

# **The Use of Concept Maps for Collaborative Knowledge Construction**

**An investigation**

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**Centre for Excellence in Work-Based Learning**

**for Education Professionals (WLE),**

**Institute of Education, University of London**

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## Executive summary

This paper describes the development of methodologies for using multidimensional concept mapping as a data collection method, and as a medium to stimulate the creation and dissemination of collaborative knowledge. These concept maps were collected during an initial series of iGatherings organised by MirandaNet Fellows<sup>1</sup> in the context of work-based learning for education professionals. The first stage of this programme was designed on the MirandaMod model<sup>2</sup>, an informal, loosely structured unconference<sup>3</sup> of like-minded educators to share ideas about the use of technology to inspire others.

This first stage of the research project aimed to

- develop a scoring system for collaborative multimodal concept maps relating to an analysis of the potential effectiveness for identifying concept development and the formation of praxis .
- post preliminary resources on the web as an example of the knowledge creation planned for Stage Two from September to March 2010.

The web-based program MindMeister<sup>4</sup> and Inspiration<sup>5</sup> were compared as the vehicle for this study for the creation and dissemination of knowledge, rather than simply for data collection.

Existing tools that have been used to analyse concept maps have either focused on a map's content in order to identify the level of a student's understanding of a particular area of knowledge (Ruiz-Primo, 2000; Park & Calvo, 2008), or have examined the complexity of the map itself (Mavers, Somekh et al., 2002, Harrison et al, 2002). Whilst these tools provided data about the complexity of the maps that had been created, they failed to provide data that related to the process of knowledge construction. They also concentrate on the learning of individuals rather than on collaborative learning.

What was needed, therefore, was a system that enabled the process of knowledge construction to be tracked, identified and analysed as it takes place within a professional group. The

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<sup>1</sup> <http://www.mirandanet.ac.uk> Last accessed 18<sup>th</sup> August

<sup>2</sup> <http://www.mirandanet.ac.uk/mirandamods/> Last accessed 18<sup>th</sup> August

<sup>3</sup> <http://en.wikipedia.org/wiki/Unconference> Last accessed 18<sup>th</sup> August

<sup>4</sup> <http://www.mindmeister.com>

<sup>5</sup> <http://www.inspiration.com/> Last accessed 18<sup>th</sup> August

functionality of the program enabled the elements of collaborative mapping process to be identified, together with the identity of those involved in the process.

In order to develop a new scoring methodology data sets were compiled that could be analysed across a number of dimensions. As a result of the analysis seven types of collaborative learning activities were identified in the creation of the maps: Adding; Editing; Inserting; Moving; Removing; Renaming and Repositioning. Each activity could be related to the relevant mapmaker, and the inter-related processes of constructing the map and building knowledge could be identified. The sequences of mapping actions were graphed, and the resulting graphs plotted the frequency of each activity across the progress of the creation of the maps. The graphs showed the inter-relationship of actions, particularly those of inserting, renaming and repositioning – the key activities in the process of knowledge creation.

The analysis of the maps in this initial stage indicates the potential effectiveness of the methodology in building a picture of the collaborative knowledge process, rather than the existing models of either content analysis of map complexity.

It can be further said that the complexity of the maps is directly related to the number of contributions by, and interactions of, the mapmakers. This initial study has revealed the complexity of the task of finding an effective methodology that will reflect the multiple perspectives from which this data is drawn. The preliminary outcomes raise a series of questions:

How effective are collaborative concept maps in creating a record of an event?

How do collaborative concept maps stimulate thinking and debate in a space and dimension other than the face-to-face environment or the virtual FlashMeeting?

How do collaborative concept maps facilitate new thinking that can support professional development and feed back into the institution?

In the next stage these questions will be used to inform a system for a more extensive evaluation of these multidimensional concept maps. The analysis of their effectiveness in identifying concept development and the formation of praxis in the context of work-based learning for education professionals will be part of this longer study, which should tell us more about the nature of collaborative professional learning.

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# The Use of Concept Maps for Collaborative Knowledge Construction

## *Introduction*

During the past ten years a number of programs have been developed that enable concept maps to be created on computers. Many of these have been used in schools, and they have facilitated the use of mapping as a curriculum tool. The ease of use and other affordances of the programs – colour, the use of images, embedding links, notes and other materials – have enabled users to explore the possibilities of the tool without the limitations imposed by paper-based applications. Recent developments in online concept maps have included collaboration between multiple users, instant communication during the creation of the map through programs such as Skype, and the export of the maps in a range of formats.

The ideas that we wish to explore in this paper are based on the outcomes of research undertaken during MirandaMods<sup>6</sup> run by MirandaNet, and iGatherings, the generic term we use for this activity in this paper when it is not run by MirandaNet Fellows. These events are simultaneous virtual and face-to-face debates between professional educators in a global context. This series of iGatherings were held during June and July 2009, and during a roundtable discussion held during a one-day conference on Work-based Learning at the WLE Centre, Institute of Education, University of London. These focused on the emerging informal processes by which theory can be transformed into practice by education practitioners themselves: the process of 'praxis' (Freire, 1970). These iGatherings were used to develop the methodology and collect data for this work-based case study, that would serve to inform a further six iGatherings to take place between September 2009 and March 2010. (See Appendix One for further details of MirandaMods and iGatherings.)

Multidimensional concept mapping has been used both as a data collection method, and as a medium to stimulate the creation and dissemination of collaborative knowledge within the profession (Preston 2009a, 2009b). The web-based program MindMeister (<http://www.mindmeister.com>) was used as the vehicle for this study for the creation and dissemination of knowledge, rather than for data collection. However, the findings from this series of iGatherings provide research data about the relationship between work-based learning and praxis and new knowledge and practice on concept mapping methodology.

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<sup>6</sup> <http://www.mirandanet.ac.uk/mirandamods/>

The multiple perspectives from which this data is drawn inform a system for evaluating multimodal concept maps. The analysis of its effectiveness in identifying concept development and the formation of praxis in the context of work-based learning for education professionals will be part of a longer study.

## **Background: the existing literature**

### **Semiotics, multimodality and concept mapping**

This investigation is based on the underlying conviction that learning, from the semiotic stance of meaning-making, can be defined as a connection between the making of signs and the making of concepts (Kress and Pachler 2007). In this paper we explore the potential of innovative modes of socio-cultural communication in learning by focusing on the analysis of one particular multimodal sign: the concept map.

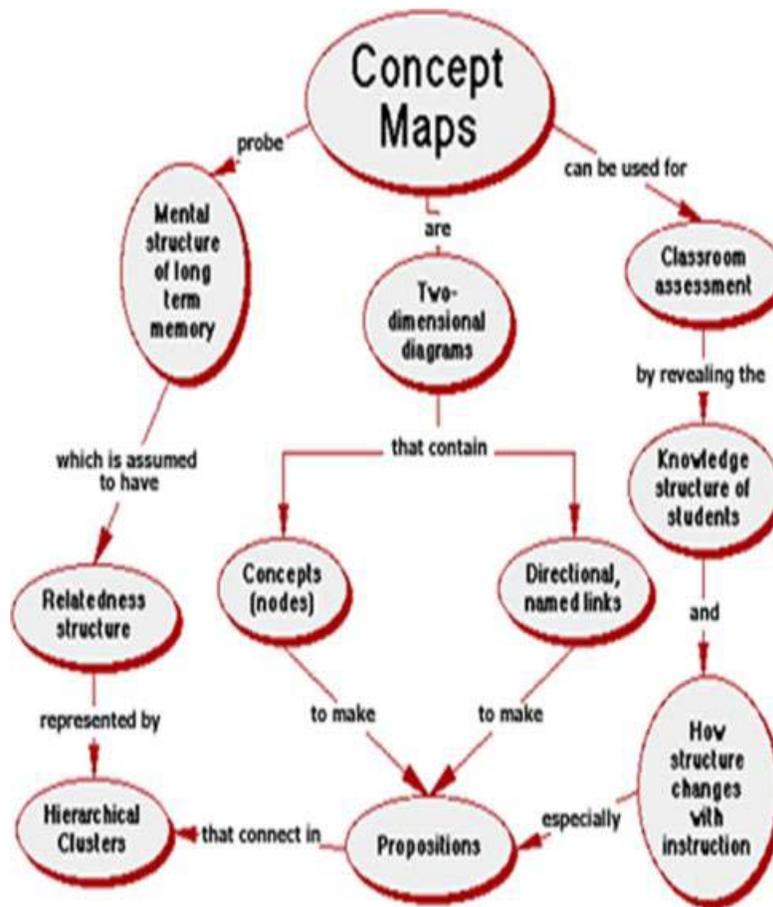
Multimodality theory is an emerging branch of socio-cultural semiotics. Multimodality (Kress and Van Leuwen 2001), a relatively new term, is used in this thesis in the context of multimodal theory, a branch of semiotics that was first defined as the science of the life of signs in society (Saussure 1916, translated 1974). Semiotics is now established as an all-encompassing term for the study of any kind of sign that is used in a society or culture to communicate meaning. Signs can be realised in many different modes including sound, animation, graphics, gaze and gesture. Signs are often, therefore, described as multimodal and the capacity to read these signs as multimodal literacy (Jewitt and Kress 2003). The influence of multimodality is increasing in this digital age in understanding and defining learning priorities.

Multimodality opens up opportunities to develop capacity in multi-literacies. This concept is defined by Jewitt (2002, 2003) as the understanding that meanings are made, distributed, received, interpreted and remade in interpretation, through many representational and communicative modes – not just through language – whether as speech or as writing. Multimodal theorists have an important role to play in helping teachers to see the difference between traditional education where the associated literacy privileges writing and multimodal learning. Controversially, multimodal theorists understand all modes as equal in their potential for meaning-making, even though images dominate in some texts and words in others. However, multimodal opportunities for meaning-making are enhanced by access to digital technologies.

A concept map, mainly associated with Novak (1990), is a way of organising ideas graphically, linking them – sometimes in an hierarchical fashion to show how individual ideas connect, and sometimes to form a more holistic approach to the linking of ideas in the shape of a network. The concept map is one kind of multimodal sign. ‘Reading’ a concept map requires multiliterate skills.



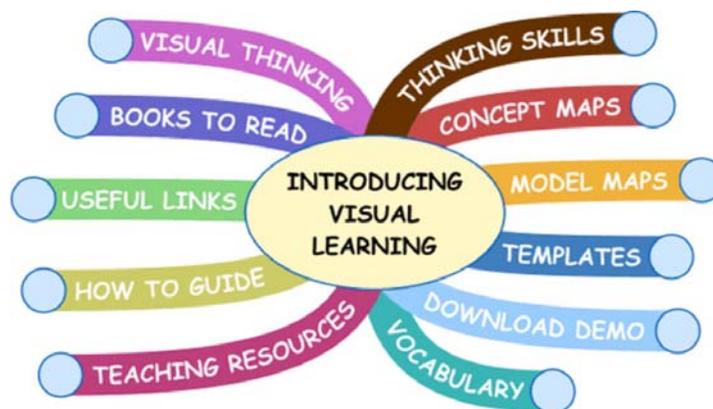
Figure 1: Novak Concept Map



### Mind Maps

The term 'mind map', trademarked by Buzan (2000), that radiates from a central node, is often used interchangeably with 'concept map'.

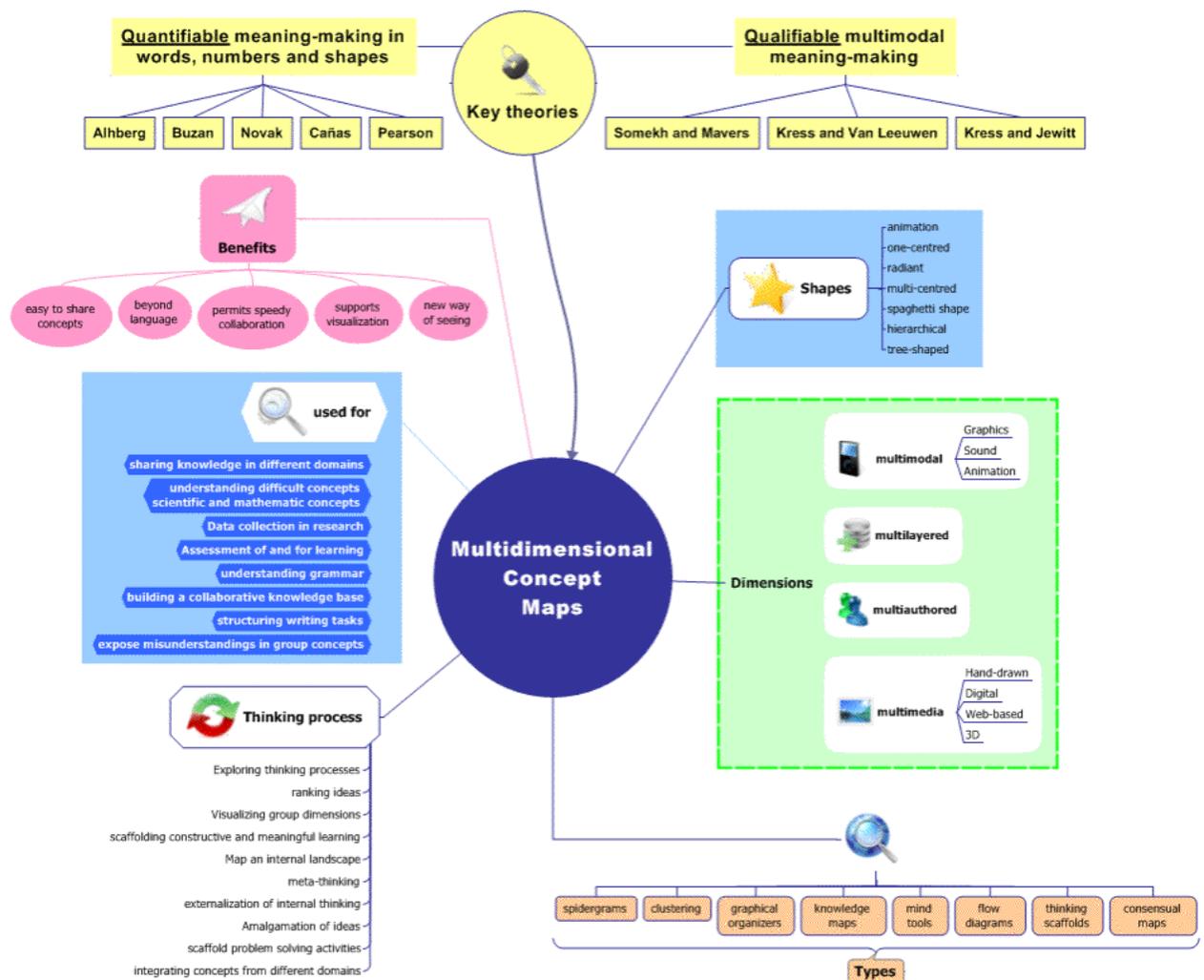
Figure 2: Buzan Mind Map



Concept maps have a long history. Even before language, human beings drew versions of concept maps on cave walls and carved them in stone to explain the relationships of ideas to each other (Ålhberg 2007). Concept maps are not universally intuitive, but this mode of expressing ideas is now widely used in education and business. Mapping is recommended to facilitate the communication of learnt, contested and new concepts. Learners and teachers benefit because concepts can be communicated rapidly, accurately and effectively on one sheet of paper (or screen) by an individual or by a collaborative group.

Map-makers label concepts by encompassing words or phrases in circles or squares called nodes. The relationship between the concepts is shown by connecting lines, called links, which are sometimes labelled with propositions as shown in the following figure, 'A concept map about concept maps'.

Figure 3: A Concept Map about Concepts



## **Multimodality and multi-dimensional maps**

The potential manifestations of concept maps range from a sketch on a table napkin to a dynamic, remotely multi-authored map displayed in hyperlinked layers across the Internet. It is the potential in knowledge creation of remote multi-authored collaborative maps that is the subject of this research. In her study about the role of concept mapping in identifying teachers learning priorities, Preston (2009 in press) uses the term 'multi-dimensional' to emphasise specific multimodal affordances of digital maps, that can be remotely multi-authored and multi-layered. These affordances are highlighted because of the potential for innovative modes of collaborative meaning-making, knowledge creation and theory development that digital tools provide for anyone with access to computers and the Internet. These interactive opportunities are likely to have significant socio-cultural impact on communication within the kinds of professional communities under discussion in this study. The mono-literate capacity required by traditional reading and writing systems is not enough to create or read a multi-dimensional map, which is why the emergent theory of multimodality provides underpinning for this analysis.

## **Building a Community of Practice**

The emergent use of collaborative maps created the opportunity to build a Community of Practice (CoP) of educators as co-researchers in another study. The subject under discussion was an investigation of ICT tools and resources for Future Teachers (Leask and Preston 2009, in press). This current study for the WLE Centre extends this work in an effort to understand the dynamics of online social learning.

The MirandaNet community that is developing these collaborative maps is a rare example of a 'community of practice'. MirandaNet, as a CoP, makes use of social interaction as a learning approach. The term, 'community of practice', first coined by Wenger and Lave (1991), exemplifies a greater will to collaborate in learning underpinned by a social interaction tradition (Wenger, McDermott et al. 2002). By 2004, Wenger is explaining how digital technologies can enhance collaboration in business. In education similar developments of CoPs have emerged that have been assisted by the development of electronic networking and, more recently, familiarity with social networking (Preston 2008a).

As CoPs become e-mature an interesting form of learning is emerging. This is collaborative, community-focused and voluntary, in contrast to focusing on the learning progress of individual learners towards accreditation for a course of study. MirandaNet Fellows, in their development of several professional networks, have developed two related theories about this kind of collective learning that expand Wenger's vision about CoP practices. These are Communal Constructivism and Braided Learning, that allude to different aspects of collaborative knowledge creation.

Communal Constructivism emphasises teachers' knowledge building role as they work together, often across national boundaries (Lave and Wenger 1991; Wenger 1998; Holmes, Tangney et al. 2001; Leask and Younie 2001; Wenger, McDermott et al. 2002; Leask and Younie 2002; Stuckey 2005). Much of this communal cross-national work is online. Braided Learning is an emergent theory that is tracing how dynamic knowledge creation works in a collaborative online context (Haythornthwaite, 2007; Preston 2007; Preston 2008).

In Braided Learning the textual basis of an email community affords visibility of ideas, and creation of braided and reflective texts. The members can use these texts to create interim summaries and repositionings through braided texts and continue these compositions into more refined braided artefacts that reach outside the community (Preston 2002; Preston and Holmes 2002; Cuthell 2005). MirandaMods utilise these technologies to set up a professional learning event that relies on social interaction and blurs the boundaries between work-based learners and researchers. As a result classroom teachers in MirandaNet also appear as 'action researchers', 'practice-based researchers', and 'tutors' and 'mentors' of other teachers. Zeichner refers to the intellectual zone we create in the MirandaMod as The Third Space (Zeichner 2008).

The expectation is that the mapping process will become a more explicit process within the CoP and that members will take different roles in this process as they have done in developing textual conversations on email. However, this process has taken about four years in the email discussion and, therefore, concept mapping, which seems to offer a more effective way of collaborative knowledge creation will take time to be understood and embedded within the CoP practice.

### **Zones of Learning**

In this current research the events that have hosted the map-makers have been varied, but they have all involved professional work-based learners as players. The expectation is that this study will give rise to a new kind of braided learning publication that is more like a mash-up<sup>7</sup> than a linear document. As the project progresses it is intended that the map-makers will themselves learn how to make the most of the potential in this professional meaning-making opportunity. The more explicit the process, the more complex and meaningful the knowledge creation process is likely to develop in the CoP. It is important to note that the map-makers are co-researchers not the subject of a research project.

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<sup>7</sup> <http://en.wikipedia.org/wiki/Mashup>

## Scoring concept maps

One way in which concept maps have been evaluated is by analysing the data and calculation a score: this indicates the level of complexity of the map. A formula was developed by the UK government ImpaCT2 team, who analysed hand-drawn concept maps to score pupil achievement (Mavers, Somekh et al., 2000). The score, expressed as a ratio, is calculated by dividing the number of nodes by the number of links. In a simple map each link would only have one node attached. This would produce a ratio of 1:1. As maps become more complex, so the second number increases in magnitude.

But what, exactly, does this ratio tell us about the learning that is taking place, or the knowledge that is being constructed? If the scoring technique is used as a classroom assessment tool, and the purpose of the assessment is to ascertain the level of knowledge of the map-maker, then it is likely that the student with a score of 1:1 has a simpler and less sophisticated understanding of material and concepts than one with a score of 1:10. However, where a concept map is used to capture knowledge created during the course of collaboration, then these assumptions become redundant. What is needed, therefore, is a process that can be used to analyse the process and outcomes of such a collaborative knowledge-building activity.

Nevertheless, it is useful to identify some of the key elements used in scoring maps. The majority of systems for scoring concept maps use some, or all, or these criteria:

- hierarchy – in which the concepts are sequenced in an appropriate order;
- semantic congruence – the ways in which concepts relate to one another;
- links between levels and/or concepts. These links can be internal or external – URLs, quotations etc;
- semiotics and creativity – organisation, images and language.

For the purpose of establishing an initial baseline score from which each map could be investigated a variant of the scoring system used during the ImpaCT2 study was used. The total number of links was divided by the total number of nodes, sub-nodes and connectors. This was then rounded to the nearest whole number to produce a ratio.

## Quantifying the maps

For the purpose of establishing an initial baseline score from which each map could be investigated a variant of the scoring system used during the ImpaCT2 study was used. The total number of links was divided by the total number of nodes, sub-nodes and connectors. The result was then rounded to the nearest whole number to produce, as a ratio, the connectivity score for each map. We shall return to these scores later. The map produced in the final section of the project, ICT CPD: Fit for Purpose? was not scored in this way.

**Table 1: Quantifying the Maps**

Map title	Connectivity score	Links	Nodes	Connectors
Educational Blogs	1:5	14	72	3
Educational Blogging	1:4	10	37	
Should teachers blog?	1:3	31	82	
Developing international partnerships in WBL	1:5	15	77	1

## Collaboration on the maps

During the MirandaMod Blogging meeting on June 19 three sets of maps were produced: one during each session. The first two sessions were face-to-face, and the maps constructed by a number of the twelve participants. The iGathering, (a simultaneous virtual and face-to-face debate between professional educators in a global context) was held from 1800 hrs until 2100 hrs and had as the subject 'Should Teachers Blog?' It involved some twenty-six online and twelve face-to-face participants – thirty-eight in total. Subsequent follow-up work continued after the event until June 24.

The 'Educational Blogs' map was produced by ten collaborators, 'Educational Blogging' map involved eleven collaborators, and 'Should Teachers Blog?' by nineteen.

The co-construction of a map involved three main actions – inserting; editing; repositioning – links and nodes. Only when these had been satisfactorily completed could nodes be linked.

'Educational Blogs' was the only map in which nodes were linked.

The penultimate map being studied - the final one that was scored – was constructed during one of the sessions in the WLE Centre Annual Conference – Work-based learning: what is it really all about? The conference session was 'Developing International Partnerships in Work-based Learning'. The majority of the map was constructed during the roundtable discussion. Amendments and additions were made in the five days after the meeting. Eight of the participants contributed to the map. The final map was produced between 1200 and 1500 on July 28 2009 by a group of advisers at the WLE Centre, looking at the issue 'ICT CPD: Fit for Purpose?'

The MindMeister maps were exported as document outlines, from which Wordle tag clouds (<http://www.wordle.net>) were generated. The more frequently words are used, the more its size increases, and the more frequently it appears in the cloud. This also reflects the status of the word in the hierarchy of the outline.

The following section takes each MindMeister map and examines the ways in which it developed, from its initial to its final stages.

Two concept maps were produced: one individually using Inspiration, the other collaboratively using MindMeister.

Figure 4a: Educational Blogs (Inspiration)

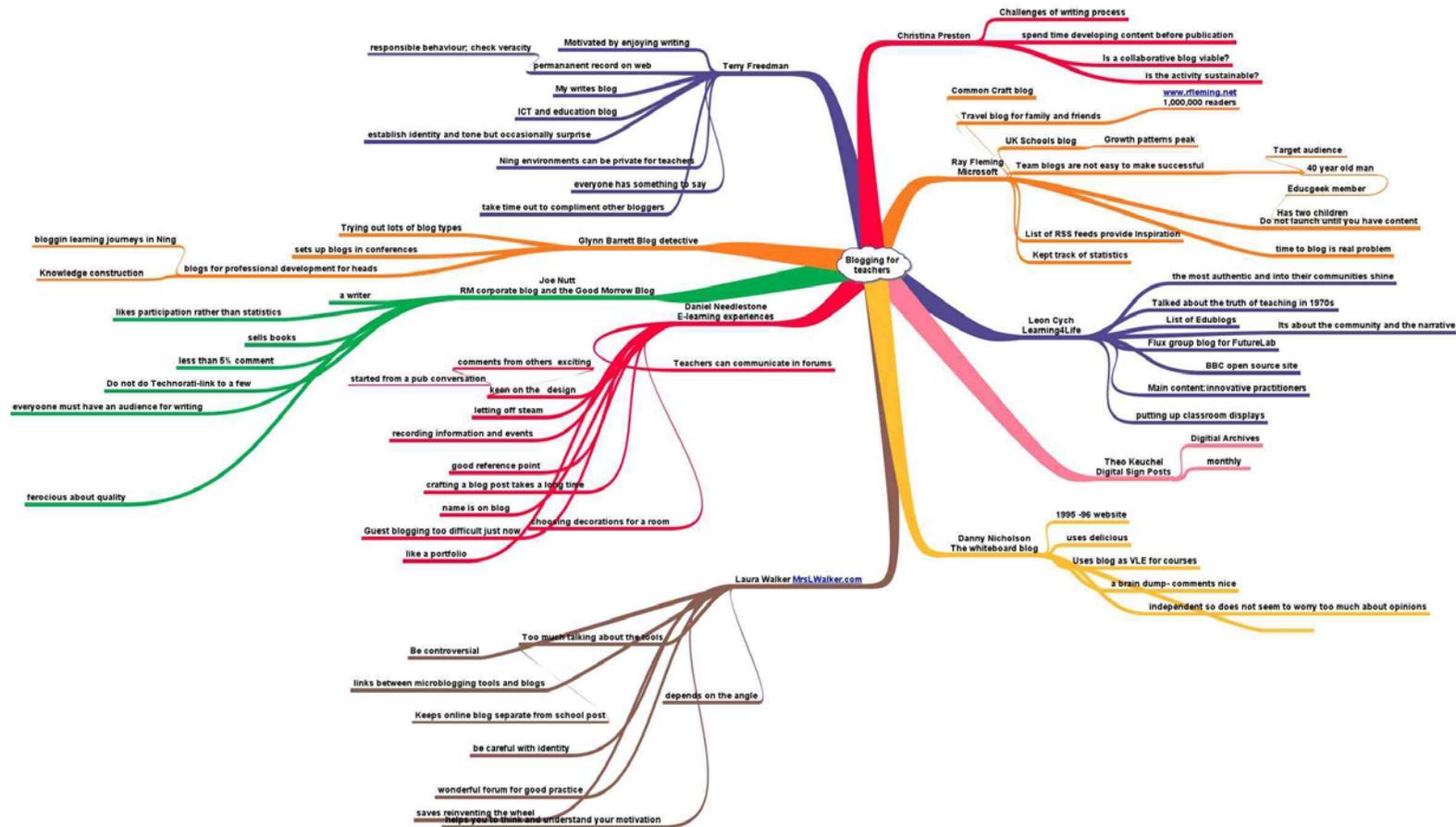
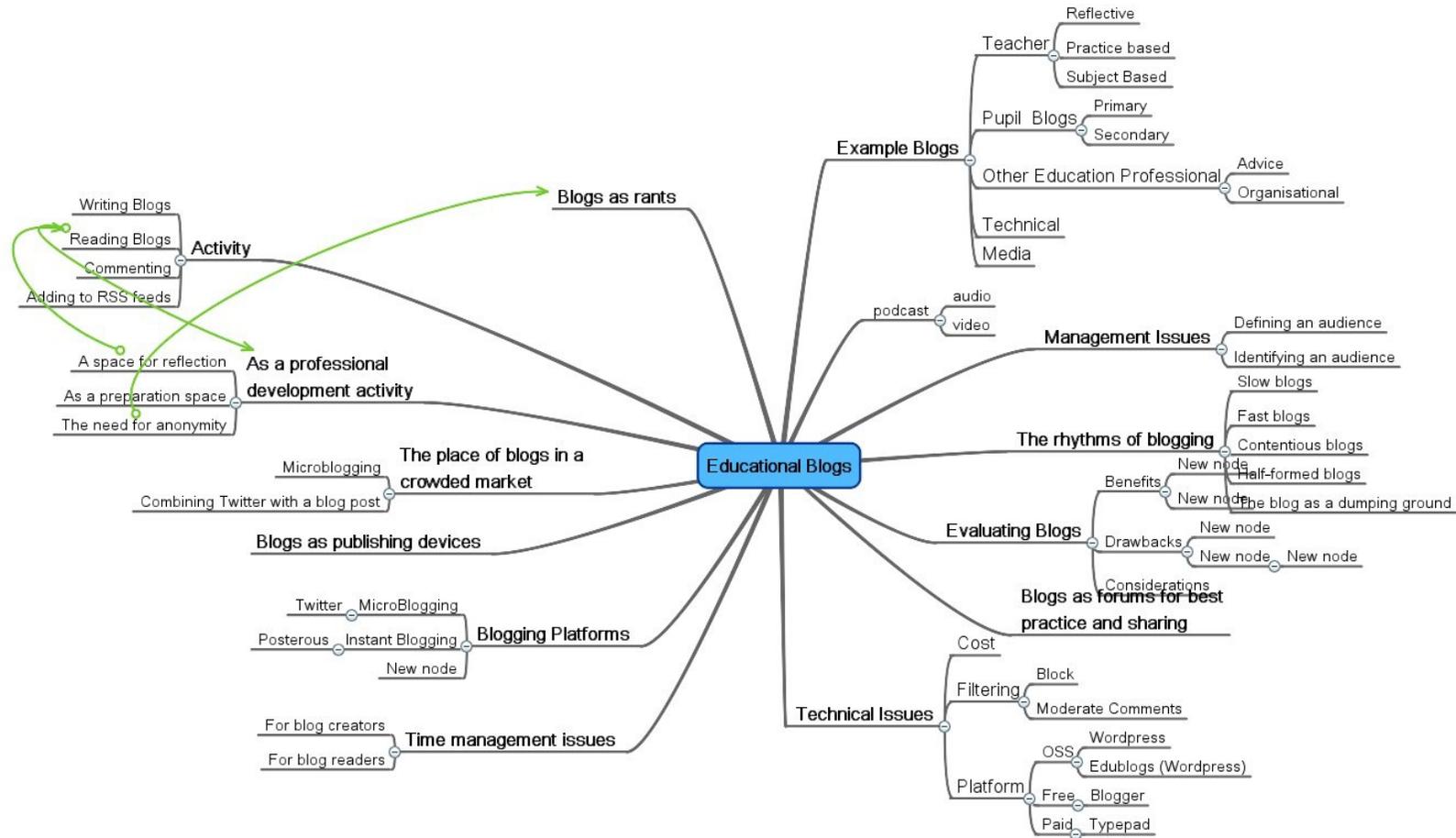


Figure 4b: Educational Blogs (MindMeister)

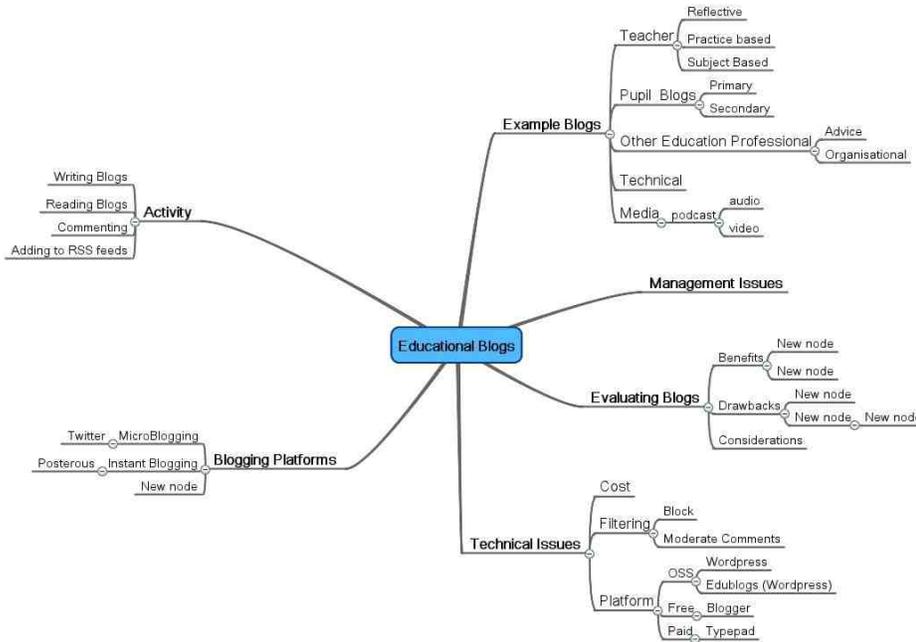


The topics in this second map can also be represented visually, in a Wordle image. Frequency of use results in an increase in size of a word, and its place in the hierarchy of the outline. This give the 'reader' an instant view of the value of the knowledge in the map mashup from their perspective.

Figure 5: Educational Blogs Tag Cloud



Figure 6: Developmental Stages: Stage One



This first stage of the map identified the initial elements. The second stage added much more detail, with a considerable amount of detail being added as sub-nodes.

Figure 7: Stage Two

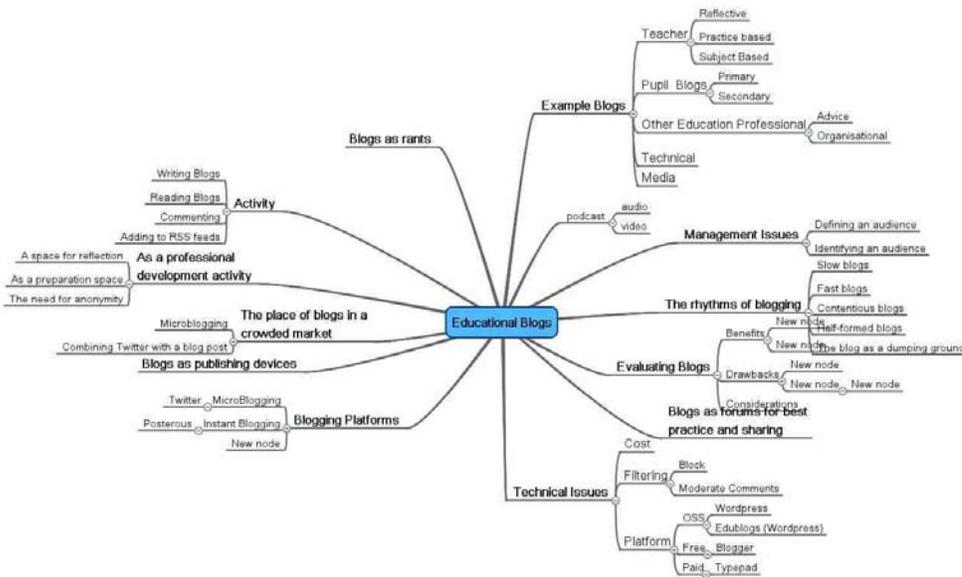
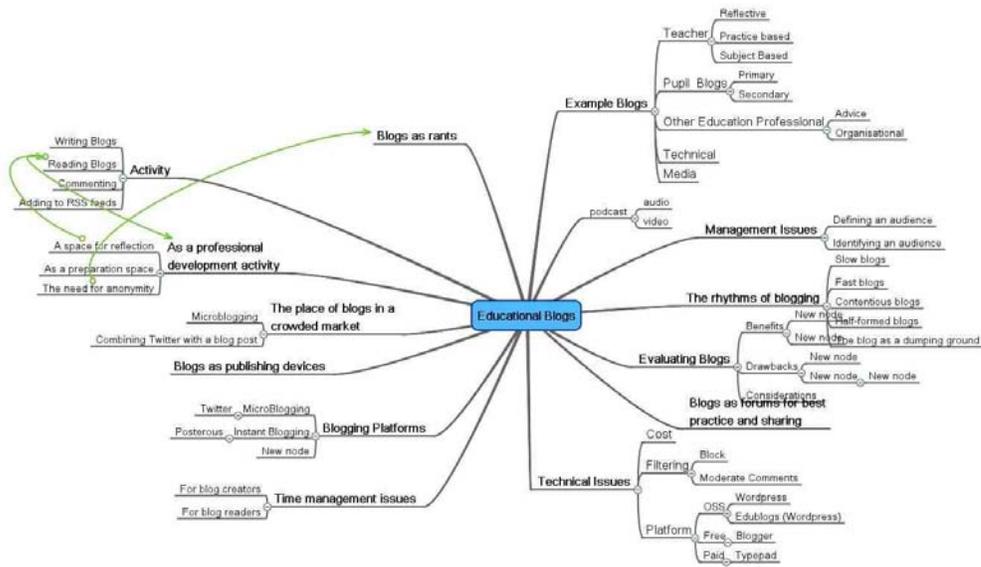


Figure 8: Stage Four



During the final stages cross-links were made from one node, or sub-node, to others.

## Educational Blogging

Two concept maps were produced: one individually using Inspiration, the other collaboratively using MindMeister.

Figure 9a: Educational Blogging (Inspiration)

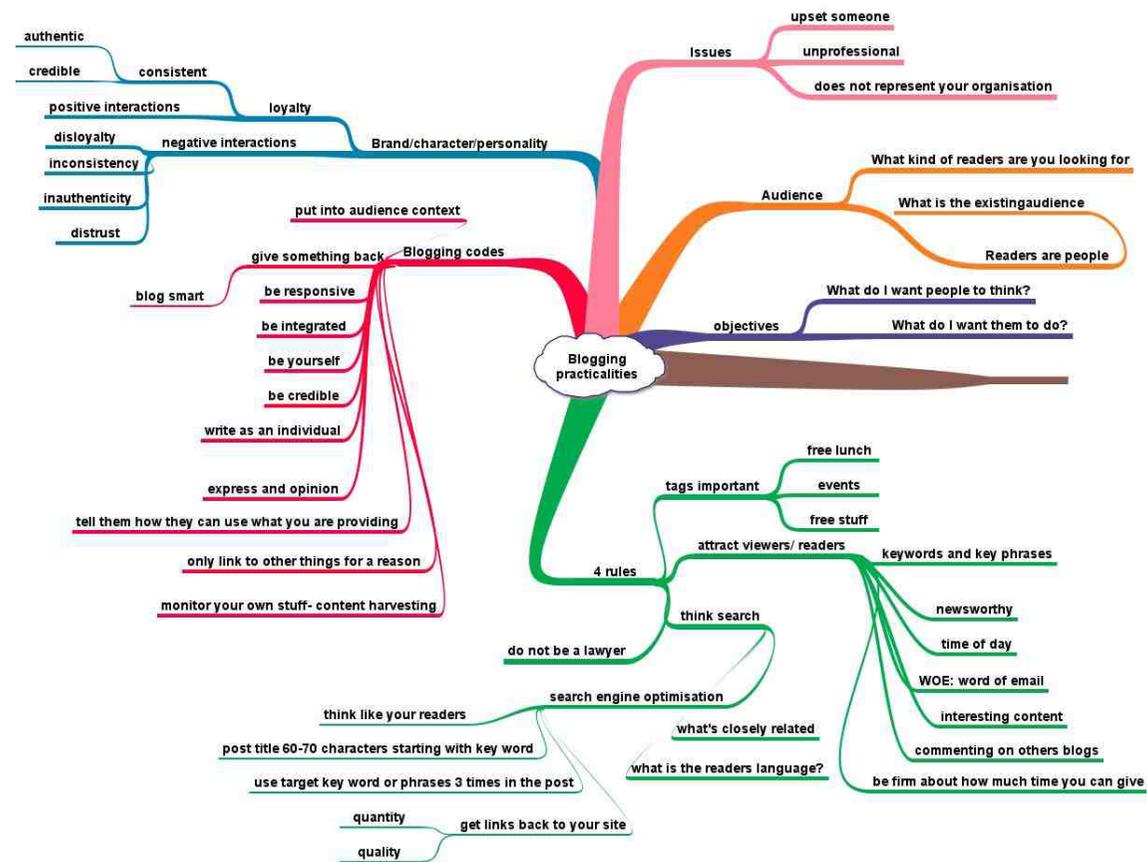
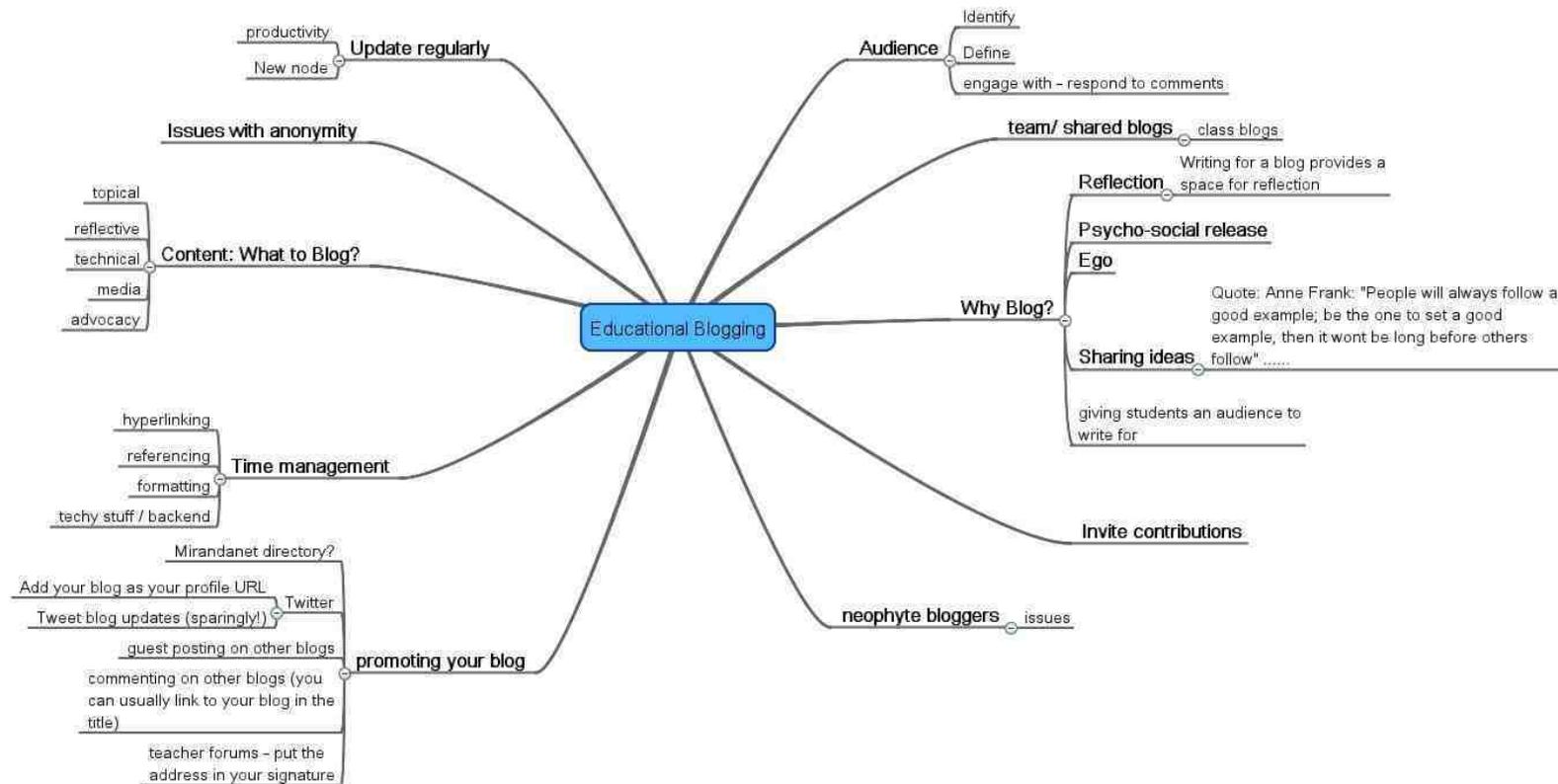


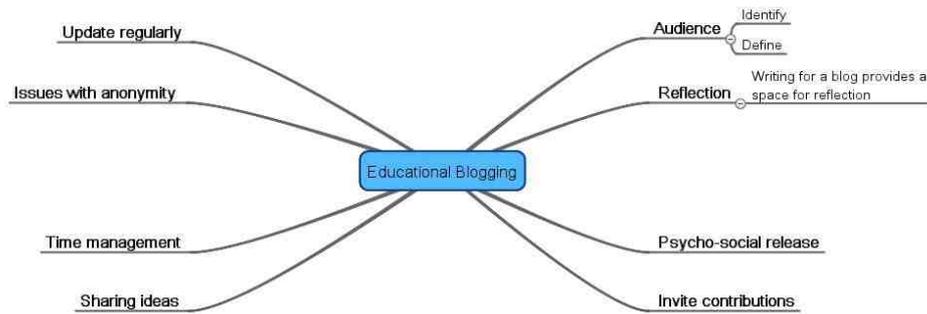
Figure 9b: Educational Blogging (MindMeister)



It can be seen that the second, collaborative, map lacks the detail of that produced individually using Inspiration.

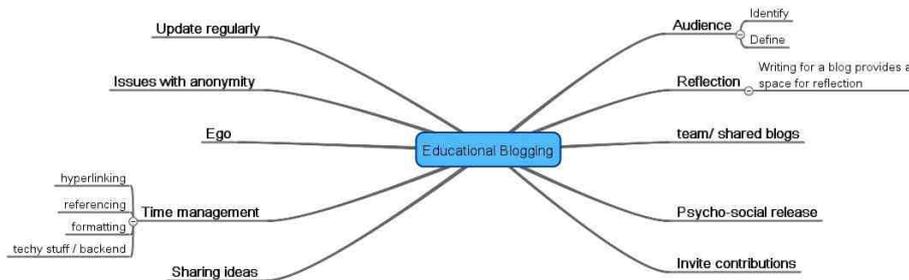


**Figure 12: Stage Two**



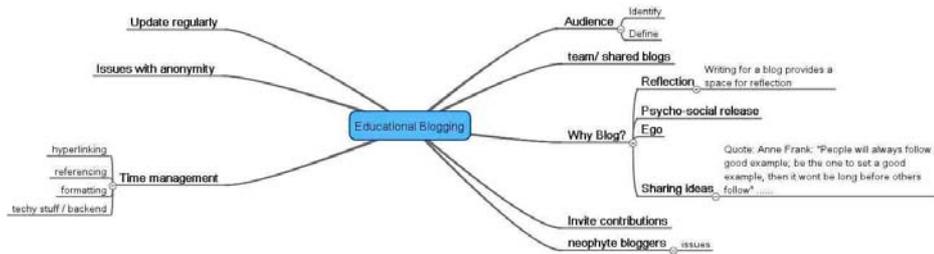
Additional nodes are then added, and sub-nodes built up.

**Figure 13: Stage Three**



The links (or branches) then go through a process of rearrangement.

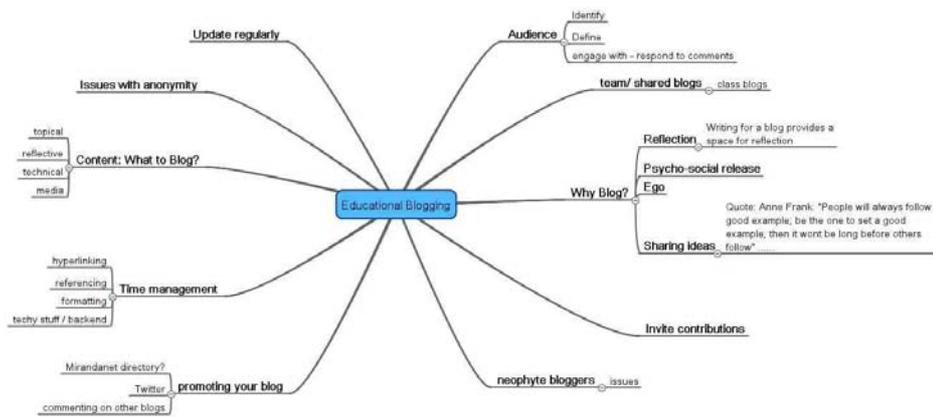
**Figure 14: Stage Four**



Further sub-nodes are added as the map is built up.

Additional links are added and the existing ones repositioned.

Figure 15: Stage Five



As the map develops, so the detail fills in. Although the map might appear to conform to a left/right orientation, it is difficult to state with any certainty that the arrangement of the map reflected left brain – right brain preferences in terms of either content or layout. This is an area that needs much more detailed analysis.

Figure 16: Stage Six

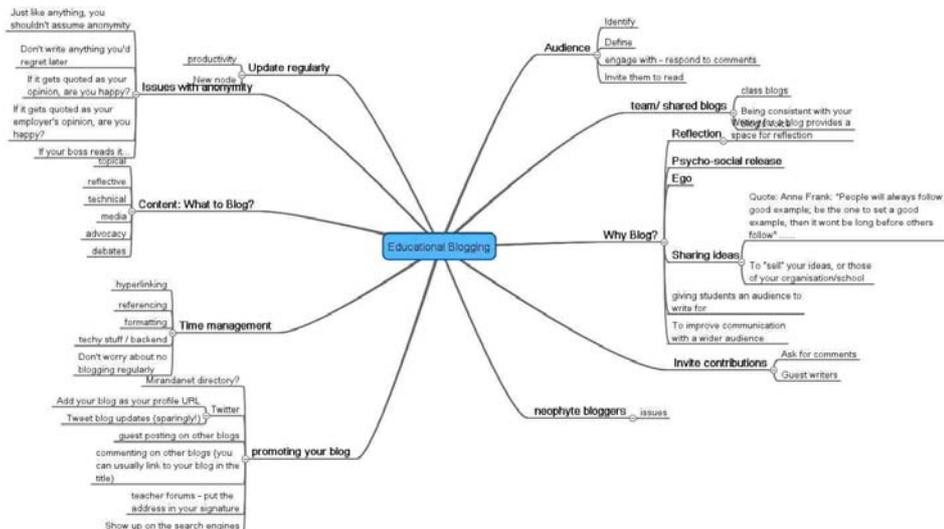


Figure 17: Should Teachers Blog?

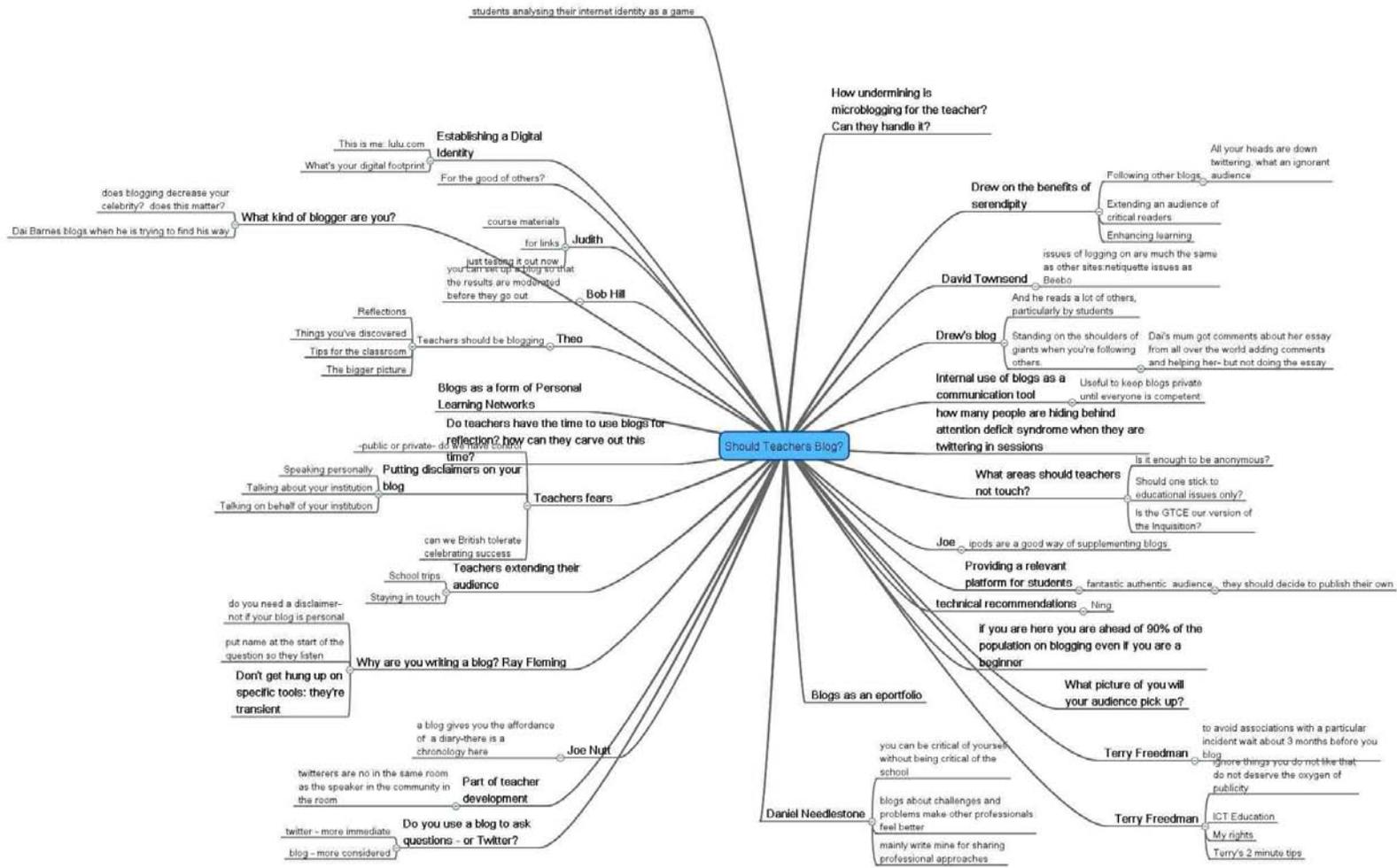
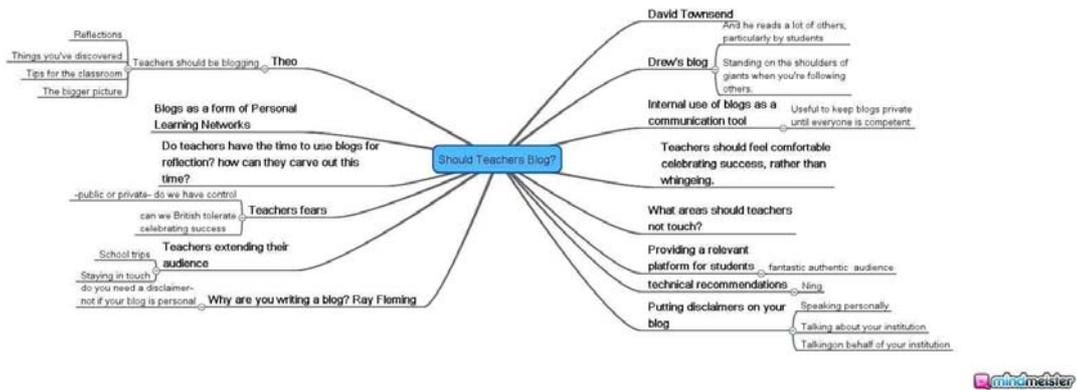


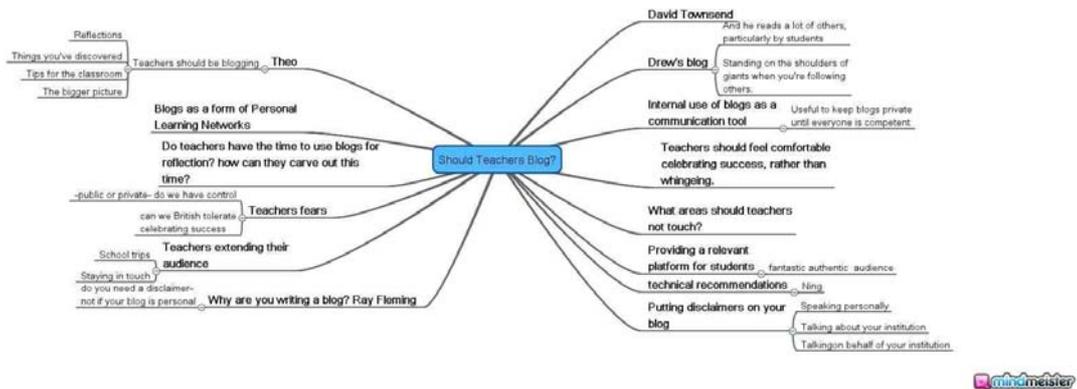


Figure 20: Stage Two



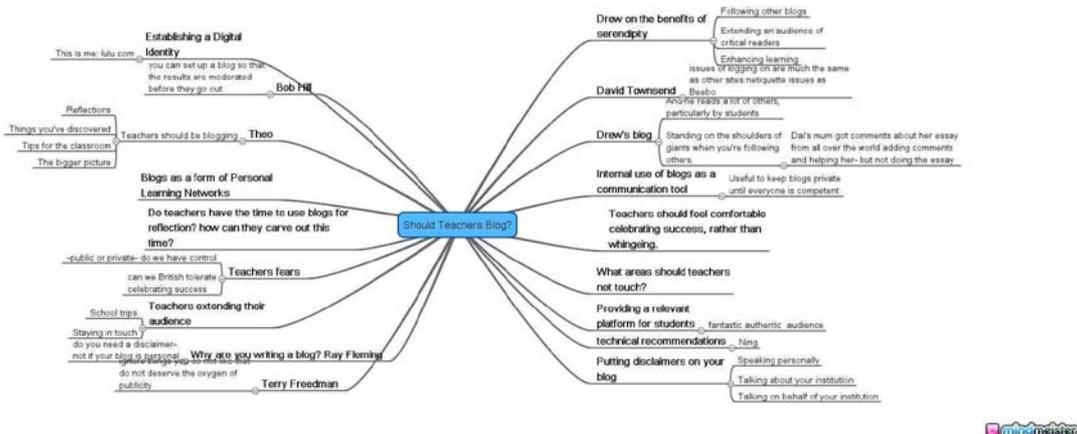
The second stage saw a flurry of activity, with interspersed contributions from a number of participants.

Figure 21: Stage Three



Nodes and sub-nodes were added without much significant rearranging at this stage.

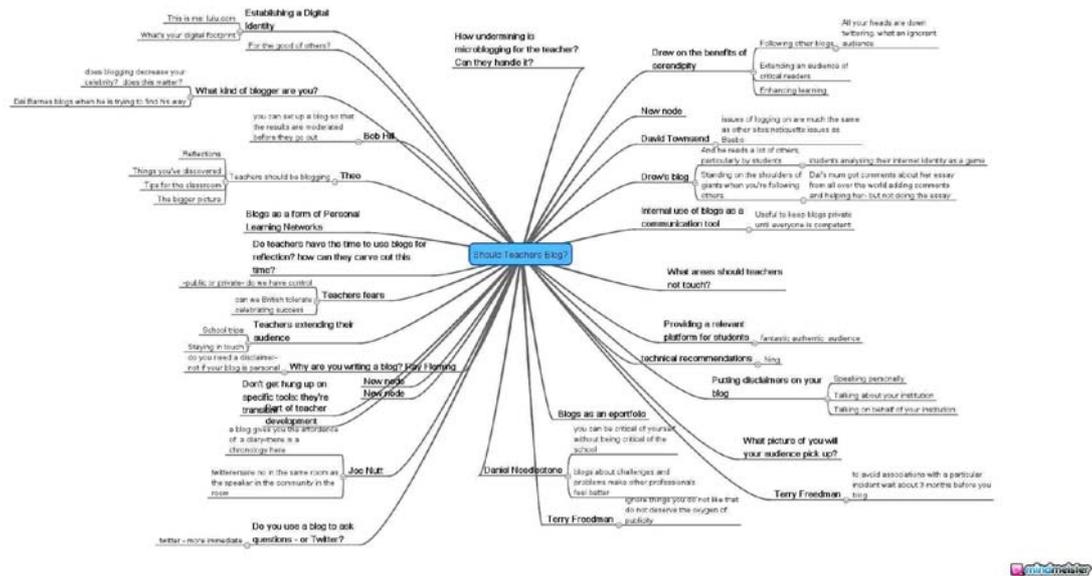
Figure 22: Stage Four





At this stage in the process the general effect was that of trying to prune and shape a bush – at the same time as other contributors were adding new growth. When users are working on the same mind map in brainstorming mode every change is replicated instantly to other editors' screens via the MindMeister server.

Figure 25: Stage Seven

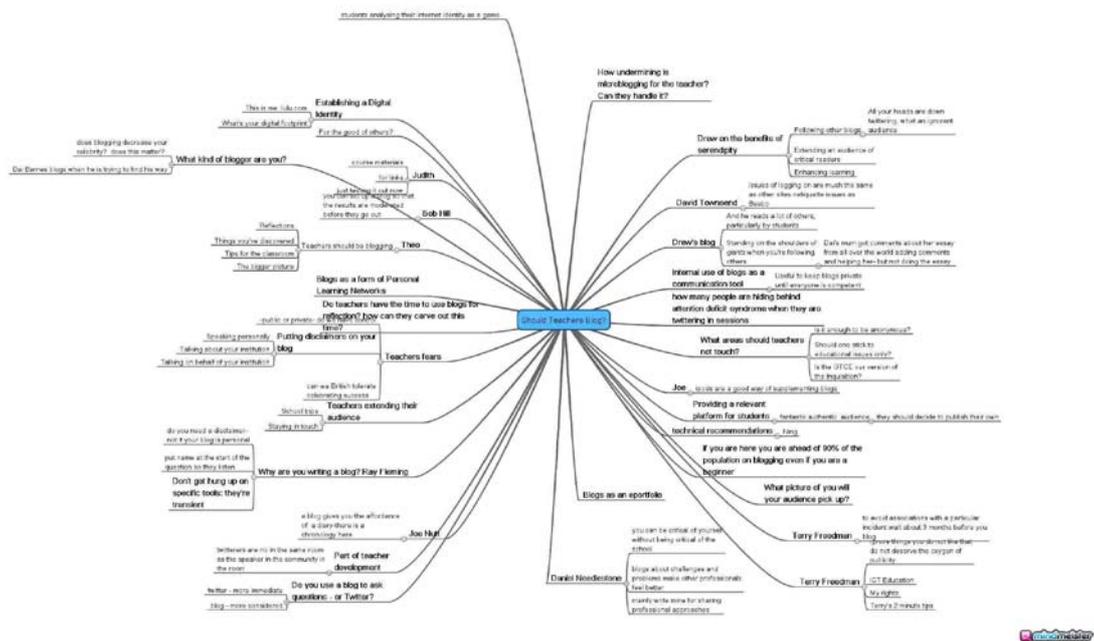


There is inevitably a time lag, the extent of which is dependent on bandwidth and individual connection speed – hence the apparent clutter that can be seen on the maps from time to time.

This 'clutter' effect can be clearly seen in these maps. It is particularly evident in the map that illustrates Stage Eight, with the link and node placed at the far top left, in an attempt to avoid this.



Figure 27: Stage Nine



This final stage was the result of rearrangement that took place in the days following the MirandaMod. The final map is more clearly sequenced.

Figure 28: Developing International Partnerships in Work-Based Learning

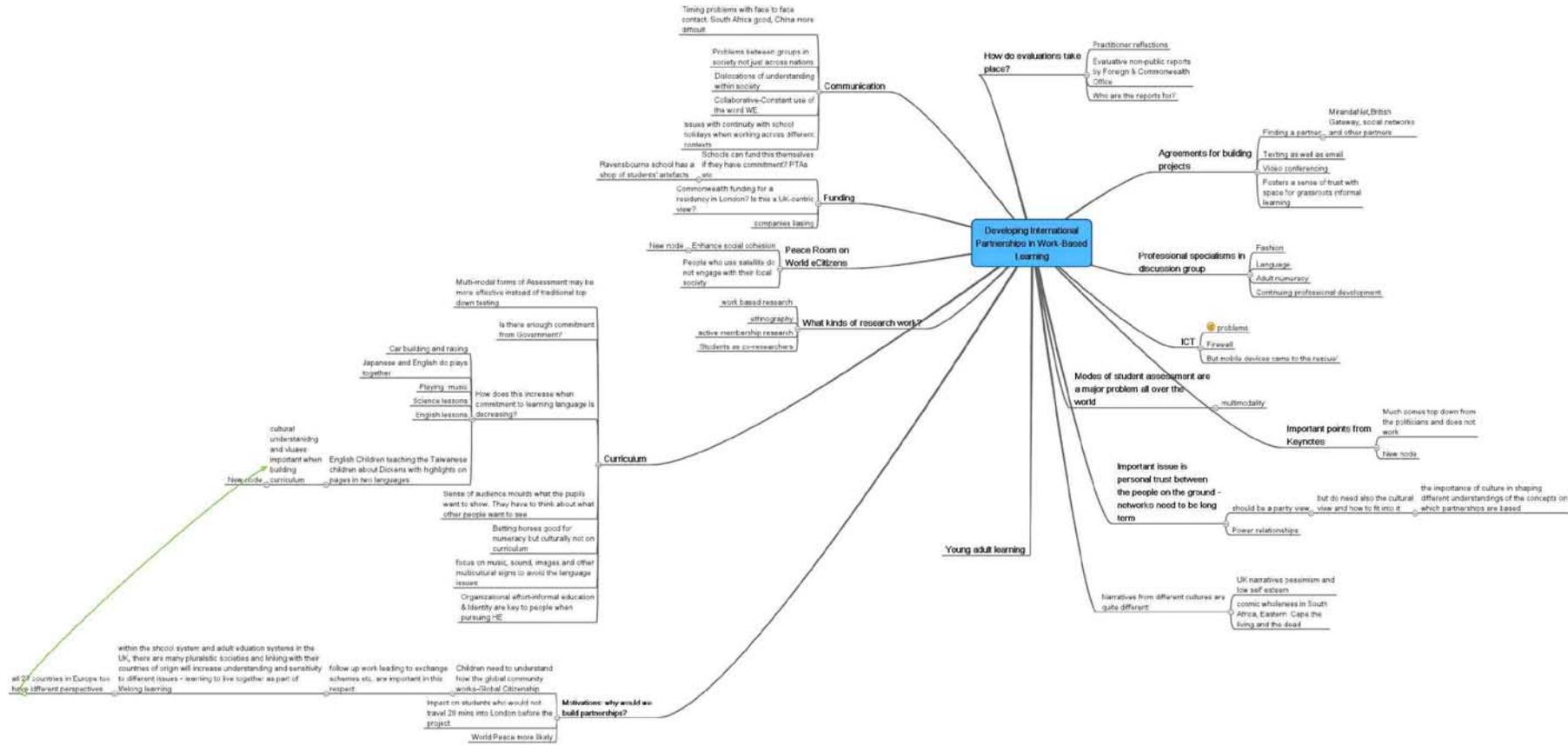
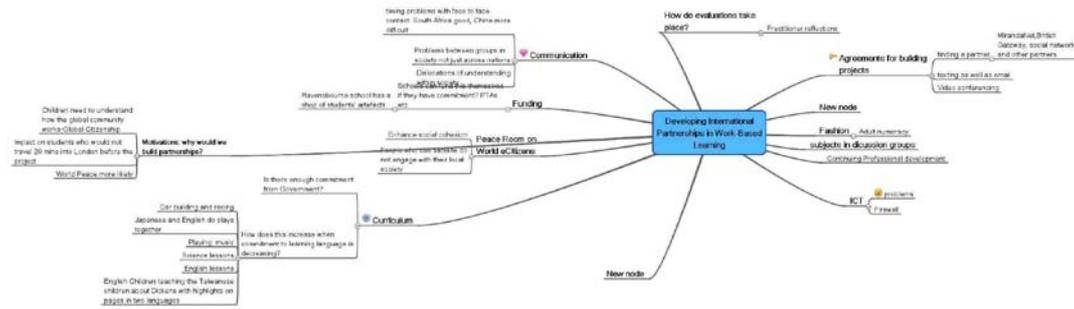


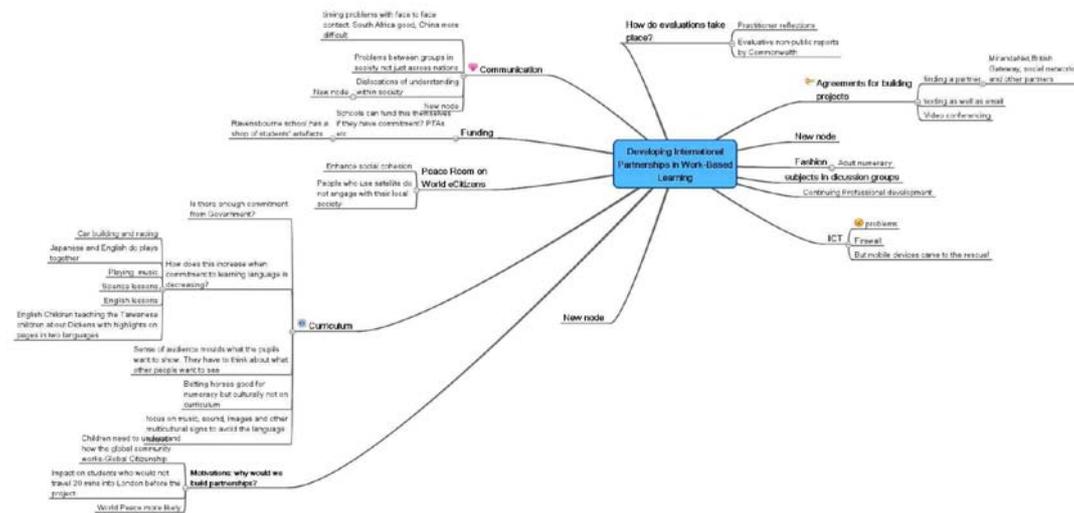


Figure 31: Stage Two



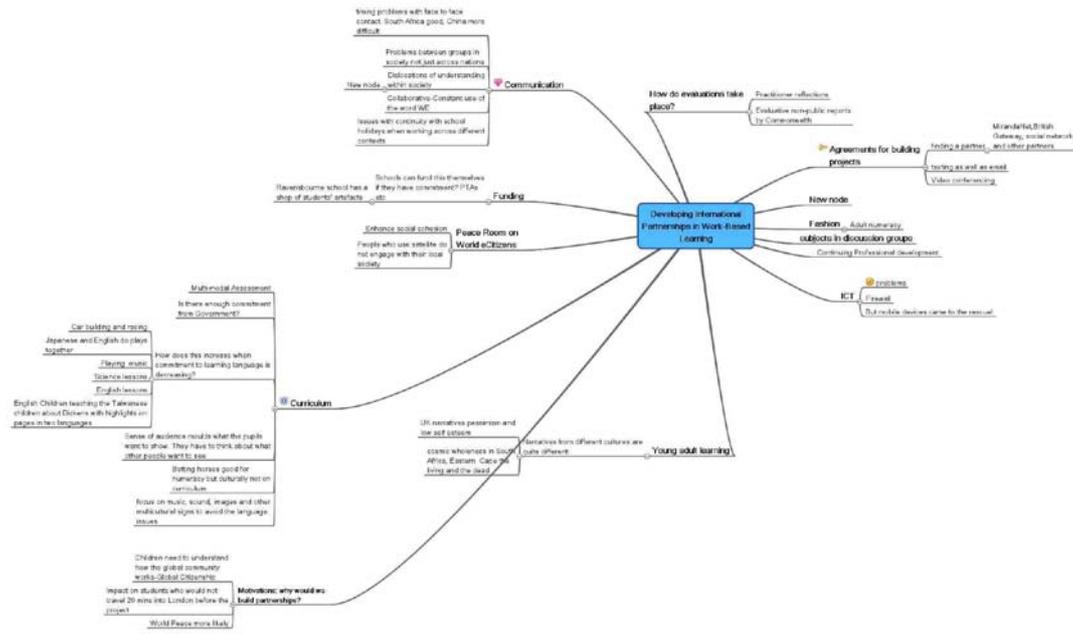
This stage – and that following – added more information to the links

Figure 32: Stage Three



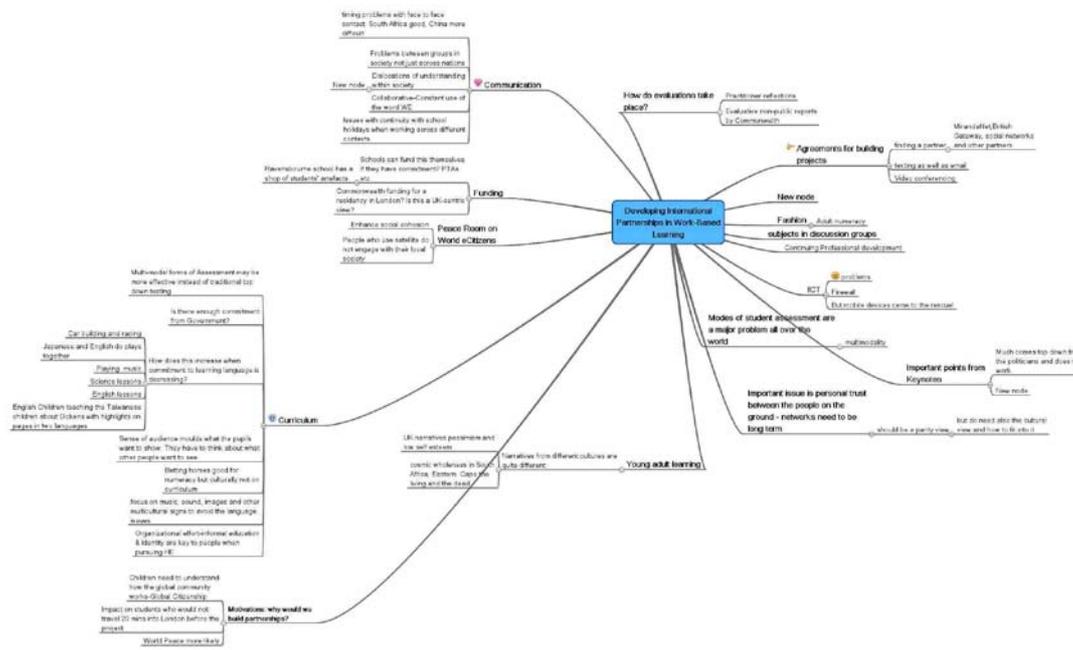
At this stage the first reorganisations took place, as data was contributions from one side of the map to another.

Figure 33: Stage Four



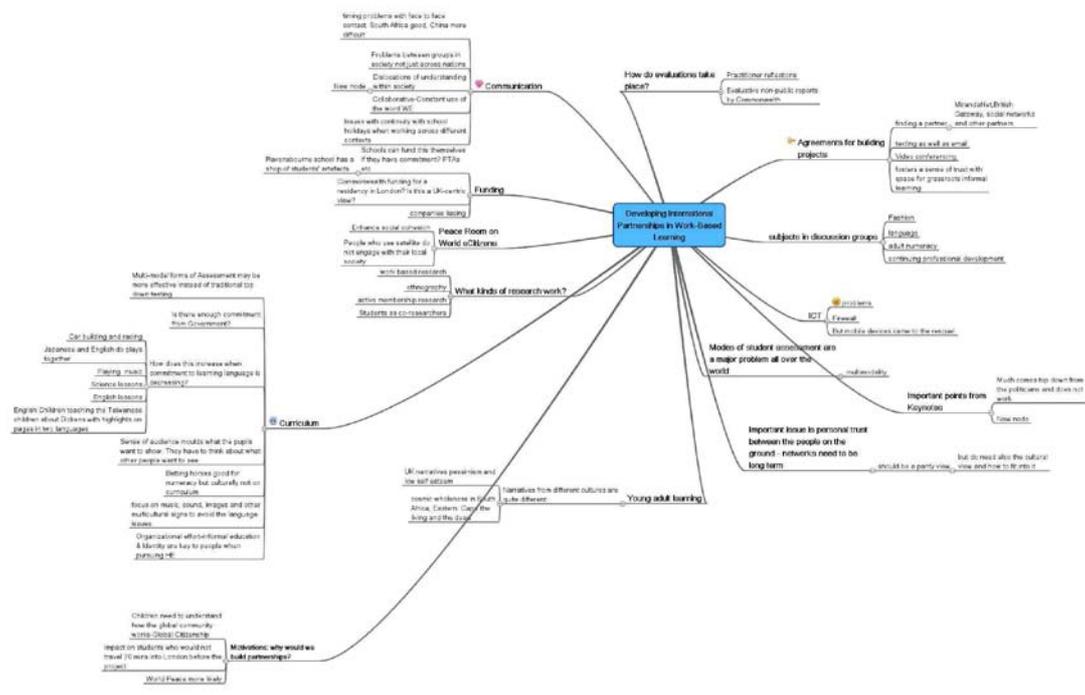
The balance between one side of the map and the other begins to change.

Figure 34: Stage Five



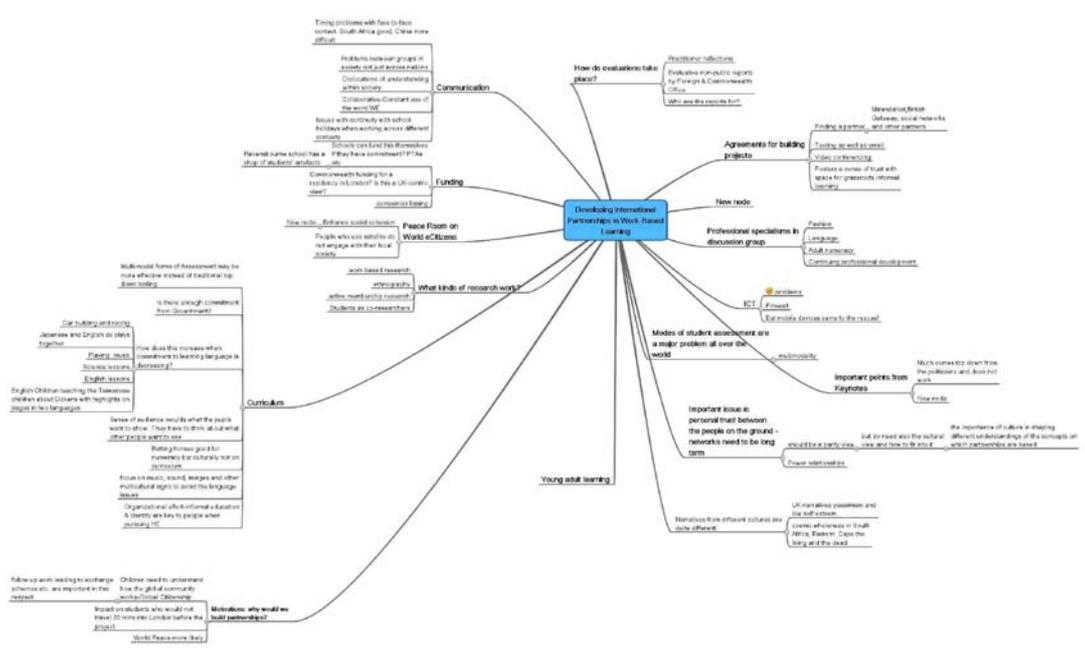
As further nodes and links are added the concentration is still, however, on the left side of the map.

Figure 35: Stage Six



At this point in the process further detail is added to the right side of the map, and the picture becomes more evenly balanced, as can be seen in Stage Seven.

Figure 36: Stage Seven



This final stage of the session produced a map that was subject to final rearrangement in the days following the conference.



## Statistical analyses

After the first phase of mapmaking, June 19 – July 9, the maps were analysed using a variant of the ImpaCT2 scoring system. The total number of links was divided by the total number of nodes, sub-nodes and connectors. The result was then rounded to the nearest whole number to produce, as a ratio, the connectivity score for each map.

The map produced during the final session, ICT CPD: Fit for Purpose? was not subject to this analysis.

**Table 2: Connectivity scores**

Map title	Connectivity score	Links	Nodes	Connectors
Educational Blogs	1:5	14	72	3
Educational Blogging	1:4	10	37	
Should teachers blog?	1:3	31	82	
Developing international partnerships in WBL	1:5	15	77	1

The maps were then examined to determine the level of activity on either side of each map. New connectivity scores then were calculated.

**Table 3: Distribution of scores across the maps**

Distribution across the maps								
	Left				Right			
Map title	Connectivity score	Links	Nodes	Connectors	Connectivity score	Links	Nodes	Connectors
Educational Blogs	1:4	7	28	3	1:6	7	43	
Educational Blogging	1:5	5	23		1:3	5	17	
Should teachers blog?	1:3	16	45		1:2	15	35	
Developing international partnerships	1:7	6	43	2	1:4	9	32	

One reason for examining the level of activity on each side of the maps was an initial hypothesis, developed from an examination of the final versions of each map, that the visual representations could be assigned to left brain/right brain activities (Luria, 1966; Gazzaniga et al, 2002). If left brain activities could be described as analytical and right brain activities as wholistic, then the nodes in each part of the maps could be broadly assigned to those categories. Whilst the descriptions could in general fit the assumption the classifications were, however, insufficiently robust to support the hypothesis.

**Table 4: Left Brain/Right Brain Map Content**

<b>Correlation between map content and left hemisphere/right hemisphere brain functions</b>		
<b>Map title</b>	<b>Left (Analytical)</b>	<b>Right (Wholistic)</b>
Educational Blogs	7	7
Educational Blogging	5	5
Should teachers blog?	13	14
Developing international partnerships in WBL	7	8

## **Interactions: analysing the activities**

It was decided that a more productive analysis could result from examining the process involved in creating the maps, and tracking the activities in which mapmakers engaged during their creation. These activities were therefore identified and analysed: graphs were produced for each map to illustrate the process. Five maps were analysed for this purpose: the initial four that had been subject to the scoring process, and the ICT CPD map from the final stage of the project on July 28.

### **Types of activity within each map**

Data was downloaded from each map: the interactions were then extracted and analysed. Seven types of activity were identified in the creation of the maps.

Adding – a note, connection, text or a style or format to text in the map.

Editing – changing the content of text in a node.

Inserting – a new node or sub-node.

Moving – text or data from one node to another.

Removing – deleting a node or a link.

Renaming – a node.

Repositioning – a node or sub-node from one area of the map to another.

For the purpose of analysis each activity was represented as a percentage of the overall number of activities within each map. The insertion of nodes, sub-nodes and links, and their repositioning, is the most frequent action identified in each map. Repositioning is the next most frequent activity. Editing was the least frequent activity, even though the mapmakers had a number of days after each event to continue working on the maps – and, indeed, they all did so.

**Table 5: Overall patterns of map-making activity**

Map title	Adding	Editing	Inserting	Moving	Removing	Renaming	Repositioning
Educational Blogs n=185	9.7%	0.5%	42.2%	2.7%	3.8%	11.9%	29.2%
Educational Blogging n=122	8.8%	0%	51.6%	3.3%	9.8%	4.9%	27.9%
Should teachers blog? n=209	0%	0%	46%	2.5%	5.5%	7%	39%
Developing international partnerships in WBL n=314	1.5%	0%	41.5%	3%	16%	11%	27%
ICT CPD: Fit for Purpose? n=360	3%	1%	25%	1%	5%	13%	52%

n= the total number of activities identified in each map.

The repositioning process is one in which nodes are moved across the map, from one side to another – which gave rise to the analytic/wholistic hypothesis. It could well be, however, that this represents an underlying aesthetic approach that results in a semiotic presentation of information. As such, it may have little or nothing to do with left/right hemisphere activity, but be more of an aesthetic ‘tidying up’ process to support the meaning that is being created.

Moving described the process in which nodes or sub-nodes are moved to become nodes or sub-nodes on another link. In this activity the map-makers add their thoughts to those of others as they become more developed. Moving can often be observed during the final stages of the map, as a process of consolidation, either by adding specific detail to more general concepts or by transferring nodes or sub-nodes to other links to expand concepts.

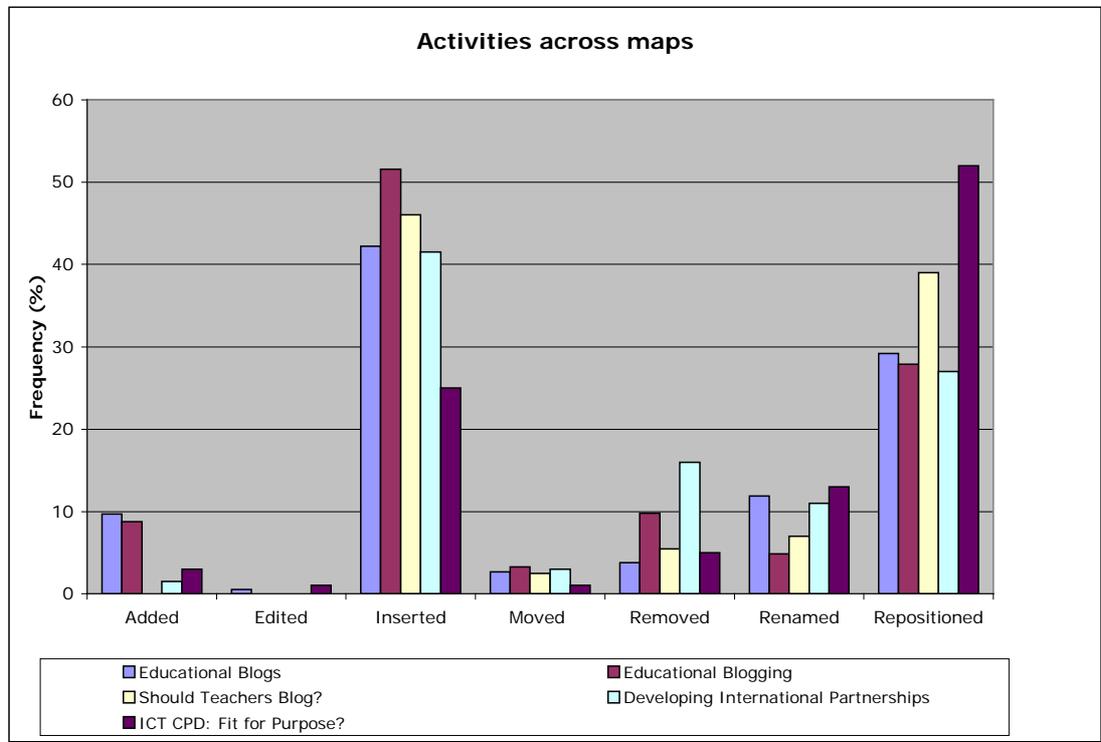
The removing process is analogous to pruning: redundant links and nodes are removed, often after others have been moved or repositioned.

The final map is therefore the result of a number of inter-related processes, all of which are collaborative. The chart that follows shows the overall distribution of activity in each map.

What is more interesting, however, is to see the inter-relationship of actions, particularly those of inserting and repositioning. These are clearly shown on the graphs that accompany the

activity tables for each map. They plot the frequency of each activity across the progress of the map creation.

**Chart 1: Activities across maps**



## Activities within maps

**Table 6: Educational Blogs**

Map title	Adding	Editing	Inserting	Moving	Removing	Renaming	Repositioning
Educational Blogs n=185	9.7%	0.5%	42.2%	2.7%	3.8%	11.9%	29.2%

Four people contributed to this Educational Blogs map, with 185 interactions.

Figure 38: Educational Blogs: The Map

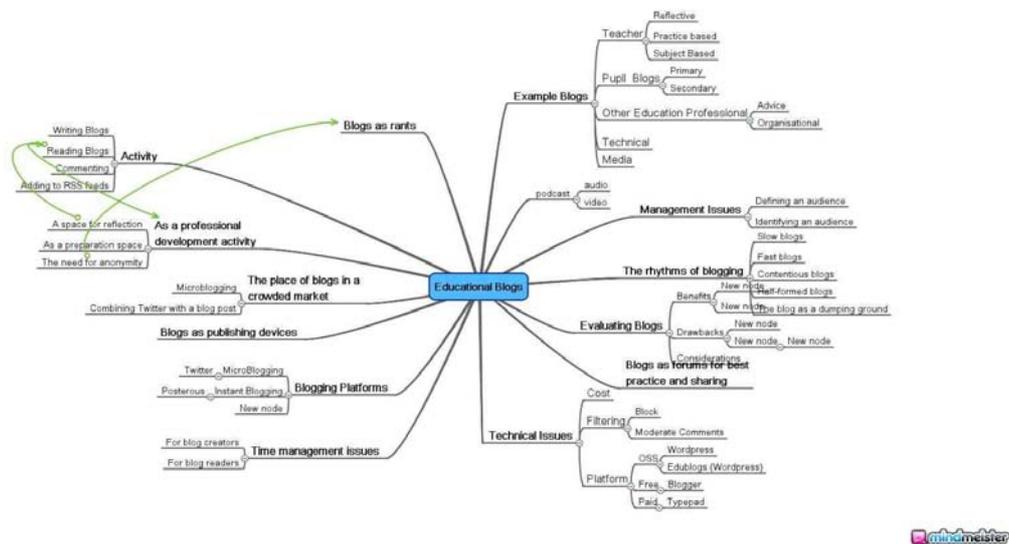
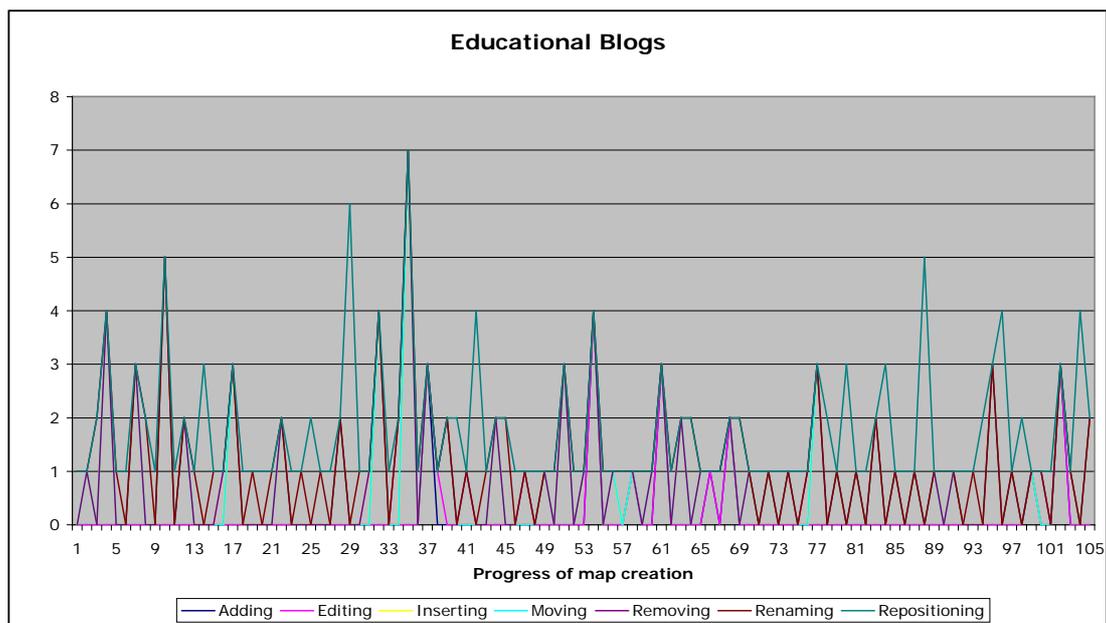


Chart 2: Educational Blogs: The Process



The repositioning process takes place throughout the creation of the map, and is combined with the insertion of new items. When participants reposition elements in a map it is often of a number of items, as the map develops and items are allocated to one or the other side of the map.

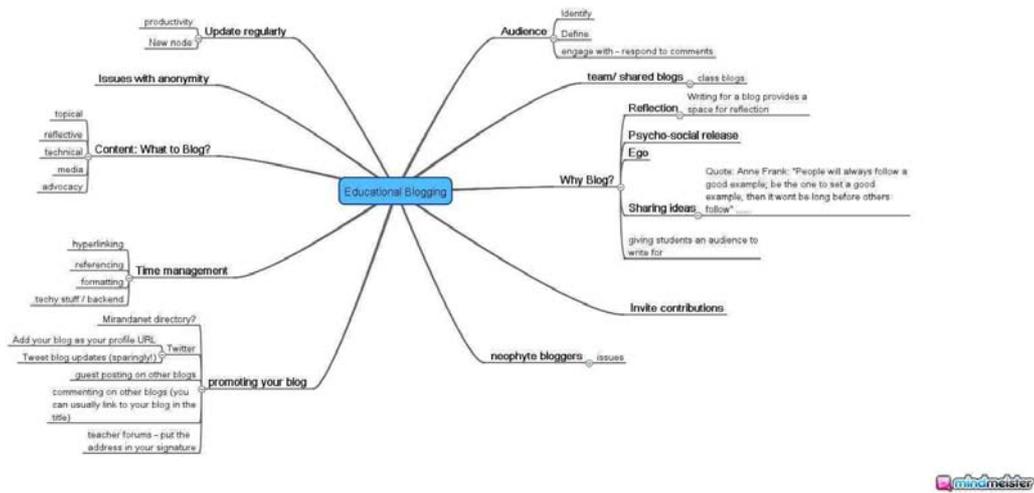
With only four people contributing to the map the collaborative process is much easier to monitor, and individual contributors more easily place items in relation to those of their colleagues.

**Table 7: Educational Blogging**

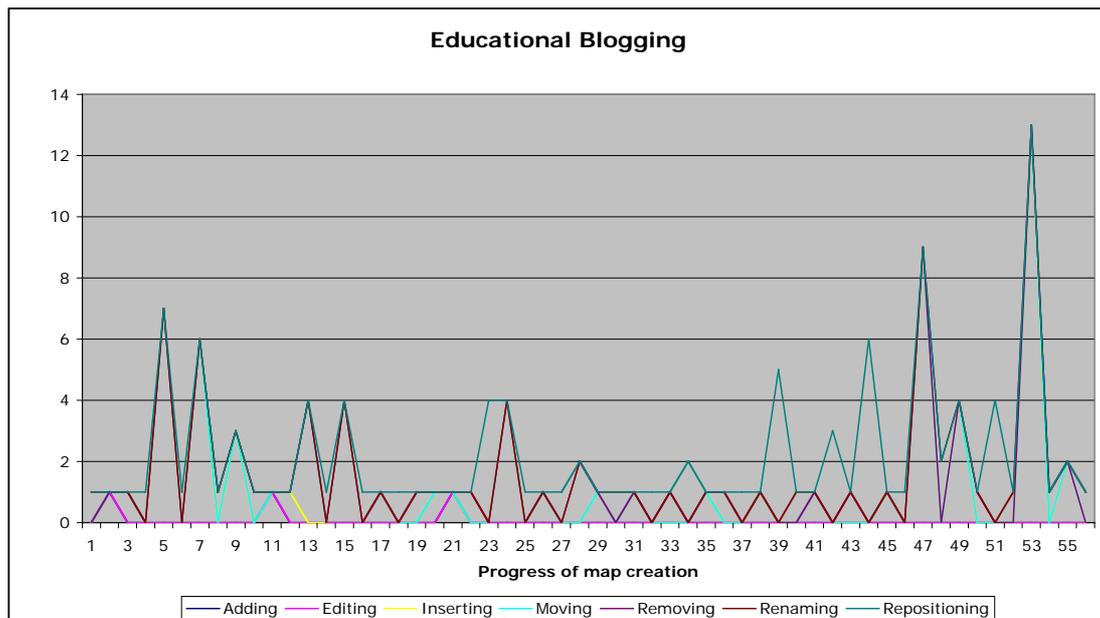
Map title	Adding	Editing	Inserting	Moving	Removing	Renaming	Repositioning
Educational Blogging n=122	8.8%	0%	51.6%	3.3%	9.8%	4.9%	27.9%

In the next session of June 19, Educational Blogging, eleven people contributed 122 interactions to the map.

**Figure 39: Educational Blogging: The Map**

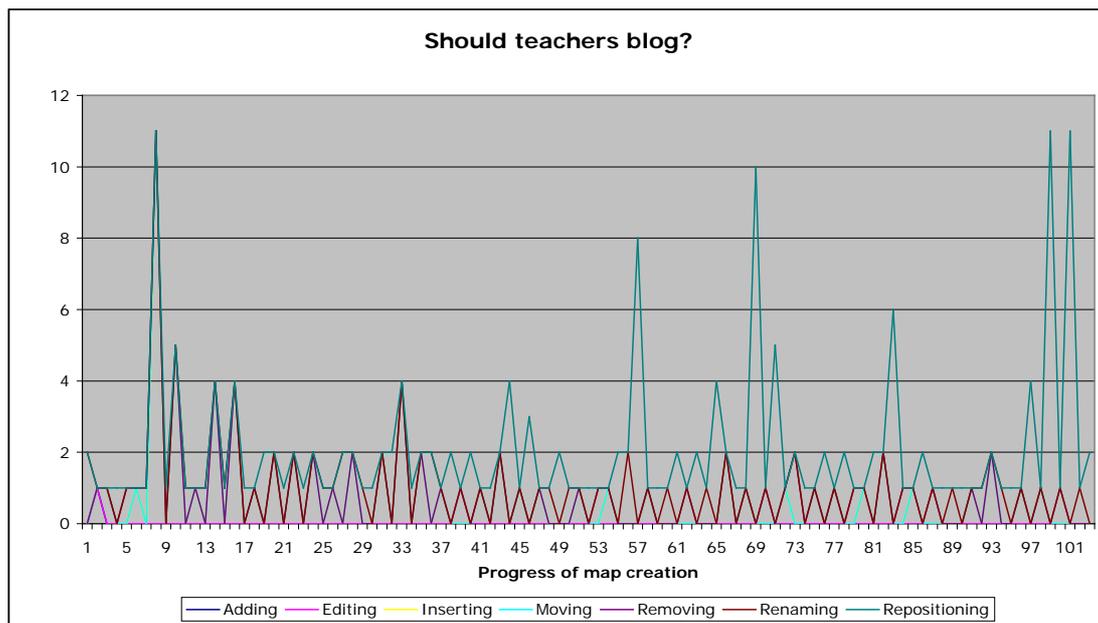


**Chart 3: Educational Blogging: The Process**





**Chart 4: Should teachers blog? The Process**



Once again, throughout the course of the session contributors added and repositioned elements. However, the majority of repositioning in this map took place towards the end of the session.

What was significant in this map was that, unlike the other maps, in which the oral contributions and ideas from participants proceeded in a more linear and sequenced fashion, this session was much less structured. Ideas were developed and built on throughout the session. At the end of the process, and in the following days, much more restructuring and repositioning took place.

**Developing international partnerships in Work Based Learning**

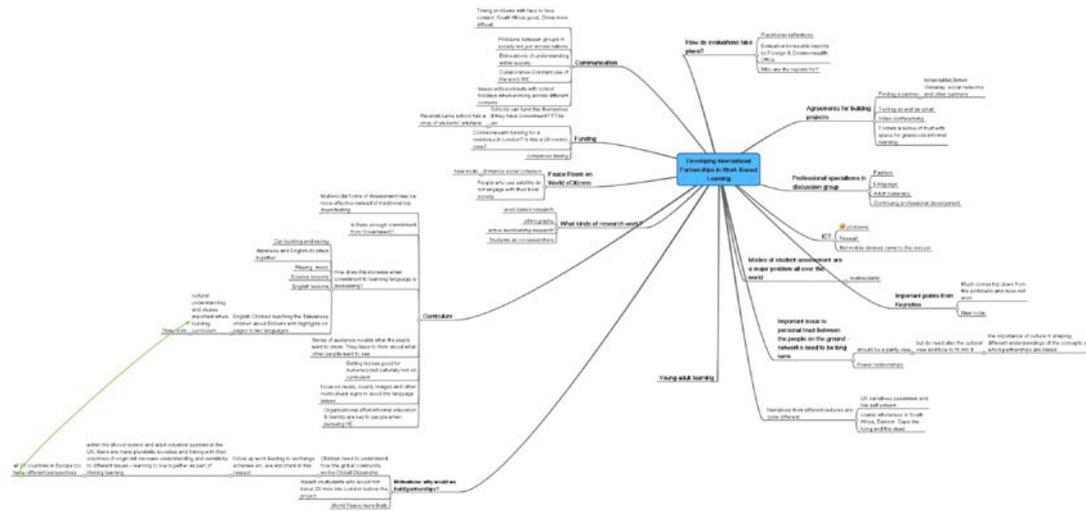
This map was created during, and following, a roundtable discussion during the one-day conference ‘Work-based learning: what is it really all about?’ held at the WLE Centre, Institute of Education on July 9 2009. Some 20 participants were in the session, a number of whom made short presentations about international partnerships in which they were involved.

This map involved six contributors, two of whom worked on the map in the days after the conference. There were 314 interactions in total.

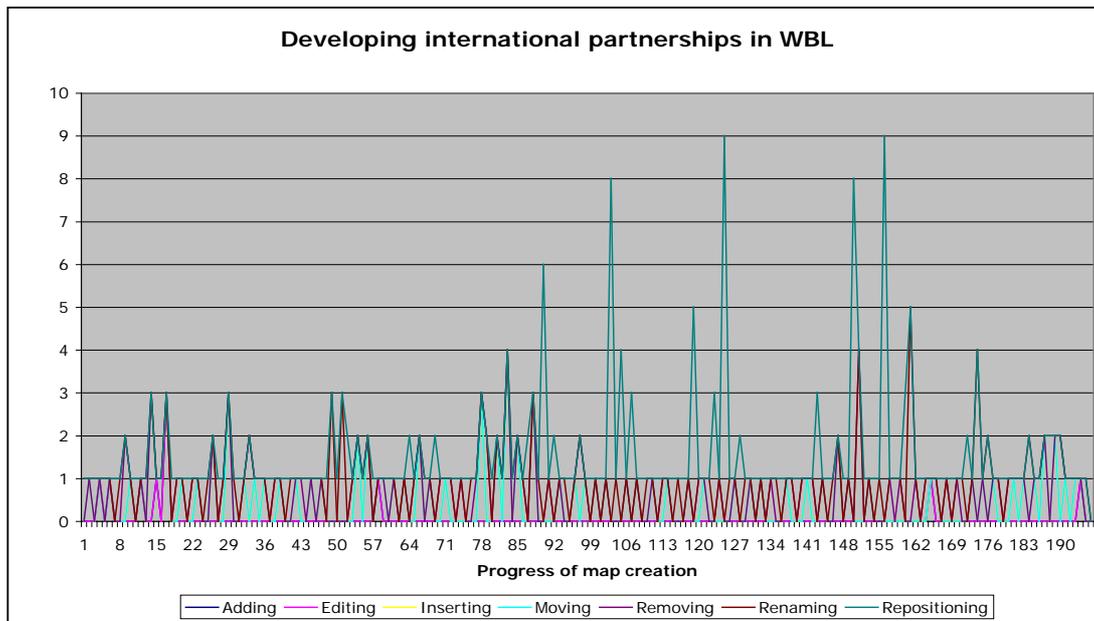
**Table 9: Developing International Partnerships in Work-based Learning**

Map title	Adding	Editing	Inserting	Moving	Removing	Renaming	Repositioning
Developing international partnerships in WBL n=314	1.5%	0%	41.5%	3%	16%	11%	27%

**Figure 41: Developing international partnerships in Work Based Learning: The Map**



**Chart 5: Developing international partnerships in Work Based Learning: The Process**



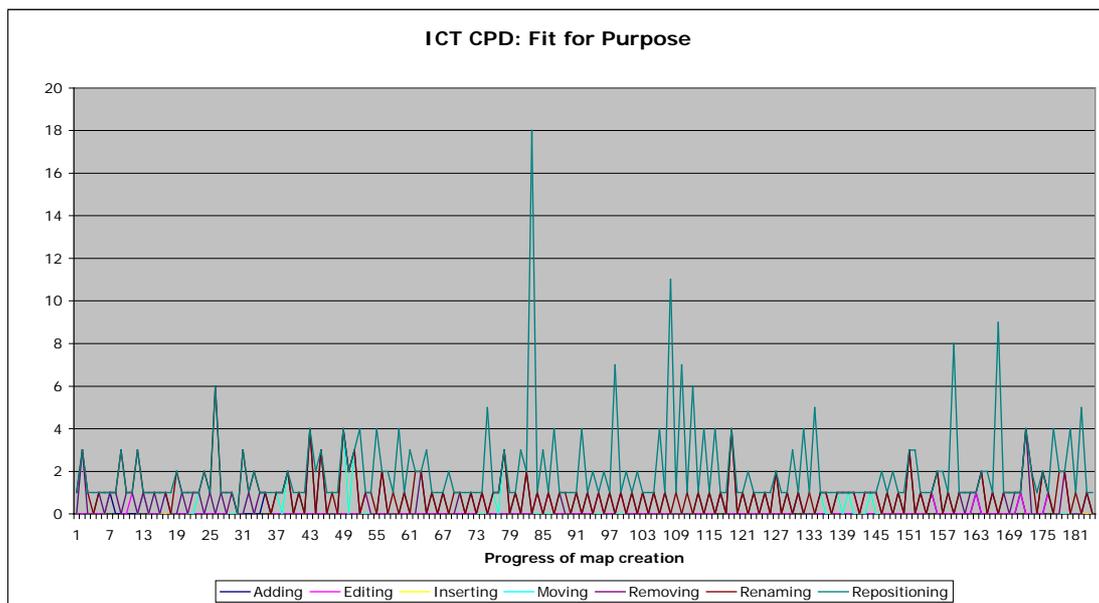
This concept map was very much a record of what took place during the roundtable discussion. During the early stages of the map construction the insertion and repositioning of items alternated. There were three bursts of repositioning from the mid-point to the end of the session, as commonalities emerged between the contributions made by speakers.

The final repositioning took place after the session finished.





**Chart 6: ICT CPD: Fit for Purpose? The Process**



This chart clearly shows that the most significant activity, that of repositioning, takes place throughout the creation of the map, but increases in frequency from the mid-point of the session, as more and more links and nodes are introduced. This repositioning, together with the processes of inserting and renaming nodes and sub-nodes, creates the final conceptual form of the map.

## **Conclusions**

### **The aesthetics and semiotics**

The collaborative process in which the mapmakers engage results in maps that are complex and balanced. Paper based maps and digital maps offer different kinds of information. In some cases 'traditional' paper-based maps yield more information about some forms of individual learning than digital maps (Preston, 2009 – in press). What the digital collaborative maps lack, when compared to an individual map produced using a program such as Inspiration, is the aesthetic appeal produced by the use of varying fonts and colours, particularly those used for the nodes. Users can change font sizes and colours in MindMeister, add links, notes, attachments and tasks, but the links themselves are devoid of formatting. With the MindMeister maps, however, the mapmakers arranged, and repositioned the links and nodes to create an aesthetic balance and appeal: both modes that contribute to the making of meaning. It may be that software developers with an interest in this mode of formative assessment could enhance the semiotic affordances.

### **Scoring the maps**

In an earlier section it was mentioned that a number of approaches to scoring concept maps were found to be inappropriate for this study. Firstly the reason for the inappropriateness of many scoring methods is that they depend upon the teaching of a predetermined body of knowledge that was being assessed by their system of scoring. These mapmakers, in contrast, were expected to construct complex maps of new professional knowledge, based on their involvement in the topics being discussed and the ease of revision afforded by the MindMeister program.

The scoring system used in the ImpaCT2 study, to determine the complexity of maps, was not dependent on learning a predetermined body of knowledge but was designed to look at the complexity of the thought processes that lay behind them. This basic scoring was effective in demonstrating the complexity of all of the maps rather than the content, but was mainly used to examine complexity across groups. When the method is used to explore individual learning standardisation becomes problematic. What is more useful is to examine deviations from the group (Preston 2009 in press). However, the main drawback from the perspective of this study was that the Impact2 scoring system could not be easily adapted to analyse collaborative maps. We found, through trial and error, that although this system did enable the maps to be scored easily, and the results to be considered valid for analysing the complexity of a group's thinking processes, we were still only examining the result – the finished product – rather than the process of collaboration and knowledge building. As a result of these deliberations, based on our pedagogical stance, it was decided that the final map, 'Is ICT CPD fit for purpose?' would not be scored, but that the interactions would be

analysed. This methodological route, which we plan to pursue in the next stage, is further explained in the next section entitled 'distribution of activities within a map'.

### **Distribution of activities within a map**

If assigning a score to the maps failed to yield more valuable information than a numerical value or ratio, and if the analytical/wholistic division was too tenuous a classification to support, then another tool had to be developed.

One function in MindMeister is 'History View', in which the various stages of a map can be viewed, together with the name of the mapmaker and the action performed. Snapshots of the map can be taken, and progress viewed until its completion. This function has been used to select the various stages of the maps in the earlier section of this paper. It is also possible to download the activities file, which identifies the name of the mapmaker and the action they undertook, together with the time. These files were downloaded, the relevant fields extracted and a table of interactions built, from which graphs could be created displaying the activities, their frequency and their relationship to others over the course of the map.

It was the analysis of this data that gave the clearest picture of the process of collaborative mapmaking.

The graphs showed the inter-relationship of actions, particularly those of inserting, renaming and repositioning – the key activities in the process of knowledge creation. The analysis of the maps suggests that the potential effectiveness of the methodology in building a picture of the collaborative knowledge process, rather than the existing models of either content analysis of map complexity. It can be further said that the complexity of the maps is directly related to the number of contributions by, and interactions of, the mapmakers.

When a new node or topic is inserted the collaborators can see this in real time as the map updates itself. This may then suggest other epistemological possibilities – ideas can be collated and nodes renamed or repositioned. Specific detail can be added and expanded, whilst hyperlinks can be made to other sources. The more these interrelationships of ideas are formed, the deeper the level of collaborative learning. Where branches and nodes are separate individual additions to the map the learning is less likely to be collaborative.

Post-session evaluations will be needed to assess the level of learning involved, and to determine the ultimate validity of the methodology for individual and group learning. Map makers will be included in this process, as co-researchers, in order to understand how they perceive their activities in relationship to our observations as main researchers (Preston 2009 in press; Leask and Preston 2009 in press).

### **Analytical vs. Wholistic distribution within a map**

During the mapmaking activities it was apparent that the maps were being created with two distinct sides, and that links and nodes were being moved from one side of the map to the other during the course of the session. Where activities continued in the days after the session it was clear that rearranging elements of the map were important. When the links and nodes on each side of the map were analysed it was felt that they might correspond to the left-brain – right-brain hypotheses developed by Luria (1966) and others. These advanced the concept that the left side of the brain supports analytical process and the right side of the brain wholistic ones. On reflection, however, it was felt that a sufficiently robust classification could not be supported, and that the final distribution on the map was more the effect of aesthetics than anything else.

### **Collaboration and concept maps**

To date collaborative concept maps have been explored in the context of MirandaMod and iGathering activities. The MirandaMod sessions involved mapmakers across the UK, from Europe and Australia.

The maps have therefore served three main purposes:

- to create a record of the event;
- to stimulate thinking and debate in another space and dimension than either the face-to-face environment or the virtual FlashMeeting;
- to facilitate new thinking that can support professional development and feed back into the institution.

This new thinking is the product of a group of professional experts from a number of background and disciplines.

On the basis of the work so far it can be said that the facility of use of MindMeister, the collaborative affordances built in, so that practitioners can see the construction of the map in real time, and the number of ways in which it can be published, suggest that it is a most valuable tool for collaboration. Inspiration does not yet have the networked multi-authorship affordances that have been at the core of this initial exploration of methodologies that can be used to identifying online learning processes.

The MirandaNet Fellowship intends to extend these participatory methodologies to identify the professional voice in the classroom and include it in dialogues on the future of learning – where consultation with teachers is currently limited. The development of these methodologies could include:

- developing of an index of interactivity, based on actions observed during the mapping process;

concentrating on enriching research methods for identifying, formatively assessing and encouraging multimodal and multi-literacy skills in communities of practice;

developing ways of completing, storing and tagging articles about a knowledge creation event written by a group from the map;

comparing collaborative mapping strategies for knowledge creation and storage with wikis;

investigating how collaborative mapping might be combined with other technologies to enrich the knowledge creation capacity of a professional work-based CoP over time;

looking at use of collaborative mapping as a platform for professional development, as well as for systemic change;

exploring collaborative international cooperation between practitioners on the ways in which education policy should reflect and enrich local practice.

Using these methodologies the teachers, as co-researchers, will gain agency in influencing local and national policy in developing regions where learning new practices can be a matter of life and death.

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## Appendix One

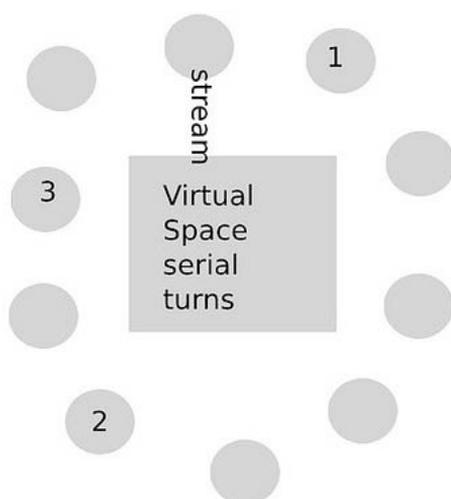
### SUPERCHARGING STREAMED MEDIA

*This is extracted from Leon Cych's longer blog on Learn 4 Life. He writes about his involvement with MirandaMods and explains the affordances of the technology that he uses to bring MirandaNet's interactive CPD to an international audience.*

[\(http://www.l4l.co.uk/](http://www.l4l.co.uk/), accessed 24.07.09)

I have recently been filming for the MirandaMod sessions – I film for post production to produce a quality film like this - which will include people's discussion, embedded PowerPoint Slides synchronised with talking heads, and so on, but I also film dynamically, incorporating live streams with both face to face and remote discussions. With the help of the amazing Theo Kuechel we also use a FlashMeeting Stream to include participants in the discussion “virtually” for reflective workshop sessions that augment the face-to-face ones.

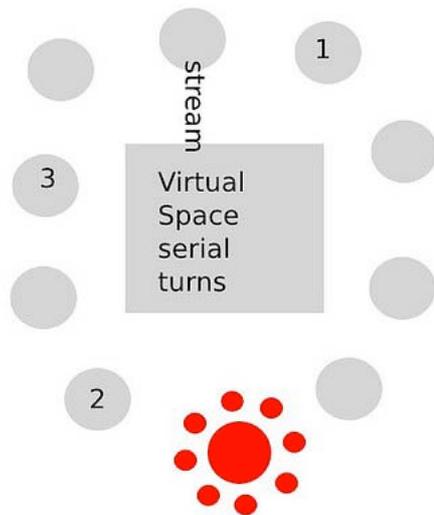
Now FlashMeeting is traditionally a serial video conferencing application where everyone's stream is visible in miniature and people take turns to broadcast out - a diagram of use might look like this:



One person talks at a time and is streamed – other remote viewers look or queue – one person can mediate.

It has some nice features built in, like voting and polling, and a text chat channel. But that “serial” model of video transmission or streaming can also be wasteful if you wish to amplify live streaming socially – all you have to do – and it is what people hit upon in the MirandaMod sessions – is add a DV camera on a tripod to a computer where a group of people are meeting and then show the FlashMeeting on a whiteboard in that room as well. You then

immediately magnify the social interactions and make them highly dynamic. So you end up with a modified Flashmeeting not unlike this:



One of the participants is now magnified to many at one node because the video is a roving camera, not a static one.

The interactions are further augmented by the use of MindMeister, a collaborative mapping tool being use to create and store knowledge created in real time by an expert group.

## Appendix Two: Map outlines

### Educational Blogs

#### Example Blogs

Teacher

Reflective ([link](#))

Practice based ([link](#))

Subject Based ([link](#))

Pupil Blogs

Primary ([link](#))

Secondary

Other Education Professional

Advice ([link](#))

Organisational

Technical

Media

#### podcast

audio

video

#### Management Issues

Defining an audience

Identifying an audience

#### The rhythms of blogging

Slow blogs

Fast blogs

Contentious blogs

Half-formed blogs

The blog as a dumping ground

## Evaluating Blogs

Benefits

Drawbacks

Considerations

## Blogs as forums for best practice and sharing

### Technical Issues

Considering the technical issues

Cost

Filtering

Block

Moderate Comments

Platform

OSS

Wordpress

Edublogs (Wordpress)

Free

Blogger

Paid

Typepad

### Time management issues

For blog creators

For blog readers

### Blogging Platforms

MicroBlogging

Twitter

Instant Blogging

Posterous

New node

Blogs as publishing devices

The place of blogs in a crowded market

Microblogging

Combining Twitter with a blog post

As a professional development activity

A space for reflection

As a preparation space

The need for anonymity

Activity

Writing Blogs

Reading Blogs

Commenting

Adding to RSS feeds

Blogs as rants

## Educational Blogging

### Audience

Identify

Define

engage with - respond to comments

Invite them to read

### team/ shared blogs

class blogs

Being consistent with your blog's voice

### Why Blog?

Reflection

Writing for a blog provides a space for reflection

Psycho-social release

Ego

Sharing ideas

Quote: Anne Frank: "People will always follow a good example; be the one to set a good example, then it won't be long before others follow" .....

To "sell" your ideas, or those of your organisation/school

giving students an audience to write for

To improve communication with a wider audience

### Invite contributions

Ask for comments

Guest writers

### neophyte bloggers

issues

### promoting your blog

Mirandanet directory?

Twitter

Add your blog as your profile URL

Tweet blog updates (sparingly!)

guest posting on other blogs

commenting on other blogs (you can usually link to your blog in the title)

teacher forums - put the address in your signature

Show up on the search engines

## Time management

hyperlinking

referencing

formatting

techy stuff / backend

Don't worry about no blogging regularly

## Content: What to Blog?

topical

reflective

technical

media

advocacy

debates

## Issues with anonymity

Just like anything, you shouldn't assume anonymity

Don't write anything you'd regret later

If it gets quoted as your opinion, are you happy?

If it gets quoted as your employer's opinion, are you happy?

If your boss reads it...

## Update regularly

The discuss seem to indicate that individual bloggers have different blogging rhythms. The consensus was that frequency of posting is not necessarily related to quality of content. productivity

## Should Teachers Blog?

How undermining is microblogging for the teacher? Can they handle it?

Drew on the benefits of serendipity

Following other blogs

All your heads are down twittering. what an ignorant audience

Extending an audience of critical readers

Enhancing learning

David Townsend

issues of logging on are much the same as other sites:netiquette issues as Beebo

Drew's blog

And he reads a lot of others, particularly by students

Standing on the shoulders of giants when you're following others.

Dai's mum got comments about her essay from all over the world adding comments and helping her- but not doing the essay

Internal use of blogs as a communication tool

Useful to keep blogs private until everyone is competent

how many people are hiding behind attention deficit syndrome when they are twittering in sessions

What areas should teachers not touch?

Is it enough to be anonymous?

Should one stick to educational issues only?

Is the GTCE our version of the Inquisition?

Joe

ipods are a good way of supplementing blogs

## Providing a relevant platform for students

fantastic authentic audience

they should decide to publish their own

What picture of you will your audience pick up?

if you are here you are ahead of 90% of the population on blogging

even if you are a beginner

Terry Freedman

to avoid associations with a particular incident wait about 3 months before you blog

technical recommendations

Ning

Terry Freedman

ignore things you do not like that do not deserve the oxygen of publicity

ICT Education

My rights

Terry's 2 minute tips

Blogs as an eportfolio

Daniel Needlestone

you can be critical of yourself without being critical of the school

blogs about challenges and problems make other professionals feel better

mainly write mine for sharing professional approaches

Joe Nutt

a blog gives you the affordance of a diary-there is a chronology here

Part of teacher development

twitterers are no in the same room as the speaker in the community in the room

Do you use a blog to ask questions - or Twitter?

twitter - more immediate

blog - more considered

Why are you writing a blog? Ray Fleming

do you need a disclaimer- not if your blog is personal

put name at the start of the question so they listen

Don't get hung up on specific tools: they're transient

Teachers extending their audience

School trips

Staying in touch

Teachers fears

-public or private- do we have control

Putting disclaimers on your blog

Speaking personally

Talking about your institution

Talking on behalf of your institution

can we British tolerate celebrating success

Do teachers have the time to use blogs for reflection? how can they carve out this time?

Blogs as a form of Personal Learning Networks

What kind of blogger are you?

does blogging decrease your celebrity? does this matter?

Dai Barnes blogs when he is trying to find his way

Theo

Teachers should be blogging

Reflections

Things you've discovered

Tips for the classroom

The bigger picture

For the good of others?

Bob Hill

you can set up a blog so that the results are moderated before they go out

Establishing a Digital Identity

This is me: lulu.com

What's your digital footprint

Judith

course materials

for links

just testing it out now

students analysing their internet identity as a game

## Developing International Partnerships in Work-Based Learning

### Agreements for building projects

Finding a partner

MirandaNet, British Gateway, social networks and other partners (link)

Texting as well as email

Video conferencing

Fosters a sense of trust with space for grassroots informal learning

### Professional specialisms in discussion group

Fashion

Language

Adult numeracy

Continuing professional development

### ICT

problems

Firewall

But mobile devices came to the rescue!

### Important points from Keynotes

Much comes top down from the politicians and does not work

Important issue is personal trust between the people on the ground -  
networks need to be long term

should be a parity view

but do need also the cultural view and how to fit into it

the importance of culture in shaping different understandings of the concepts on  
which partnerships are based

Power relationships

Modes of student assessment are a major problem all over the world

multimodality

## Narratives from different cultures are quite different:

UK narratives pessimism and low self esteem

cosmic wholeness in South Africa, Eastern Cape the living and the dead

## Young adult learning

### Motivations: why would we build partnerships?

Children need to understand how the global community works-Global Citizenship

follow up work leading to exchange schemes etc. are important in this respect.

within the school system and adult education systems in the UK, there are many pluralistic societies and linking with their countries of origin will increase understanding and sensitivity to different issues - learning to live together as part of lifelong learning

all 27 countries in Europe too have different perspectives

Impact on students who would not travel 20 mins into London before the project  
World Peace more likely

## Curriculum

Multi-modal forms of Assessment may be more effective instead of traditional top down testing

Is there enough commitment from Government?

How does this increase when commitment to learning language is decreasing?

Car building and racing

Japanese and English do plays together

Playing music

Science lessons

English lessons

English Children teaching the Taiwanese children about Dickens with highlights on pages in two languages

cultural understanding and values important when building curriculum

New node

Sense of audience moulds what the pupils want to show. They have to think about what other people want to see  
Betting horses good for numeracy but culturally not on curriculum  
focus on music, sound, images and other multicultural signs to avoid the language issues  
Organizational effort-informal education & Identity are key to people when pursuing HE

## What kinds of research work?

work based research  
ethnography  
active membership research  
Students as co-researchers

## Peace Room on World eCitizens (link)

Enhance social cohesion  
People who use satellite do not engage with their local society

## Funding

Schools can fund this themselves if they have commitment? PTAs etc  
Ravensbourne school has a shop of students' artefacts  
Commonwealth funding for a residency in London? Is this a UK-centric view?  
companies liasing

## Communication

Timing problems with face to face contact. South Africa good, China more difficult  
Problems between groups in society not just across nations  
Dislocations of understanding within society  
Collaborative-Constant use of the word WE  
Issues with continuity with school holidays when working across different contexts

## How do evaluations take place?

Practitioner reflections  
Evaluative non-public reports by Foreign & Commonwealth Office  
Who are the reports for?

## ICT CPD: Fit for Purpose?

Where's the fun in all of this?

Twitter?

Face book

Community

Mistake always = opportunity to learn. Change mindset!

Level of community engagement - compelling content

Who we are

John Cuthell: MirandaNet; Virtual Learning: School improvement & other things ([link](#))

Christina Preston- MirandaNet and iCatalyst ICT CPD programme ([link](#))

Dughall McCormick: Kirklees LA E-Learning Consultant

Richard Allen Independent consultant - Learning Platforms etc., etc.

<http://www.outstream.co.uk>

Leon Cych- Learn 4 Life - Independent Consultant - <http://www.L4L.co.uk>

Dai Thomas- Director of ICT/Elearning Warden Park School, MirandaNet

<http://www.daithomas.org.uk> ([link](#)) notes are here

Allison Allen - Independent consultant; School improvement through ICT etc.

<http://www.outstream.co.uk> ([link](#))

Marilyn Leask Brunel University [www.brunel.ac.uk/marilynleask](http://www.brunel.ac.uk/marilynleask) ICT for CPD, web 2.0

see for example [www.communities.idea.gov.uk](http://www.communities.idea.gov.uk)

Tom Cooper-Strategic Leader ICT-Lewisham LA

Relevant theories

Diffusion of innovation

communal construction

braided learning

Democracy

What do teachers do?

Are all teachers learners?

Some teachers might talk the talk but do they walk the walk?

Is there a climate to enable this?

Teachers must be at the same level as their students at least

Is this realistic? cf tennis coaches.

All Teachers at least need to try Nintendo Wii

## How continuous is CPD?

Is there a point where you can know it all?

Can we link it with behavioural factors?

Maslow

Locus of control

Motivation

Self-image

Catalysts for personal CPD Change

other people

Young people and what they do/are capable of

Events

projects: BPRS, MirandaNet etc

Money/efficiency

Theories of how people learn

Changes in curriculum and/or exam board specs

Mentoring (South Africa)

## New Teachers and CPD

Do we encourage reflection in the right ways?

How is this continued after QTS?

How embedded is reflective practice after University course?

## Games?

Gamers use 'community' for personal learning.

Most ICT Developments are in Games play. We need to harness the best to ensure we are inclusive i.e. Boys!

## Must be timely

Generic or 'course'-based CPD is not the best model

Improved if leader is practitioner & allows course to be led by "delegates"

Action research pull model

If the CPD doesn't hit you at the right point in your development, the impact is lost

Relevant to learner needs

## Learning platforms?

too boring and unassociated with needs

How do you make these authentic

Other models than just a repository

Where well led & relevant to all learners makes whole school buzz!

need to utilise social network style input

We learn better together, helps reflection

We need to come up with a Statement of Requirements which is platform agnostic!!!

Collaboration should be national not limited to individual schools!

## What are the barriers?

Diversity of people's existing ICT skills

Lack of recognition of how ICT can help

"What I've always done before works really well. Why should I change?"

Fear of admitting a need.

The kit is unreliable

Leadership not fully 'signed up'.

Time and opportunity for CPD cascading

Lack of opportunity to monitor impact and plan strategically as a result

Short-term vs. long-term

Institutional Arrogance

Over cautious filtering/restrictive technical teams

We are a barrier as our lang/jargon excludes rather than includes!

fear of thinking others are better able to use the technology

"I've got enough on as it is thank you!"

## What does innovation mean?

Changing the school day or terms?

## New node

Teaching of ICT will not survive much longer

Are Functional Skills enough?

## What can help ICT CPD

E-Learning

ICT CPD Key role mentorship within schools with time to team teach and facilitate

TeachMeets

Leadership Focus

Open school cultures

Kit getting easier and more reliable

ICT embedded as good teaching & learning catalyst

Higher profile on national/local agendas

MirandaMods

Drivers to help with intrinsic motivation

## Assistive technology

Teaching & learning at core

## What you see is what you get

### Management role in CPD effectiveness?

Must be enlightened in order to empower

Willing to take risk

Does accountability get in the way?

Must be an ICT management person on the SMT

## Accreditation?

skills

T&L Pedagogy

GTC accreditation

again authentic - action research models

## purpose of ICT CPD?

Must be relevant

work-based research

timely

develop a community problem solving ethos?

Supportive, not competitive

Remove feeling of exposure

Develop higher thinking skills (Bloom's)

Avoid the skills - so what? question