxv]. This, in turn, leads to individuals developing the ability to clearly see an issue and understand its elements and structure.

This brings us back to Jerry Maguire; for in carrying out this enquiry, the author's overriding aim is to ascertain whether learning to map can help make pupils' classroom experiences more 'complete' - to determine whether this visual learning tool can enable young people of diverse learning abilities to access the bigger pictures of their learning. The study will also add to the growing knowledge base concerning how learning and teaching processes can be effectively adapted to take account of the latest educational research.

In this respect, it has been argued that Mind Mapping possesses a number of advantages over traditional linear note-making/taking systems[xxvi]. This is because the scheme integrates brevity, efficiency and active personal involvement into note-making; all scientifically proven to be of crucial importance in successful noting[xxvii]. Their use also more readily encourages the generation of ideas, as key words are used as triggers to generate further thoughts and associations[xxviii].

In addition, model mapping has recently been heavily promoted as meeting the learning style preferences of all learners, whether they are visual, auditory or kinaesthetic[xxix]. Underlying the theory of model mapping is what psychologists call individuals' 'schemas' or 'cognitive maps'; business authors call them 'mental models'. Schemas are our mental models of the world, incorporating our views, opinions, attitudes, and knowledge and understanding of the world. When these mental models are committed to paper, they cease to be mental, and become models that are mapped, hence the term model mapping.

Thus, the qualities of model mapping brought to the fore in this study, in addition to the established benefits of left-right brain laterality promoted by Tony Buzan's Mind Mapping® scheme[xxx], seem to offer educators an attractive teaching and learning technique. Mapping requires learners to make sense out of ideas, and to order these in visually meaningful ways. By demanding this, it encourages pupils to see and search out relationships, and to understand how partial ideas or partial concepts connect to a unified and larger whole. For teachers and learners of a subject like history, where national arrangements currently place great emphasis on fostering creativity, conceptual understanding, 'deep' learning, and quality of thought, such attributes might prove irresistible. Indeed, it may be the case that mapping possesses qualities that can be applied more widely across the curriculum.

1.7 Summary

The points highlighted in this *Introduction* form the overarching context for this research paper:

- A growing feeling that children of all learning abilities can, with teachers' support, become more competent thinkers and learners; and
- A desire to develop new classroom tools and evaluate their efficacy in this respect
- Renewed interest in the ways in which young people think, in approaches such as 'teaching thinking' and constructivism, and
- A belief that teachers can improve children's thinking through specific interventions, such as teaching pupils how to map
- A desire to know more about how best to apply new theories concerning students' learning and thinking to the practical circumstances in which learning and teaching take place

2. Methodology

The study took place over a 6 month period from September 2003 to February 2004. To establish the integrity of the research[xxxi], several data sources and information collection methods were used. These are described below, in relation to each of the study's specific objectives.

2.1 Specific Objective 1
To overview and evaluate recent developments in the use of Mind Mapping techniques in educational practice (with special focus on Thinking Skills and Constructivism)

Methods:
a) Review of literature.

b) Visit to Buzan Centres to interview Vanda North, CEO of the Global Buzan Organisation, and the world's leading exponent in the teaching worldwide of Mind Mapping (using the interviewing approach described for *Specific Objective 2a*).

c) Study of current practice in two Scottish Secondary Schools – Oban High School and Galashiels Academy (The methods for *Specific Objective 3* detail the information sources). During the literature search, only Pinegrove School, in Rochester, New York State, was identified as having carried out a comparable study[xxxii]. This secondary data source is used for comparative purposes. Details of each school are provided in *Appendix B.*

2.2 Specific Objective 2
To assess pupil perceptions of Mind Mapping techniques, considering their outlooks in cognitive areas and in the affective domain

Methods
a) Semi-Structured Interviews & Survey questions
At the end of the study, 57 students participated in a 10-15 minute semi-structured interview that explored their individual understanding of mapping as a learning tool. Adopting this format allowed the author to explore focused topics, while giving pupils freedom to expand on their ideas. Careful notes were written-up after each interview.

Students were also asked to provide scaled responses to 6 survey questions that explored their opinions about various aspects of mapping. The more straightforward analysis provided by this type of survey served as a means to crosscheck the information given in interviews and open-ended questionnaires, and to corroborate interpretations of the data.

Several sources informed the interview and survey preparation process: Bloom's *Taxonomy of Educational Objectives*[xxxiii], the *Minnesota Schools Attitude Survey*[xxxiv], and the work of Munn & Drever[xxxv].

b) Field-notes
Observation can reveal insights about learners that other methods cannot match[xxxvi]. Within the limits of his role as the classroom teacher for the research groups, the author took detailed field-notes both while observing classes at work and shortly after the observation period (*Appendix C* provides an example of an observation schedule).

c) Open-ended questionnaire
At the study's close, pupils were asked to respond, in writing, to eight open-ended questions concerning their perceptions of mapping. These questions were also employed as part of the interview schedule of questions. In this way, students had opportunities to elaborate on their written responses, and the author could compare different types of data for the convergence of themes. *Appendix D* includes both survey items and interview questions used in exploring students' perceptions of mapping.

d) Exemplars
Pupil-generated documents (examples of Maps, writing and other products) provided another means to ensure triangulation of results. In addition, lesson plans and other materials produced by the author became sources of data, enriching analysis and interpretation. *Appendix E* provides an example of a student-generated map.

2.3 Specific Objective 3
To ascertain teachers' perceptions of Mind Mapping as an instructional tool

Methods
a) Visit to Oban High School
Ten teachers from Oban High School participated in 30-45 minute interviews that explored their perceptions of the uses of mapping in classroom practice (the same interviewing technique as described in relation to *Specific Objective 2a* was employed). *Appendix F* gives details of the interview questions used to explore teachers' views.

b) The author's perceptions of mapping after carrying out this study, and those of other teachers at the school who use the technique (using the same interview methods as for *Specific Objective 2a*).

c) Relevant information from the literature review.

Several levels of data analysis were employed, from the most fundamental of assigning tags to short passages of text, to the establishment of categories and then broader themes. The author became "grounded" in the data[xxxvii] as concepts were identified and themes developed. Some themes emerged from the data, while others reflected themes that predated the start of the study.

2.4 Outcomes and Discussion
The Battle of Bannockburn, a 5-14 Unit of Work, specifically created for S2 pupils by Galashiels Academy History Department, provided a context for the study. The Unit's primary learning goals are to help students develop: an awareness of people, events

and societies of significance in the past, and an understanding of change and continuity, cause and effect. In addition, a large focusing activity - an Investigation - aimed to help pupils' progress in the skills areas of preparing for, carrying out and reporting on tasks.

3. Results and Discussion

3.1 Specific Objective 1

To overview and evaluate recent developments in the use of Mind Mapping techniques in educational practice (with special focus on Thinking Skills and Constructivism)

3.1.1 Review of literature

Those who recommend mapping cite a range of justifications, outlined in *Figure 2*:
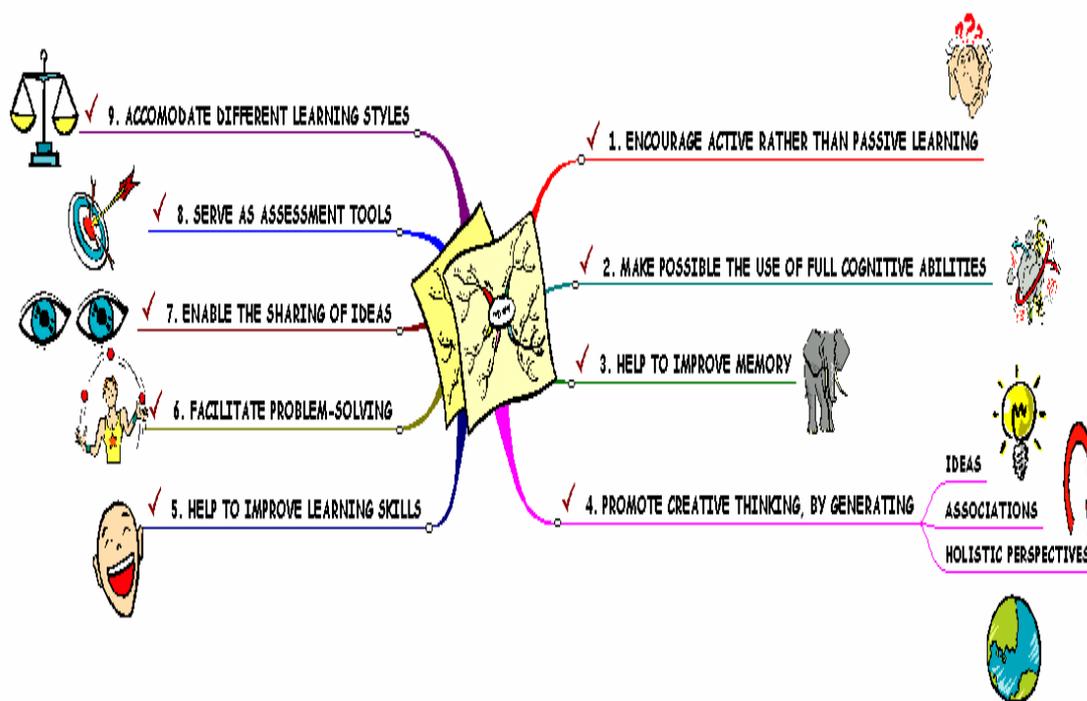
Figure 2: Advantages of Mapping

However, the research literature about the efficacy of mapping as both a teaching and learning tool in the context of secondary education is meagre. Three databases were searched using *Mind Maps, Mind Mapping, model maps* and *model mapping* as key words: ERSDAT, the British Education Index (1986-2003) and ERIC (1976-2003) yielded 0,0 and 49 references respectively[xxxviii]. Most references are American and few comply with Slavin's[xxxix] conventions of best evidence: many are resource books and manuals for practitioners' and students' use, rather than evaluations. Only one reference provided a study comparative with this research[xl].

While the research base to support the adoption of mapping as an effective pedagogical strategy does not currently exist, an American Case Study[xli], and a range of educational textbooks, highlight that the technique seems to be consistent with a number of contemporary perspectives in education.

3.1.1(a) Developing Thinking Skills through Mapping

In 1999, the Department for Education and Employment[xlii] stated that: "Current attempts to teach thinking are part of a more general thrust in educational reform which emphasises quality of thinking, processes and thinking skills as a means to raise educational standards and to prepare children and

young people for lifelong learning. Raising standards requires that attention is directed not only on what is to be learned but on how children learn and how teachers intervene to achieve this."[xliii]

The review's key conclusions also emphasise that subject specific infusion approaches offer opportunities to embed teaching thinking within the curriculum, rather than relying on 'bolt on' courses which can fail to make a lasting impact[xliv]. History is identified as one of the subjects well placed to achieve this. In *Figure 3* (overleaf), Caviglioli & Harris[xlv] provide a simple, yet elegant, solution to the problem:
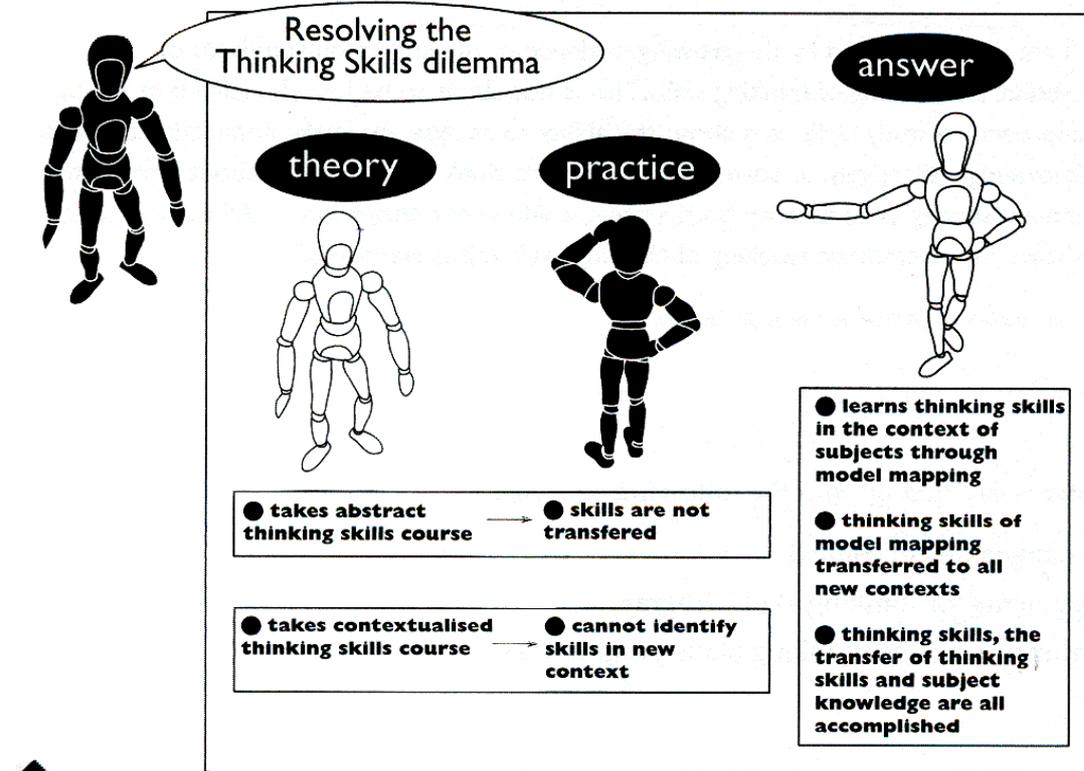
Figure 3: How to embed thinking skills into subject teaching
(Reproduced here with the enthusiastic permission of Model Learning)

Furthermore, in 1999 the National Curriculum in England contained for the first time a rationale for the curriculum which recognises the need to 'learn how to learn' and lists five Thinking Skills[xlvi]. This desire is reflected in the contents of the new 5-14 National Guidelines in Scotland[xlvii]. In Scotland too, curricular change stresses a focus for pupils on 'knowing how' as well as 'knowing what' and 'learning how to learn'.

McGuinness[xlviii] points out that many of the current strands on 'teaching thinking' include some of the following: collecting information; sorting and analysing; comparing and contrasting; drawing conclusions; determining bias and reliability; evaluating options; determining cause and effect; decision making.

The question of how to stimulate such higher-order intellectual processes in children has never been more widely discussed. There is currently much interest in Scotland, and further afield, in how pupils' thinking skills can be enhanced. The recently established National Priorities for Education in Scottish Schools explicitly refer to the need to support young people to acquire a range of fundamental transferable skills, for example, in problem solving and critical thinking. In 2000, a national forum took as its theme "Teaching Thinking Skills". What emerged from teachers' discussion groups was a strong sense that thinking skills could be taught, and that such approaches hold great value (Mind Mapping, as a means to achieve this aim, was a recurring theme)[xlix].

Children use a wide array of types of thinking in their everyday lives, such as generating opinions and predicting outcomes, and they do not have to be taught how to "do thinking". Any use of the brain

constitutes thinking, but when people talk about thinking skills they are usually referring to higher-order thinking. This is when we use the brain for more than merely storing and retrieving knowledge. These higher-order skills are not involved in learning to recite the key dates of the Scottish Wars of Independence, for example; they are if you devise your own mnemonic, or create a Mind Map or a timeline to help you remember them. If teachers cannot teach pupils to "do thinking", they can, however, encourage children to develop the quality of their thought, and thus to perform thinking tasks more skilfully. This is not to say that developing thinking skills as part of subject teaching does not happen; simply that it is not always explicit, at present. Effective teaching of mapping may help to ensure that thinking skills are infused into subject teaching.

In working towards these aims, Caviglioli & Harris[l] provide teachers with a useful and practical model for applying model mapping to develop subject specific thinking *and* infuse transferable thinking skills into subject delivery. Model Maps are very similar in structure to Mind Maps (though the latter, in the view of teachers interviewed during this study, can sometimes lack adherence to categorisation). However, the theoretical justification for the former, rooted in cognitive psychology and schema formation theory, has recently, in the authors' own words, "expanded the paradigm" in which Mind Mapping had become trapped. From the 1970s onwards, Mind Mapping was essentially seen as a tool to improve note-taking, memory and creativity (a message given in books on the subject by Buzan and others)[li]. Caviglioli & Harris'[lii] exploration of the technique revealed that this 'definition' had unnecessarily limited the potential impact of mapping in the classroom. They discovered that it offers many more possibilities for learners and teachers[liii], including developing a wide range of thinking skills.

In relation to thinking skills, their perspectives are hugely instructive for Scottish teachers targeting pupil development in the knowledge and understanding strands, and skills elements, of the *5-14 guidelines*. In planning this study, and in implementing the Unit of work associated with it, the author adapted Caviglioli and Harris's model for developing thinking skills in order to target student improvement in specific areas. *Appendix G* details how model mapping can be used to support these developments[liv].

In the context of the history education, then, and in other subject areas, teaching children the skills of mapping, and giving them structured opportunities to reflect on and become more aware of what they have been doing, seems to facilitate the development of a wide array of thinking skills. This approach offers the promise of both improving subject specific thinking and achieving the transfer of thinking skills to other subject areas.

Ultimately, Caviglioli and Harris[lv] argue, model mapping can "enable pupils to access the structure of their thinking and learning," as: "It shows them how they learn, and it teaches them how to learn. It does this because it makes evident, supports and develops their thinking skills. It places thinking at the heart of the curriculum because it supports the teachers' explanations and the learners' understanding." In other words, through model mapping, teachers can model effective thinking for their pupils, rather than students simply being on the receiving end of the linear speech/writing that results from their teachers' effective thinking.

Model Mapping, then, appears to offer teachers a powerful system for making the processes of learning and teaching visible, and thus accessible to all. Moreover, the technique offers opportunities for cognitive apprenticeship, and the thinking skills of model mapping acquired by pupils can be utilised in other subject arenas. Teachers can encourage this 'learning about learning' by always trying to make the mental processes involved in the classroom explicit, and by providing frequent opportunities for pupils to reflect on what they have been doing thinking wise[lvi]. Model Mapping is a highly practical visual tool for meeting all of these aims (Caviglioli & Harris's[lvii] two textbooks on model mapping stand tall, amongst many others written on the subject of Mind Mapping, in providing a cogent and sophisticated model of cognition, that weaves in many of the current strands of thinking in education, alongside a wealth of practical advice for teachers which is directly transferable into classroom practice).

3.1.1(b) Constructivist Theories and Mapping

Another important theory for history teaching and learning is constructivism. According to the constructivist view of knowledge, "individuals construct their own meaning and understanding of the world and knowledge through the interaction of what they know and believe and the ideas and

experiences they encounter."[lviii] In simple terms constructivism implies that we learn through what we already know. There is an assumption that if new information can be interpreted through existing knowledge structures, termed schema (plural schemata), then it will be integrated into a better understanding of a topic. For example, by employing analogies, examples, stories, and visual tools like Mind Maps, teachers use some knowledge that pupils already possess to help them to understand something new. Conversely, if no connection can be made with existing knowledge, new information will be lost. If one accepts this view, then it follows that because everyone has different experiences and perceptive powers, then every individual constructs their own unique understanding of the world.

Constructivists, therefore, also portray learners as active creators of their own knowledge, most famously Vvgotsky,[lix] and some, like Bruner,[lx] stress the important role that individuals' language development plays in structuring experiences, developing schemata (by which learners assign meaning to their experiences and build this new knowledge onto existing understanding structures), and building conceptual understanding. All of these processes, Bruner suggests, are closely related to language acquisition and development, if not intertwined.

Put another way, a meaningful understanding of the specialised language of history and its key concepts may be the key to pupils' development of subject-specific thinking, of an ability to talk about the subject, and to make distinctions and connections within it. Mapping, if adopted as a collective or individual learning tool, has the potential to provide a means for young people to explore prior knowledge and understandings, to consolidate new learning with previously held ideas and conceptions, and to reveal how new ideas are changed and adapted as new learning takes place. Maps provide a visual record of pupils' thinking and the development of their ideas, as well as a means for teachers to make subject-specific language, thought structures and rules explicit and, therefore, teachable and learnable. Thus, mapping offers teachers a concrete and common-sense strategy for translating the theoretical underpinnings of constructivist theory into classroom practice.

The theory has had a significant impact on history education, and is reflected in recent curricular changes and in calls for further educational reform. Changes in the emphasis of history teaching in Scotland have been reflected in a series of major curriculum developments recently, when the 5-14 national arrangements, Standard Grade and Higher Still have all been implemented. Collectively, these represent a major shift from the 1960s norm of teaching historical facts, or rote learning, to a focus on the nature of history, and the knowledge, understanding and skills that young people require to enable them to effectively engage in historical enquiry, rather than the facts, *per se*. Current conceptions of historical literacy, as conceptualised in the new arrangements documents and noted in recent Her Majesty's Inspectorate of Education reports[lxi], require pupils to become familiar with the content knowledge of history and to be able to engage in historical enquiry; to empathetically 'interact' with people, places and events in the past; to develop an understanding of historical evidence and sources through thinking, problem solving, analysis and interpretation; and to acquire an awareness of the complex interplay between history, society and the environment. These reforms require new roles for both teachers and students.

Despite significant progress, there remains an identified need for teachers and pupils to further explore the new roles demanded of them by reform, and, in particular, to improve the pace and quality of students' learning experiences in S1 and S2[lxii]. If pupils are to develop high levels of historical literacy, they need to be afforded opportunities to learn in classrooms that are premised on constructivist learning principles. While this may have been partially achieved, recent reports indicate that a deeper embedding of these principles is required[lxiii]. They suggest that the attainment of a common goal of historical literacy in S1/S2 for groups of children with very different initial experiences and widely varied learning abilities is not easy. It requires "interesting and varied activities…which allow (all) pupils to engage with characters in historical situations." [lxiv] Students need "more opportunities to …engage in challenging and varied assignments…at S1/S2; more active involvement in lessons; a greater pace of learning…particularly at S1/S2;" and they require chances to experience learning, assessment and support in a variety of ways that consider pupils' individual learning abilities, needs, interests and backgrounds[lxv].

3.1.1(c) Other Applications of Mapping to Classroom Practice
While beyond the scope of this study, many other theories exist in relation to applying mapping to classroom practice[lxvi]. These arguments are summarised in *Appendix H*.

3.1.2 Visit to Buzan Centres, 15-16 September 2003

While the literature review reflects many of the themes discussed during an interview with Vanda North, she was passionately keen to highlight one area not already mentioned. Mind Mapping, she believes, can be very effectively used as a tool to aid disaffected learners. As such, she asserts that there is a moral imperative for educators to adopt the technique.

During her time as an accelerated learning trainer in the United States in the 1970s, Ms. North used Mind Mapping, she says, "as a tool to reduce students' pain caused by feeling labelled as 'learning disabled' and to enhance the thinking capabilities of all learners regardless of age or ability." This, she continued, "produces happier and more confident students and people out of otherwise disenfranchised learners – the outcome for all involved can become a virtuous circle." [lxvii]

She went on to argue that Mind Mapping offers new directions for students right across the range of learning abilities, and that it can be a particularly powerful aid in combating feelings of disaffection and exclusion amongst learners who have traditionally become regarded as – and have quite naturally came to see themselves as – having learning difficulties. Mind Mapping, in her view, also offers alternative approaches to more traditional ways of learning and teaching which some pupils find problematic. This is because it offers further options to students whose writing and verbal expressive skills may require development. In addition, when judiciously used by teachers, it can give disadvantaged pupils the hope, the belief, the confidence, and the will to persist and learn. Ms. North also pointed out that as a more active, visual form of learning and self-expression, Mind Mapping offers people with different learning styles another way of thinking, and of expressing their ideas.

3.1.3 Study of specific practice
3.1.3(a) Galashiels Academy

During the study, the organisational principles that model maps and Mind Maps share were applied to teaching and learning, and the author drew from both approaches, though with emphasis on the theoretical basis and further educational options that the former offers[lxviii]. After initial discussions with the research groups, the term "Mind Mapping" was adopted as some students had previously heard of the technique (though they had not received any formal training in it).

As the pupils involved in the study had no previous experience of mapping, the author provided considerable time and support to assist them in mastering the technique. To begin to help students to acquire the basic skills that they would need, the teacher took each class through a series of categorization exercises. These included categorizing:

- Using pictures
- Using shapes
- Using characteristics
- Using concepts
- Using sub-categories

Examples of the type of exercises used, with instructions, can be found in the recent work of Caviglioli & Harris[lxix]. These exercises, the author feels, are absolutely essential first steps in developing mapping skills, because categorisation is the key thinking skill that allows us to make sense of our world, and, for most people, much of this information processing is done through language. The categorization exercises make explicit for pupils what it is we do with language in order to make sense of the world; that is why they are so valuable, and central to successful mapping.

Time was then spent showing students how to represent categories in a new graphic format, and creating opportunities for them to build up these skills through a series of phased exercises[lxx]. Two videos were successfully used – *Learning with Lana* and *Get Ahead*[lxxi]. These give a simple step-by-step guide to Mind Mapping. Once the teacher was confident that all pupils had mastered the basic skills of mapping, the focus was shifted to developing their maps through use of colour, dimension, images, and typography, and adjusting the thickness of lines and the dimension of words to indicate the central importance of some concepts and ideas in the Unit of work being studied. The rationale for each of these developments was explained by the teacher and modelled for students. They were then given opportunities to incorporate these new features into their maps.

After this global introduction, the author felt that pupils were ready to integrate mapping into their work on the *Battle of Bannockburn* unit. This occurred one month into the study. During the remainder of the study, mapping was used for a variety of purposes (detailed overleaf):

- To develop a wide range of thinking skills (*Appendix G* provides examples)
- To show pupils main concepts and ideas, leaving lots of white space to stimulate thought and to help them to see the connections with what comes next
- To access prior learning and find out what students already knew; and
- To plan and organise future teaching accordingly (e.g. building-in opportunities to 'connect the learning')
- To add new connections, knowledge and understanding as learners progressed through the topic
- To record class discussions and provide a new means of teacher explanation
- To provide a new learning tool for pupils that they used on their own, and in pairs
- To establish new ways for students to demonstrate understanding – pupils were asked to explain their maps to other pupils who were then asked to explain the map back to the explainer; and
- By using this method they were able to review for recall and 'check out' individual understanding
- As an effective means of assessment – assessing students' understanding is easier when teachers can see how each student is organising their thinking; because of this
- Feedback (marking) becomes quicker, specific and more useful
- As a planning for writing tool – children can use maps to help them structure and produce the linear text

3.1.3(b) Oban High School
Model Mapping is applied across the curriculum in a variety of ways at Oban High School: in groups or by individuals for gathering ideas or brainstorming, being used by teachers to outline a topic at its introduction, "as highly effective revision aids

before tests, and as a tremendous means of checking pupils' knowledge and understanding."[lxxii] Social Subjects teachers use brainstorming and subsequent map as a way of slowing down students in their thinking about complex topics; in order to achieve deeper understanding, while at the same time making their thinking visible. They can then check that pupils have assimilated large amounts of knowledge and made the appropriate connections. Teachers believe that capturing 'screenshots' of thinking in this way helps students to move the knowledge and understanding from short-term to long-term memory.

Teachers also use model mapping in staff development exercises by composing maps, then using them to explain their work to colleagues, and stimulate discussion. They are also used by staff, for example, in annual development planning and as a note-taking tool at conferences and meetings. "This has the advantage," Rector Linda Kirkwood says, of allowing other notes and references to be added later and is so instantly visible." "Most of all," she adds, "I find it a fantastic method for creating ideas and sparking new thoughts."[lxxiii] These benefits are cascaded to the wider school community, as model mapping features on the menu of learning techniques that the school shares with its pupils' parents and feeder primaries in workshop sessions.

The school decided to adopt model mapping following the very positive experiences of three teachers at Model Learning's Mapwise training course. They found that model mapping was a style of mapping to which they could relate. Linda Kirkwood discovered that: "There was a structure to this and a means of training other staff and pupils to use it."[lxxiv] As a result the school's SMT decided to train students in its use through Social Subjects teachers initially, and to inform other staff of the system and its uses. "It was important," Linda Kirkwood said, "that the staff go through the same training we…give the pupils." "This involved a lot of work on classification techniques; although this takes time, it is crucial to the development of mapping skills since without it pupils find it difficult to identify the main branches of their maps."[lxxv]

A further important part of the training involves transferring information into the map format, for which both staff and students choose a subject of personal interest. Teachers also shared ideas during a collective review of when, why and how they would use mapping in classroom practice. Once staff had been trained the focus shifted to training pupils, with S3 (14-15 year olds) targeted – this took the form of events bringing together whole S3 subject groups, while other teachers preferred to do the training with their own classes.

3.1.3(c) Comparison with Pinegrove School Study[lxxvi]
Galashiels Academy and Oban High School use model mapping, whereas Pinegrove School adopted Mind Mapping. Nevertheless, all of the schools shared common experiences in implementing mapping. In the US Case Study, similar aspects of practice included an emphasis on three areas:

1. Acquiring a mastery of the basic skills of mapping e.g. by supporting students to represent categories in a new visual format *via* teacher modelling and structured practice

2. Focussing on skills that allowed children to develop their maps e.g. having them integrate symbols, colour and dimension into their maps, and clearly explaining the rationale for each
3. Finally, following this global overview, Mind Mapping was incorporated into the *Blue Ice* Unit (a science programme specifically produced for US Middle Schools)

Throughout the Unit, Mind Mapping strategies were used for a variety of purposes. Many of these correspond with applications highlighted in this study (See *Appendix L*).

3.2 Specific Objective 2
To assess pupil perceptions of Mind Mapping techniques, considering their outlooks in cognitive areas and in the affective domain

To facilitate later comparison, the same survey, questionnaire and open-ended interview questions used in the American Case Study[lxxvii] (with the exception of two non-relevant questions) were applied to the research carried out at Galashiels Academy. As these processes did not extend to the pupils of Oban High School in this study, their perceptions of mapping are not reported here in any detail. However, a few general comments have been included from teachers who use the technique, to give a flavour of students' responses to the visual tool (this data was collected during practitioner interviews).

3.2.1 Galashiels Academy
In ascertaining pupils' perceptions of mapping after using it over a four month period, three distinct themes emerged from the data:

1. A majority of students perceived mapping to be an enjoyable, interesting and involving approach to learning
2. Pupils believed that mapping had a range of uses in learning history, and
3. Most reported that mapping had enhanced their learning in a variety of ways

Although these themes emerged primarily from data collected through student surveys and interviews, they were also corroborated using evidence collected through classroom observations and the assessment of pupils' work.

When given the survey statement "I enjoy creating Mind Maps," 60% of students either agreed or strongly agreed with this statement, while 33% disagreed, and 7% were uncertain. During the interviews, many pupils reported that using Mind Maps was an enjoyable and interesting way to learn history (see *Appendix I*).

Fifty five per cent of students attributed the enjoyable nature of mapping to the opportunities that it gave them to be creative e.g. use of colours, drawings, integration of words and pictures, as well as the ability to express emotions through this synthesis. This evidence is corroborated by other data collected in the pupil surveys: when given the statement "Mind Mapping allows me to be creative," 68% of students either strongly agreed or agreed with this statement.

Closely connected to pupils' perceptions of learning in the affective domain are cognitive outcomes. When given the statement "Mind Mapping helps me understand concepts and ideas in history," 70% of students responded with strongly agree or agree, while 21% disagreed, and 9% were uncertain. In responding to a more focussed statement about learning in the Bannockburn Unit, "Creating Mind Maps helped me to understand the relationship between the Battle of Bannockburn and the Wars of Independence, and why Scotland won the battle," 84% of pupils agreed or strongly agreed with this statement, while 16% disagreed. In the open-ended survey questions and during interviews, students identified a range of ways that mapping helped them in learning history: More opportunities to be creative; enhanced memory, better organisation of ideas and thoughts; an effective planning tool; ease of transfer into linear text; easier to understand new concepts and ideas; useful for generating and sharing ideas; easy categorisation of information; cognitive challenge; increased attention; good for seeing the big picture; increased involvement in learning; deeper understanding (refer to *Appendix I*).

As mentioned previously, some pupils did not feel that mapping helped in their learning of history. When probed about their reasons for these beliefs, their answers reflected mixed emotions about using the tool. One boy thought mapping was fun, but reported that he felt that "any other plan works just as well." A common theme identified by 7 students who reported that they did not find mapping useful was, one said for all, that "it takes too long to create a map." Three pupils felt that mapping was confusing in both the construction and interpretation of the maps, but believed the technique did give them some information and opportunity for learning.

3.2.2 Oban High School

At Oban High School, most students pick up the skill of model mapping rapidly, and few have problems with it. Staff discovered that when pupils were having difficulty with the technique, this was primarily caused by problems in classifying information. Teachers report that, at first, as students grow used to the method, they provide help with deciding on the classifications, especially the main branches. Later, as pupils become more confident, they are able to generate their own maps without any help from teachers. Students and Teachers identified that the time spent working on classification techniques was crucial to the development of mapping skills (without it, pupils said, they found it difficult to identify the main branches of their maps).

Students liked model mapping for a variety of reasons: It suits able and gifted pupils, as well as SEN students - the former tend to design complex maps, while the latter can cope with simple maps; boys take to it well, especially those who dislike writing tasks – they would even use colour in their maps where this would normally be considered 'uncool'; many pupils appreciated the opportunities that mapping provides to see the big picture, make connections, generate ideas and organise information in a visual format; some found it to be a highly effective revision aid before tests; others enjoyed the social aspect of brainstorming – by using a map to gather ideas; some students felt that maps allowed them to show and organise knowledge more effectively than traditional methods.

Oban High School's associated primary schools also report that they and their pupils are finding the tool useful for many purposes e.g. collaborative group work, planning for writing, and connecting the learner to prior learning and experiences.

3.2.3 Comparison with Pinegrove School Study[lxxviii]

The themes identified in this research are broadly similar to those which emerged from the US Case Study. Practitioners involved in the latter reported that (also see *Appendix L*):

- Mind Mapping had positively impacted on cognitive *and* affective aspects of students' science learning
- Sixty six per cent of children perceived Mind Mapping to be a fun, interesting and motivating approach to learning science
- Sixty per cent of students attributed the fun aspect of Mind Mapping to the opportunity to be creative when creating Mind Maps, citing e.g. choice in colour, symbols, key words and design
- Children conceptualized Mind Mapping as having a wide-range of purposes in their learning
- A vast majority of students said that the technique helped them in learning science, for a variety of reasons
- Eighty per cent of students believed that Mind Mapping assisted them in understanding concepts and ideas in science
- When children did not feel that Mind Mapping helped their learning, their reasons reflected ambivalence about using the tool, rather than direct statements concerning the inefficacy of mapping

3.3 Specific Objective 3
To ascertain teachers' perceptions of Mind Mapping as an instructional tool

As very few teachers at Galashiels Academy use mapping, it was not possible to identify themes from a full interview and survey schedule (interviewees' comments are reported in *Appendix J*). Therefore, the sub-section on the school is largely written from the unique perspective of the teacher-researcher; giving a personal account of his experiences in using the technique during the study.

3.3.1 Galashiels Academy
This is a scene from the author's classroom two months into the study:

Every pupil in the S2 History class at Galashiels Academy is working silently. The only sounds are the click of colour pencils as they are taken from the centre of each table. Today, students are mapping what they consider to be the decisive factors in Scotland's victory over England in the Battle of Bannockburn. They are energetically on-task, rapt with concentration, clearly loving every minute of the activity. To them, this is more fun than work - yet by using the technique of mapping, they are learning far more effectively than by using traditional methods of rote learning.

After this optimistic opening, it will be no surprise to read that the classroom-based part of the research inspired most excitement. In this arena, the use of mapping has improved concentration, memory and retention, learning, and, consequently, behaviour. Mapping has increased pupils' motivation and enjoyment, and improves the creativity of children. Students enjoy the use of colour and images that are built into the scheme, and the association of ideas. They also find it great fun. The author uses mapping to introduce lessons, halfway through lessons to check how much pupils have learned, and then again at the end for review purposes. When students map, they have a visual statement in front of them of how much they have learned. Most of them love doing it and they don't see it as work. They are learning with ease.

(1) The effects of mapping on pupils' self-image

Since starting to use the technique, a transformation has occurred in many pupils' perceptions of their learning abilities. This is especially true of those who have records of needs, and are generally more self conscious about school. Where before SEN students seemed to be primarily concerned with combating their learning difficulties, and often gave up if they could not overcome these, they are now displaying newfound abilities and confidence through mapping. This growth in self-assurance extends, in the author's opinion, to his classes as a whole. For teachers, and especially the pupils themselves, these are extremely satisfying and promising developments.

Indeed, through developing mapping skills, and applying these to solve historical problems, some students are for the first time seeing themselves as individuals of considerable scholastic ability. The spin-offs in terms of more positive behaviour and enhanced classroom atmosphere have to be seen to be believed. By freeing pupils who routinely struggled with written work from the constraints of traditional noting, their confidence as learners has grown, and they can now use their maps to help them produce linear text. Experiences like this have renewed the author's efforts to help children learn in new ways that enhance their learning experiences.

(2) Using the power of categorisation to support pupils' learning

The key to successfully supporting pupils to develop these skills seems to lie in teaching them how to effectively categorise their everyday experiences. For students as much of this information processing occurs inside schools as it does outside of school, and the two processes, naturally, interact. So before integrating the mapping technique into their studies, the author spent a great deal of time helping pupils to build-up their categorisation skills, as mentioned before. Teachers can forget that the 'old ideas' and 'established knowledge' of their instructional menus are, essentially, new experiences for students. By returning to first principles of categorisation to help pupils to make sense out of and order 'new' information and ideas within their existing knowledge structures, the author felt that his teaching and, consequently, students' learning benefited.

Pupils then applied these categorising skills to present and organise information in a new visual format - mapping. And over time they were given teacher help to develop their maps.

(3) The relevance of mapping to teaching and learning

These teaching decisions were informed by the insights of Mind Mapping expert Vanda North. Equally influential has been the time spent on INSET days with Ian Harris, the co-developer of model mapping. On Model Learning's Mapwise course, the author first started to realise the transformation mapping could bring to the classroom. Central to this training is the belief that an ability to create ever more significant and meaningful categories of language is right at the heart of the 'meaning-making' process, or of understanding itself. Model Mapping is the perfect way to make these hierarchical and spatial relationships concrete, visible and thus available to all pupils.

Caviglioli & Harris' theories[lxxix], which place students at the heart of the learning process by seeing them as active creators of their own knowledge through schema formation (in which new information must be connected to existing understanding structures in order for it to 'slot in' and be retained), have made a profound difference to interactions within the author's classroom. By applying these ideas to practice, teachers can teach pupils how to categorise language - on a map they can see these previously hidden and, understandably, often impenetrable relationships. Moreover, by mapping out your understanding of a topic you are making visible for students how you, as a teacher, understand or make sense of your subject. A meaningful understanding of the specialised language of the author's subject – History - and its core concepts, enhanced by the use of mapping, is proving to be the key to pupils' development of subject-specific thinking, of an ability to talk about the subject, and to make distinctions and connections within it.

This approach carries immense value. Model Mapping opens many doors for students:

- It enables them to access their own thinking and learning structures as well as those of subject specialists
- It provides them with a toolkit to create meaning in their world with security and rigour
- It equips pupils to deal with the conceptual building blocks of subject understanding, and, as a result, attain higher levels of historical literacy
- It offers them a visual record of their learning

- It provides teachers with powerful graphic scaffolding and modelling processes
- By applying it, teachers can help students to create meaning out of their experiences, at the same time equipping them with valuable skills for life
- Pupils learn to make connections with previous experiences and knowledge, providing huge potential for developing speaking, listening and writing

In short, students gain a real understanding of understanding, so the time spent by the author learning the technique, and then passing on its benefits to pupils has clearly been well spent. Mapping gives students an enormously powerful aid to making sense of the material teachers give them every day (While not the subject of this study, attainment rose considerably within the research groups, across the ability spectrum. Though difficult to assess accurately the impact of particular developments, teachers in the History Department believe that mapping played a substantial role in the improvements).

The study also led the author to actively think about his teaching practice; consequently, many new possibilities were explored, often with positive outcomes (see *Specific Objective 1C*). Thinking is not like many of the routine bodily functions that kids perform. It will not naturally develop like walking. In an age where children are used to immediate results and 'quick hits', teachers need to teach pupils how to enhance the quality of their thought. They tend to need more direction from their teachers, as their desire to think and find solutions for themselves is perhaps not as great as in the past. Learning how to map has helped students to improve the quality of their work and motivation to learn.

3.3.2 Oban High School

The author visited Oban High School on 6-7 November 2003, to interview ten teachers who use model mapping. Teachers from the following departments participated in the study: history, geography, modern studies, craft & design technology, technical education, art, maths and physics (fantastic displays of pupils' maps were on show in each of these departments).In ascertaining their perceptions of mapping, seven distinct themes emerged from the data:

1. Teachers perceived mapping to be a useful and multifaceted approach possessing a number of advantages, and some disadvantages
2. They were largely positive and optimistic about the scheme, and many identified categorisation as the key skill in mapping
3. Students' thinking skills development had improved as a result of mapping
4. Teachers believed that mapping had enhanced pupils' subject-specific understanding
5. Teachers perceived that mapping helps students prepare for writing and, consequently, leads to improved extended writing
6. In many cases, learning to map had boosted learners' confidence, improved their attitude to school, and enhanced their self-image
7. Pupils had been generally positive in their response to mapping, while some negative feedback was received

Eighty per cent of teachers interviewed said that they made frequent use of visual tools, including maps, to support their instructions. This group also thought mapping to be a very effective method of scaffolding pupils' learning. A sample of the comments of all teachers interviewed can be found in *Appendix K*.

(1) Effects of mapping on classroom practice

Oban High School teachers identified a range of ways in which mapping has enhanced learning and teaching, outlined in *Figure 4:*
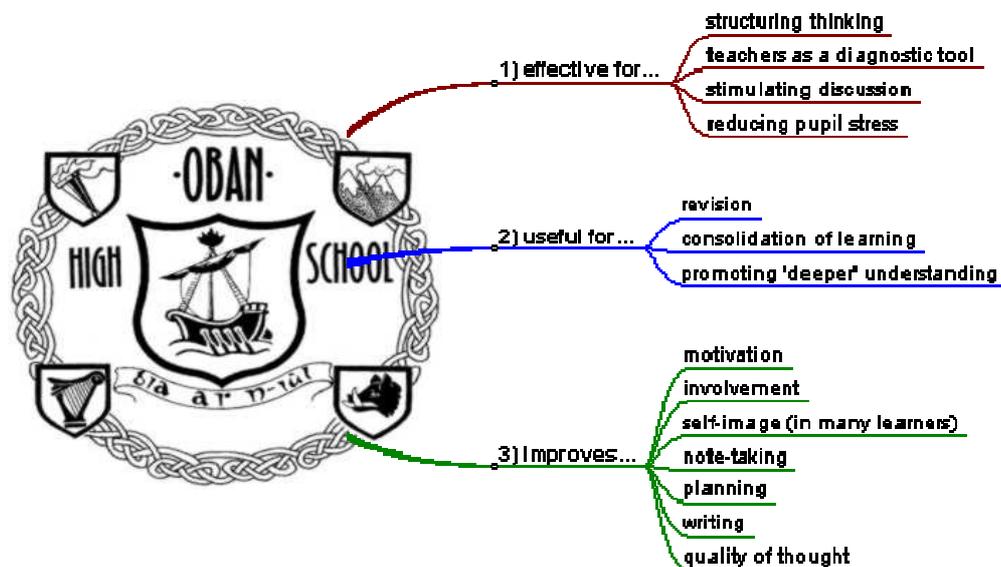

Figure 4: Effective uses of model mapping in Oban High School

Overall, teachers believe that mapping offers a highly flexible and visual learning tool, and a more naturalistic way of learning than traditional linear and text-based methods. When responding to the interview question "thinking of your own classes, what do you see as the main advantages/disadvantages in using mapping?," 100% of teachers agreed that the technique can be used with a range of abilities, and, without exception, perceived it to be a flexible and useful classroom tool (for reasons summarised above). Seventy per cent of teachers cited only advantages in using the technique, while 30% qualified their reports of positive outcomes with critical comments. Where pupils had difficulties with mapping, the latter group of teachers highlighted one common factor: that students' categorisation skills required further development (refer to *Appendix K*). It was generally stated that more able pupils completed self-initiated maps on a more regular basis than their less able peers.

(2) Teachers' responses to mapping

Teachers have taken well to the technique. When asked how their immediate colleagues had responded to the introduction of mapping, teachers generally painted a positive picture. Many stated that their fellow practitioners found the technique a useful and flexible classroom approach that had benefited their students' learning in a variety of ways (reflecting themes highlighted in this sub-section). Of the teachers interviewed, 80% believed that the way mapping was introduced in the school had played an important role in its subsequent success. One spoke for all when she said that: "it was important that staff go through the same training we were going to give the pupils, which we did in-house through two social subjects teachers who had attended a model learning course on mapping and returned to the school full of enthusiasm and keen to put what they had learned into practice." This fostered popularity because "teachers listen to other teachers and pay particular attention when they are highly positive about something." The 'basics first' approach of teaching staff the prerequisites of mapping, primarily categorisation and

organisation, before training them to translate this into a visual format had been important in bringing teachers onboard. Other teachers' opinions reflected and extended this theme (see *Appendix K*).

Some teachers (30%) reported that a small number of their colleagues still did not feel comfortable with mapping, but that these tended to be teachers who prefer linear approaches. However, one commented that "they have taken on board the fact that we must design our methodology for all learning styles and although it (mapping) may not be their own preferred style, they do use the technique, but perhaps not as frequently as others."

For all of the teachers interviewed, the beauty of mapping is that it does not require revision of curriculum materials; the basic requirements are, for the teacher, a blackboard and a box of chalks. They also believed that the system was logical; both in the sense of its layout and applications, and in that teachers and pupils understand why they're doing it.

(3) Students' thinking skills development in relation to mapping
An enhanced ability to categorise information *via* mapping was cited by all of the teachers interviewed in this study as a vital factor in pupils developing quality of thought. "Categorisation is the key skill," said one, "prioritising and setting things out in an organised and hierarchical way." Thirty per cent of teachers talked about students' thinking skills development in relation to mapping. They all believed that mapping in itself was a transferable thinking skill that could be applied across subject areas. One said that evidence of improved thinking skills was apparent in class discussions and written work based on mapping. Two attributed these improvements to the visual nature of mapping, which allowed pupils to show their understanding and subsequently develop their thinking. A sense that students' thinking skills had improved through mapping is evidenced in other comments (refer to *Appendix K*).

(4) Developing subject specific understanding through mapping
Teachers also reported favourably on the effects of mapping on other cognitive aspects of their pupils' learning. When responding to a question concerning the effects of mapping on students' ability to develop subject specific understanding, all teachers strongly agreed that this area of pupils' development had benefited for a variety of reasons (see *Appendix K*).

(5) Mapping as a route to better writing
Feedback from teachers indicated that mapping was a useful way to help students prepare for writing. This is evidenced in comments detailed in *Appendix K*. Ninety per cent of teachers attributed the structural and organisational qualities of maps e.g. "easeful use of branches to generate paragraphs," "organisation of information and ideas," "use of hierarchies," "the key skill of categorisation," as having led to improvements in their pupils' extended writing.

(6) Improving students' motivation and involvement in learning through mapping
Closely linked to cognitive types of outcomes is affective learning. When asked the question, "how has mapping affected pupils' motivation and involvement in learning?," 100% of the teachers interviewed responded positively. The Principal

Teacher of Learning and Teaching, who helps staff and students with mapping, said that: "Introducing the technique has improved pupils' motivation and involvement in their learning and provided an antidote to disaffection. Through mapping the use of left-right brain laterality is naturally more involving." Positive beliefs like this were echoed in other teachers' comments (refer to *Appendix K*).

(7) How mapping affected learners' confidence, attitudes, and self-image

Similarly, all teachers responded positively when presented with the question "have there been any observable changes in attitudes and dispositions towards learning, or changes in the self concept of pupils since using mapping?" According to teachers, mapping: "Can act as an antidote to behaviour problems because: it is a less aggressive, less stressful and more flexible method of teaching and learning – it improves teacher-pupil talk, particularly pupil interaction." ;"Raises their self-image and can foster better attitudes towards learning, but it is not an answer to all disaffection."

Fifty per cent of teachers believed that having the ability to map can lead to a more relaxed and less stressful learning experience for students. As a reason for these improvements, they pinpointed the fact that mapping is a great release for learners from what one teacher called the "tyranny of the blank page," and "from the kind of attitudes that if you cannot write in linear text you're thick." In addition, all used the metaphor of a toolkit to explain lower levels of pupil stress, reasoning that, for many students, mapping was like having another 'tool in the bag' that helped them to cope with their learning experiences (and reassured them that proof of learning and attainment need not always be achieved *via* text).

(8) Teachers' opinions on Pupils' responses to mapping

Introducing mapping into the school had been generally well received by students. As previously noted, many teachers believed that it had led to a lower stress learning experiences for pupils, and offered further options for those who struggled with more traditional writing tasks. Teachers commented that learners enjoyed the creative aspect of the scheme, using colours, drawings, symbols, and individualistic designs, and that they "liked being able to see all of the information on one page." A number of teachers (50%) highlighted that the younger children are introduced to the technique, the less resistant they are to using it when they become older. One teacher supported this assertion by pointing out the success of the school's outreach programme to its associated primary schools, involving P6/7 classes. Consequently, teachers in the secondary school were now finding that "some kids who know how to map are coming into Oban High School from our feeder primary schools." (See *Appendix K*)

(9) Raising attainment via mapping

A further interesting theme that emerged from the data, was that forty per cent of teachers identified a correlation between the introduction of mapping and improvements in students' results. Pupil attainment has been rising steadily in all year groups in Oban High School, and all teachers were generally positive and optimistic about the impact of mapping on results improvement (*Appendix K* provides further corroborative evidence).

(10) Other areas of interest
Towards the end of each interview, when teachers were asked if they wished to say anything else on the topic of mapping, 40% said that they had tried both approaches and preferred model mapping to mind mapping. Twenty per cent of teachers added a word of caution about mapping software. They believed that students' maps tended to be more creative with paper and pens. A schools' approach to CPD and cross curricular skills work was also highlighted by teachers as being vital to ensuring the success of mapping. In relation to uses of the technique, 40% of teachers wished to add that they found mapping a useful diagnostic tool (see *Appendix K*).

Returning to the toolkit metaphor of learning, one teacher stated that "the toolbox needs to be full, pupils and teachers have much more confidence through having the ability to use maps in classroom interactions, they (maps) are powerful, but not the only tool." "Maps," another practitioner said, "or anything else that helps to take the stress out of pupils' attempts to create understanding, are a great help." In terms of developing understanding, one teacher was keen to highlight that: "The main benefits of mapping, for pupils and teachers, lie in the power of categorisation, and the structure that the format offers – both are great for visible thinking. Seeing all of the information presented and organised in a highly visual way allows pupils to access teachers' thought structures and develop better subject understanding and thinking skills." Finally one teacher resonantly observed that "the teacher-pupil relationship is paramount, on top of that you need good strategies like mapping."

3.3.3 Comparison with Pinegrove School Study[lxxx]
Similar to the findings of this research, the American teacher-researchers found that (also see *Appendix L*):

- Mind Mapping possesses a number of benefits in science learning and teaching
- There were some difficulties in incorporating the technique into students' learning
- When children experienced difficulties in using the technique, these were of the nature of 'teething problems' e.g. development needs in categorisation skills and visual formatting
- As students gained confidence in using the technique, problems fell away
- Practice and regular teacher-modelling was important in helping learners to secure their mapping skills
- Mind Mapping was valued both by teachers and students
- Children's learning was enhanced by "the opportunity to use colour, symbols and generally expand their ideas in…an open format"
- Mind Mapping "provided a unique window" into students' struggles to create understanding, and into "just what students really find new and difficult"
- Mastery of the cognitively demanding aspects of Mind Mapping, such as categorising information correctly on a map, combined with the creative appeal of the technique, promoted deeper conceptual understanding amongst learners
- Children enjoyed and were motivated by the technique
- Students who struggled with expository expression gained self-confidence from being able to explain their understanding in a less text-based format
- Using the technique led to energized self-reflection on other areas of the teacher's classroom practice

4. Conclusions

4.1 Overall Research Aim
The ways in which Mind Mapping can be used as a teaching and learning tool (with particular reference to history education, and pupils' and teachers' perceptions of their uses and usefulness)

In this study, mapping was used as both a teaching and learning tool. Teacher-created maps were generated before and during direct instruction to explain historical ideas and concepts. In addition, mapping was used by pupils to secure, to synthesise, to record, and to demonstrate, their developing understanding, amongst other uses. In relation to the adoption of mapping, the evidence gathered highlights a number of implications for both history education and learning and teaching more widely.

Mapping exhibits considerable flexibility as a pedagogical tool. This is evidenced by the multiplicity of purposes reviewed in this study. In addition to flexible application, mapping may be combined with other approaches such as 'teaching thinking', catering for students' multiple intelligences, developing a climate of enquiry, and providing a model for social constructivism in the classroom. However, as with any educational approach, teachers need to be cognizant of the purposes for using a specific strategy, and of the outcomes that they hope to achieve by adopting it (e.g. other visual tools, such as fishbone diagrams for illustrating cause and effect relationships, can be used to better represent key areas of understanding)[lxxxi].

Mapping fostered pupil motivation in learning history. Although at times students were required to map out their understanding of specific concepts and ideas, there was considerable 'artistic license' for them to express individuality in their maps. The creative aspects of mapping - using it as a brainstorming tool, integrating colour, symbols, and images, and expressing ideas and connections amongst concepts in unique personalised arrangements – appealed to pupils and seemed to contribute to their largely positive attitudes about using the visual tool.

As noted previously, some students did not enjoy mapping because they experienced difficulties in interpreting maps, or the technique did not meet their preferred learning styles. This supports the notion, and is consistent with the prevalent theme (discussed earlier), that history should be accessible to all pupils, regardless of their abilities, interests, needs, and backgrounds[lxxxii]. If teachers are to engage all students; there is a need to adopt eclectic learning and teaching methods that cater for the needs of diverse learners. Moreover, pupils will be better equipped if they have a varied repertoire of learning strategies that allow them to explore new ideas and incorporate these into their developing understanding. Helping students develop facility with a new learning tool offers them more variety in how they can: learn, demonstrate understanding, and receive feedback (marking or assessment). Yet, not all pupils in this study liked mapping, while others were ambivalent about its use. This highlights that a particular approach will not appeal to all students; thus, the adoption of a variety of learning and teaching strategies would be more likely to cater to multiple intelligences[lxxxiii] and pupils' diverse learning needs. Therefore, while this research provides some evidence to support the view that teachers can help children to improve their thinking through specific interventions, like mapping, it also

emphasizes and acknowledges the need to avoid 'one size fits all' philosophy of teaching.

Although the positive learning outcomes, affective and cognitive, that were reported by students in this study cannot be solely attributed to mapping (many other constructivist-based learning approaches were adopted during the inquiry, and other variable factors were, as always, 'at play' in the classroom), use of the tool certainly contributed to the overall success of the *Battle of Bannockburn* Unit. Moreover, teachers reported that the theories connected to mapping can be easily applied to classroom practice, and stressed the relevance of the tool for this arena.

Overall, the established benefits of Mind Mapping®, and the further educational options that model mapping offers, impacted positively on history teaching and learning and, according to teachers interviewed and the secondary data from the US Case Study, are similarly profitable when used in other subject areas. It would be inappropriate for the author to advise subject specialists on specific uses of mapping. However, when viewed collectively (in the contexts of considering, then further synthesising, the main findings for each Specific Objective), the evidence points to potentially wide ranging applications of this flexible learning tool across the curriculum.

4.2 Summary of main findings

4.2.1 Specific Objective 1
To overview and evaluate recent developments in the use of Mind Mapping techniques in educational practice (with special focus on Thinking Skills and Constructivism)

While further qualitative and quantitative research is required to assess and extend the findings of this study, some tentative conclusions can be drawn from the evidence collected. The literature review, an interview with Vanda North, and studies of specific practice in two Scottish Secondary Schools, underline that:

- The secondary literature that promotes mapping as a means of improving children's higher-order thinking, and developing classrooms based on constructivist learning principles, is supported by data collected in this study.
- Similarly borne out by this research, are beliefs, held by North *et al*, that Mind Mapping offers new directions for students of all learning abilities, and that it can be a particularly helpful approach with some SEN pupils and disaffected students - to assist them to develop the motivation, persistence and optimism to see themselves as successful learners.
- Also confirmed by the study, are various authors' arguments that mapping can be practically applied to enhance many aspects of teachers' practice and pupils' learning experiences – the two Scottish Schools studied found a wide-range of advantageous uses for the technique. These applied across the curriculum, and helped students to overcome real and perceived barriers to developing their intelligence and transferring their learning between subject areas.

All of the above points receive further support from the findings for Specific Objectives 2 and 3.

4.2.2 Specific Objective 2
To assess pupil perceptions of Mind Mapping techniques, considering their outlooks in cognitive areas and in the affective domain

In evaluating pupils' perceptions of mapping after using it over a six month period, three distinct themes were identified:

1. Students perceived mapping as an enjoyable, interesting and motivating approach to learning.
2. Pupils conceptualized mapping as having a variety of uses in learning history. This is evident in that they were able to identify a variety of uses for mapping, and many highlighted the flexibility of approach that it offered them in their learning.
3. The majority of students reported that mapping enhanced their learning in a variety of ways, in both the cognitive and affective domains. They particularly appreciated the creative facets of the scheme, and the assistance that it gave them in understanding concepts and ideas. Improved confidence and more positive attitudes towards learning were also apparent.

In addition to their participation in surveys and interviews, the two groups of children's work were assessed throughout the study, to corroborate themes and ensure consistency of analysis and interpretation. The evidence suggests that pupils had largely positive experiences of mapping. This broadly reflects Oban High School teachers' opinions about students' mapping experiences, and the findings of the US Case Study.

4.2.3 Specific Objective 3
To ascertain teachers' perceptions of Mind Mapping as an instructional tool

Teachers reported a number of benefits in using mapping, as well as highlighting some difficulties in incorporating the technique into pupils' learning. A vast majority of teachers felt positively about mapping. The most prevalent themes identified were:

- Increased effectiveness of learning and teaching - practitioners were able to identify several areas of students' cognitive and affective development that had benefited from using the technique (including improved thinking skills, subject specific understanding, preparing for writing, confidence, self-image, and attitudes to learning)
- Teachers also believe that mapping has improved pupils': question and answering during class discussions, motivation, involvement, concentration and, consequently, behaviour
- Mapping makes thinking visible, which promotes better understanding of subjects
- Improvements in pupils' learning were built primarily on helping them to develop sound categorisation skills, then supporting them to transfer this information into a visual format

- Mapping possesses several classroom uses - these impacted favourably on students' learning across the ability spectrum

Mapping was valued as a pedagogical strategy by all of the teachers who participated in this study. Additionally, many shared the view that this perception extends to their pupils.

Finally, *Think it – Map it!*[xxxiv], a recent textbook on "how schools use mapping to transform teaching and learning," supports many of the themes identified in this study. While the case studies in the book are not, strictly speaking, regarded by the research community as systematic evaluations, they do, nevertheless, provide many examples of best practice for teachers.

4.3 Concluding Comments

Many teachers strive to find ways to make the learning of history more interesting and meaningful for pupils. Like other visual tools, mapping has the potential to foster symbiosis in learning, helping both teachers and students to "penetrate (the) structure and meaning of the knowledge they seek to understand." [lxxxv] This research attempted to investigate the possibilities of mapping as a tool for enhancing pupils' ability to engage in history education. Although small in scale, it does provide some preliminary evidence for the value of mapping. A majority of students were able to understand the rationale and purposes of mapping, and mastered the skill in a relatively short period of time. In addition, most pupils enjoyed mapping and identified several ways in which it enhanced their learning in history.

Teachers were similarly enthusiastic about the new possibilities that mapping brings to the classroom. Beyond their efficacy in categorising information, teachers noted that pupils can literally 'see' what is going on within their own thought processes as they complete a map. And, as previously noted, teachers highlighted that mapping provides opportunities for them to model their effective thinking for pupils, rather than students simply receiving the linear products – be they in speech or writing - that result from teachers' effective thinking. Teachers also report that maps are easy and inviting to look at, the structure is clear and things can be added here and there and in-between as people come to think of them. They believe them to be a robust, yet flexible, and highly visual method of organising and reordering information, and of making ever more meaningful connections and conceptual adjustments. The way they are open seems to help pupils to think and come to think of more things - the white space on maps invites both creative and analytical thought. All-round, based on the evidence drawn together by this study, maps are becoming powerful, versatile and popular classroom tools.

This study pinpoints a great degree of harmonization between the uses and benefits that three schools identified for mapping. These applications and advantages seem to possess cross curricular qualities, and can potentially apply across age ranges, as well as the spectra of learning abilities (including that related to an attainment gap between girls and boys).

Weaving together these developments is one unifying thread: Mind Maps and model maps, as long as they adhere to categorisation, are perceived by teachers and students alike as being useful and relevant tools for almost all learners, irrespective of age, ability or gender. Perhaps this is because they provide insights into what understanding actually looks like. Mapping makes this happen by mirroring the cognitive processes that all human beings go through in constructing understanding. It turns the normally fleeting, invisible and internal act of thinking into something that is explicit, public and accessible to all. Mapping enables teachers and learners to see and understand the very processes and products of understanding itself[lxxxvi]. This is why it may hold such value for teacher practitioners; when taught and used properly, mapping provides one route to ensuring a sense of 'completeness' in their pupils' learning, and their teaching. If adopting this perspective, more teachers are likely to want to explore ways of applying it to their classroom practice.

5. Recommendations

More research is needed in the context of history education – and other subject areas - at all levels (Primary, Secondary, and Further and Higher Education) to determine the effectiveness of mapping as a teaching and learning tool. Some avenues of inquiry worthy of further investigation include:

- Can mapping be used to engage boys more in their learning, and to address the identified 'attainment gap' between females and males in Scottish Secondary Schools?
- Is the technique suitable for younger and older learners?
- Is it more effective as an embedded formative assessment tool, as opposed to being used in formal tests?
- Does mapping offer an approach that fosters inductive and social learning (proved by recent research to benefit children's learning[lxxxvii])?
- Could mapping be synthesised with other National Priorities in Scottish Education e.g. raising attainment, the use of ICT, and 'learning for creativity' approaches?
- Can mapping be applied to enhance the learning experiences of SEN pupils?
- How effectively does mapping cater for developing a wide-range of thinking skills?
- To what extent can mapping be used to promote pupils' metacognitive development?
- Does the technique have the potential to enhance extended writing in history and other subjects?
- How effective is mapping, seen within a wider context of applying a range of visual tools in the classroom, as a means of addressing the above issues?
- Although not used in this study, computer software such as *Mind Manager*, *Mind Genius*, *HeadCase*, and Leckie & Leckie's recently created *Revision Mind Maps* online resource, could provide further options for exploring the technique in the classroom.
- How do constructivist-based learning approaches impact on students' learning?
- Comments from children and teachers involved in this study reflected a sophisticated level of analysis of their own learning and teaching respectively. This highlights, again, that there exists a rich quarry for evidence-based research which carries direct relevance to teacher practitioners' day-to-day work and pupils' experiences of school.

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Note: The Three Types of Learning

There is more than one type of learning. A committee of colleges, led by Benjamin Bloom, identified three domains of educational activities. The three domains are cognitive, affective, and psychomotor. Domains can be thought of as categories. Cognitive is for mental skills (Knowledge), affective is for growth in feelings or emotional areas (Attitude), while psychomotor is for manual or physical skills (Skills). This taxonomy of learning behaviours can be thought of as "the goals of the teaching and learning process."

Cognitive Domain

The cognitive domain involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major categories, which are listed in order below, starting from the simplest behaviour to the most complex. The categories can be thought of as degrees of difficulties. Within which pupils can work at their own level in developing six broad competences.

Affective Domain

This domain includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

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These possibilities include:
  - Helping pupils' create understanding by making visible the 'Big Picture'
  - Connecting the learner to prior learning and experiences
  - Providing a framework on which further learning or connections can be based
  - Collaborative group work
  - Making recall more likely
  - Teacher planning, development planning and meetings
  - Formative assessment
  - Empowering and including SEN pupils
  - Planning for writing

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[lv] Caviglioli, O., & Harris, I., *Mapwise: Accelerated Learning through Visible Thinking* (2000), Network Educational Press, Stafford, 2000, p.11 & p. 120.

[lvi] Chances to reflect could be provided e.g. by supporting pupils to model their maps and the thinking behind them by 'walking and talking' these through with the class. As a teacher you are thus supporting pupils to develop and model for others the thinking skills involved in producing the map. Similarly, by using this modelling method as a teaching style, teachers can give students access to their thinking; to how they produce ideas, organise concepts and adjust conceptual positions – thinking is thus made 'visible', and public and accessible to all.

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[lxii] *Standards and Quality in Secondary Schools 1995-1998: History*, HMI, 2000.

[lxiii] *Standards and Quality in Secondary Schools 1995-1998: History*, HMI, 2000.

[lxiv] *Standards and Quality in Secondary Schools 1995-1998: History*, HMI, 2000, p.18.

[lxv] *Standards and Quality in Secondary Schools 1995-1998: History*, HMI, 2000, pp.15-16.

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[lxxiii] Interview with Linda Kirkwood, Rector and Geography teacher, Oban High School, 7 November 2003.

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[lxxxvii] See Caviglioli, O., & Harris, I., *Think it – Map it!: How Schools use Mapping to transform Teaching and Learning*, Network Educational Press, Stafford, 2003, pp. 14-21 & p. 87, for an introductory discussion of the recent research of Hopkins *et al* and its relevance to mapping.