Tracking the stages of learning: concept maps as representations of liminal space

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Abstract. The concept of liminal space has recently been applied to ways of learning: the learning journey through this space encounters difficulties and misunderstandings, that are resolved as knowledge is mastered. Since 1992 the MirandaNet Fellowship, a growing international community of educators, has investigated the ways in which this relates to the collaborative learning in the liminal space of the Internet. These professionals have explored social networking, microblogging, digital mind mapping, distributed video and other innovative technologies to determine how they can be deployed through grassroots collaboration to build the theory and practice of new professional knowledge. The use of collaborative digital mind maps affords tools for the analysis of the stages and development of collaborative learning. From these shared liminal spaces beyond the screen provocative questions emerge about the relationship between learning, collaboration and innovation.

Keywords: Liminality, representation, mapping, collaboration, community, professional learning

Introduction

The term 'Web 2.0' is notoriously slippery, often appropriated for a number of conflicting purposes. O'Reilly's 2005 summary includes the use of the Web as an applications platform, the democratization of the Web, the use of new methods to distribute information and the use of the Web itself as a Platform. As hardware and software developed and became ubiquitous so the initial Web 2.0 concepts have become internalized as expectations and performative actions by users, despite the fact that institutions have either been slow to implement Web 2.0 possibilities or, in the case of the educational establishment, rejected them in their entirety. A significant number of teachers, however, quickly realized the possibilities offered by Web 2.0 for learning and teaching, and in particular for their own professional development. No longer would they be dependent on whatever professional development their school, local authority or higher education systems saw fit to offer.

The affordances of Web 2.0 technologies have been explored by education professionals in the MirandaNet Community (MirandaNet, 2012) for more than five years (Cuthell, 2008; 2009a; 2009b; Cuthell et al., 2009; 2011; Preston & Cuthell, 2011), and have been combined to produce an approach to professional development that has enabled innovative developments to be evaluated in terms of their effectiveness for learning. Devices ranging from conventional desktop and laptop computers, through netbooks and tablets to smartphones, coupled with web-based applications – collaborative concept mapping; wikis; video streaming; web conferencing – have supported collaboration and community across a diverse range of settings, geographical locations and time zones.

In this chapter we examine the ways in which one of these technologies, online collaborative concept maps, has been used by the community to build knowledge bases that will

summarise and underpin their professional development in each session. We explore 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 MirandaMods organised by MirandaNet fellows in the context of work-based learning for education professionals. The programme was designed to share ideas about the use of technology that would inspire and support others. The research project we describe initially aimed to develop a scoring system for collaborative multimodal concept maps that could be used to analyse the potential effectiveness for identifying concept development and the formation of praxis. This notion came from early experiments in reading concept maps (Preston, 2009). However, as the use of maps developed, scoring the maps proved an inadequate method for understanding new approaches to collaborative learning, that were unfolding as map-makers encountered this new medium and gradually become more expert in their use of this tool. As a result, as well as scoring, we experimented with other ways of reading the maps that are documented here.

In addition to the progress in learning about map creation demonstrated by MirandaNet members during this period of MirandaMods, the numbers developing the maps remotely also grew. We found in this case that the complexity of the maps is directly related to the number of contributions by, and interactions of, the mapmakers. This 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. As a result of factors that emerged during this experimental research, a number of questions emerged that extend the exercise further than a scoring exercise and into the realm of how educators learn collaboratively:

- 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?

This work in knowledge management has progressed during the past ten years because 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. What is lost with digital representations of concepts, however, is the individual characteristics that convey information about the mappers' state of mind (Preston, 2011). Recent developments in online concept maps do, however, facilitate aspects of collaborative learning that cannot be replicated on paper: 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 explore in this chapter are based on the outcomes of research undertaken during the series of MirandaMods run by MirandaNet since 2005. These events are simultaneous virtual and face-to-face debates between professional educators in a global context. This work was supported by the Centre for Work-based Learning at the Institute of Education, University of London and the Learning Futures Research Centre, IREd, University of Bedfordshire. One focus of our work was the emerging informal processes by which theory can be transformed into practice by education practitioners themselves: the

process of 'praxis' (Freire, 1970), and was used to develop the methodology and collect data for this study.

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, 2009). The web-based program MindMeister was used as the vehicle for this study for the creation and dissemination of knowledge, as well as for data collection.

Background

For the past seven years the MirandaNet Fellowship has run its own modified version of the unconference mode of informal learning, called a MirandaMod. The unconference movement alters the traditional balance between expert speaker and audiences to debating participants with theme leaders. The MirandaMod version is intended to create and share new professional knowledge. This approach stems from the vision of the MirandaNet Fellowship, founded in 1992. This e-community of practice for international ICT policy makers, teachers, teacher educators, researchers and commercial developers aims to use digital technologies to promote cultural understanding, democratic participation and the construction and dissemination of new professional knowledge. Currently there are around 700 members in about 70 different countries worldwide. The website, online forums, seminars, workshops and projects run by members are funded by international partner companies and government agencies (MirandaNet, 2012).

In these MirandaMod events a wide range of education professionals choose a theme for a face-to-face meeting. Others join in across national boundaries, using a range of such digital communications as video conferencing, microblogging and collaborative concept maps. The technologies used – whether laptops, smartphones, desktop computers or Netbooks – enable people to participate from a range of locations. Some lead participants set the tone in five-minute talks and further contributions are selected by the chairperson to achieve a balance in participation between teachers, researchers and teacher educators.

Many of the educators in MirandaNet are interested in exploring the theories and the pedagogies underpinning their own teaching practice, which means that those pursuing postgraduate studies find the debate merging with their formal learning. These MirandaMods, therefore, provide an innovative extension to Continuing Professional Development (CPD) where professionals collaborate to manage their own learning agenda. This online and virtual social interaction was first recorded face-to-face in the process of building 'communities of practice' as a means of informal learning (Lave & Wenger, 1991), and which are now sometimes informally referred to as 'digital tribes'.

MirandaNet has added to communities of practice theory and practice by developing Braided Learning theory (Haythornthwaite, 2007; Preston, 2008; Preston & Cuthell, 2011), which can track the informal dynamic knowledge creation in the collaborative contexts of MirandaNet and MirandaMods, as participants move from text-based debate in a conventional mailing list or discussion forum, to video conferencing, micro blogging contributions and collaborative concept maps. This collaborative technology creates a liminal space – a term drawn from anthropology that describes a rite of passage, in which a person moves from one state of being to another. In the MirandaMod communities participants are observed to be transformed in this liminal space by acquiring new knowledge, a new status and a new identity in the community. If learning is to be successful, this change is of critical importance. Whilst remote and informal learning is largely is what has been understood about mobile learning, the concept can now be

extended to include these Web 2.0 informal spaces in which learning takes place – the liminal spaces that those who push the boundaries of digital possibilities now inhabit intellectually (Cuthell et al., 2009).

This paper, then, aims to describe the ways in which collaborative concept mapping can record these liminal spaces, their contribution to the Braided Learning process and chart the process of knowledge creation. The processes can be described as a form of Bricolage (Levi Strauss, 1962), in which people build new knowledge from what is at hand – now often referred to a 'mashup'. The next three sections outline the components and process of such a 'mashup'.

The components and processes of Bricolage – or 'mashup'

The following sections provide the scaffolding for our work with concept maps in the context of MirandaMods.

Mise-en-scène

In a MirandaMod a group of people come together in a room – their physical (F2F) space. They are also joined by others: not present other than as words writing themselves on a screen; as a low-resolution images and voices echoing across continents; as symbols on a growing map of concepts and ideas. Some will have made their mark earlier, contributing ideas on the concept map or in the wiki, leaving traces from which others will build. After the event has finished and the group has left, gone away from wherever to wherever, the words, images, voices, symbols and ideas will remain to be re-purposed by the passing strangers who will bind themselves into this community of liminal space, wandering scholars through a virtual digital world.

What is happening? How is it happening? Who is it happening to? To whom will it happen? Who – where – are the agents; the actors; the participants? Where are the boundaries? In a state of flux, where can permanence be found? The answer could be everywhere, and nowhere:

- There is a physical space, a room to which some are invited and to which some can come. It builds synchronously. People come and people go in real time.
- There is a virtual wiki space, in which others can bind themselves to the community and within which they can deposit their messages and artefacts. It builds semi-synchronously – people come and go before, during and after the event.
- There is a virtual web space that builds asynchronously.
- There is a streamed video link that goes out to others not present and who watch synchronously or asynchronously – during the event, through a sometimes tenuous video stream that battles through the communication fog, or after the event, when broadcast-quality video can be accessed through the web space.
- The screens in the room inscribe other messages; other participants.

Web conferencing through FlashMeeting brings others to the meeting, as both audience and participants, through oral contributions, uploaded presentations, text chat comments or URL web references. All of these are archived and available to all. FlashMeeting is an application based on the Adobe Flash 'plug in' and Flash Media Server. Running in a standard web browser window, it allows a dispersed group of people to meet from anywhere in the world with an internet connection. Typically a meeting is pre-booked by a registered user and a

url, containing a unique password for the meeting, is returned by the FlashMeeting server. The 'booker' passes this on to the people they wish to participate, who simply click on the link to enter into the meeting at the arranged time.

During the meeting one person speaks (i.e. broadcasts) at a time. Other people can simultaneously contribute using text chat, the whiteboard, or emoticons etc. while waiting for their turn to speak. This way the meeting is ordered, controlled and easy to follow. A replay of the meeting is instantly available to those with the 'unique' replay url.

A Twitterfall wall collates tweets from across the world that use the hashtag of the meeting and displays them on the screen. Conversations within the room and across the world display and interact with presenters and participants. Twitterfall is a Twitter client specialising in real-time tweet searches. New tweets fall into the page.

On another screen a MindMeister online collaborative concept map is displayed whilst it is building: those within and outwith the room add ideas, materials, links, resources and comments. It is a collaborative web-based tool supporting unlimited simultaneous users, who can create, edit and share maps on the Web. In coming days the map allows for reflective thought. Upon completion it serves as a permanent record of the collaborative knowledge construction of the event. The development of these symbols on the map of concepts and ideas can then be analysed to determine the processes of learning – and are available for others to analyse and interrogate.

It is this concept map that not only provides the summative record of the ways in which the liminal space has been built, but also provides the formative record of the ways in which the concepts and resources have developed.

Concepts of liminal space

Liminal space could be described as Void, without form, without light; inchoate, but aware (however imperfectly) of form and purpose. In pre-modern society the liminal spaces – embedding rites of passage, with people moving from one state of being to another – were three-layered multiverses incorporating a physical space, the virtual space of trance and dream and a visual space of representation: paintings left behind on cave wall; artefacts. Shamans and creatures from Myth entered these spaces, left behind their constraining present and found their identities shifting and changing. They brought back to those unable to cross with them (their communities, confined by spatial temporality) messages to guide them in their daily life. The shamanistic ability to shift time, shift place and shift shape linked the grounded earth world with fluid visions to guide their future.

The concept of Liminality (van Gennep, 1960) identified the in-between-ness of those in a condition of dislocation, where hierarchies are reversed and uncertainty rules. Jung (1978) then referred to liminal spaces as boundaries between states of being, where the liminal space offers the possibility of a re-creation of self, where symbolic actions create meaning for the participants. Conflict, chaos, uncertainty and the breakdown of old structures accompany these actions.

So, in terms of teacher professional development, within these MirandaMods participants are transformed by acquiring new knowledge, a new status and a new identity in the community. Liminality brings with it a sense of power and possibility that is in part a release from prior constraints (temporal; spatial; personal; professional) and in part a reflection of the autonomy engendered by the de-stratification of existing professional power relationships of learning.

The conventional ecosystem of learning is based on the separation of home, the institution (school, college, university), neighbourhood, work: all of these are bound into a system. This system operates the constraints of age, class, money and expectations, all of which act as gatekeepers for the system.

In contrast, the liminal spaces that we inhabit and within which we work are everywhere, and nowhere.

This liminal state is heightened when many of the participants are engaged in the research process, ethnographers exploring the boundaries of what is, and is not, possible in the interrelationship between technology and culture – as complete participant researchers. The more deeply the individual participates in the group and evaluates the actions and values within it then the more deeply they are in the liminal self-reflexive state between participant, researcher, observer and analyst. The range of interests and concerns of all these participant-researchers reduces the possibility of researcher bias when conclusions are drawn. In the MirandaMod context and process, therefore, a range of actors come together, accepting the possibly chaotic, fluid instability and uncertainty of creating meaning and new knowledge.

Mapping journeys through liminal space

Since 1992 MirandaNet members have published academic papers, journal volumes and articles. Concept maps have been an important element in the visual representation of knowledge, and the work that MirandaNet has undertaken on Visual Learning. As a result, spontaneous hand drawn concept maps produced by educators became an element of MirandaNet community history and have had significant influence on MirandaNet practice: members were seeking a means of expressing community knowledge and experience that could not be contained within a multi-authored linear essay. However, written text and the restrictions of A4 or A5 sheets of paper were proving to have significant limitations as evidence of community thinking and the production of immediate knowledge.

From the early 2000s attendance at face-to-face MirandaNet CPD, conferences and meetings was beginning to exclude many members, both for reasons of geography and for lack of CPD funding. In response a new kind of meeting of minds, the MirandaMod, began to emerge from 2007: this was built around a central virtual strand. Those who attend are committed to the unconference notion of sharing knowledge informally within a community of practice who set the agenda. This learning experience is in contrast to the conventional formal CPD experience in which an agreed body of knowledge is to be communicated to the students by the tutor.

Methodology

The focus of this paper is a six-hour MirandaMod on blogging in education. It took place on June 19, 2009 at the Institute of Education, University of London and the final session, from 18:00–21:00, involved thirty-eight participants: twelve face-to-face and twenty-six online. During this MirandaMod all of the online participants were drawn from the United Kingdom. It represented a liminal space for collaborative learning for MirandaNet members consisting of a number of constantly-shifting elements that build semi-synchronously – people come and go before, during and after the event.

Two methods were used to analyse the MirandaMod maps: word clouds and tracking the development stages of the map.

The initial experiment was a Wordle analysis that presents a digital cloud of the words on the map ranged in size according to the frequency of occurrence. We find support for this mode of analysis in a paper from Denning, Fisher and Higgins (2011) in which they explore the terminology of papers in the journal Technology, Pedagogy and Education over the last 20 years. What is significant is the emergence of the words 'community' and 'social' for the first time in the last of their three maps that represent recent years. These results accord with the recent focus on the educational potential and development of technologically mediated (online) communities and the emergence of social media that we also note here.

The MirandaMod Wordle analysis of the first maps in the seminar and the workshop showed the community's factual grasp of the key issues in blogging. However, in the final debate it is not surprising that the Wordle analysis (see Figure 2) highlights emotive and colloquial vocabulary that relates to the language of the debate and to identity: dumping; contentious; rants; anonymity; and, need. Many of the other preoccupations are about managing a blog and about software that might be helpful. In this case the Wordle proved not as illuminating as the concept map (Figure 1).

The second – and main – analytical technique was to track development stages in collaborative map making. The digital map that is used, MindMeister, has a timeline that shows the development of the map and its contributors. Cuthell and Preston (2009) worked on the development of all stages that led to the production of the web-enabled map. All the stages of the research are best explored online, since the reproduction all the stages of the map in this journal is not technically easy: they are too large and multi-layered.

The collaborative map

The collaborative learning space that we are concentrating on in this study is one collaborative map from the session 'Should Teachers Blog?' (Figure 1). It is one of a series of maps produced over six hours by MirandaNet members. Because this map is interactive and layered it cannot effectively be reproduced on paper. The full map is available at MindMeister (2012). Whilst print versions (paper) of maps have to be reduced to the main branches, so that the main points can be read, viewers of the interactive digital map can investigate the links at leisure. In a conventional classroom hand-drawn maps become unmanageable in size and reach.

The maps from this session were in three phases. The first phase recorded the comments on blogs from those speakers who had been invited; a relatively conventional two-hour seminar on blogging. The next phase, lasting two hours, was a workshop led by a well-known blogger: members used the maps in this session as a note-taking exercise for later distribution to those unable to attend. Microblogging (predominantly through the use of Twitter) was also used, although this was spontaneous and unplanned.

The third and final session took place between 18:00–21:00 hrs (GMT) and was a debate on blogging under the title 'Should teachers blog?' It forms the subject of the map in Figure 1. The educators debated perspectives on such blogging issues as personal safety and creative freedom versus institutional control. This session involved some twenty-six online and twelve face-to-face participants – thirty-eight in total. Some of the daytime participants had left at this point, whilst others had joined. Nineteen of them built the map during the debate and all the participants collaborated during the last 30 minutes in building and consolidating this perspective on the blogging landscape for other teachers. This final map was the most complex, and the result of collaboration between participants interacting both face-to-face and online. The session also involved a number of the other technologies previously explained: MindMeister; video images streamed to the web through blip.tv; multiple online conferencing through FlashMeeting and microblogging through Twitter.

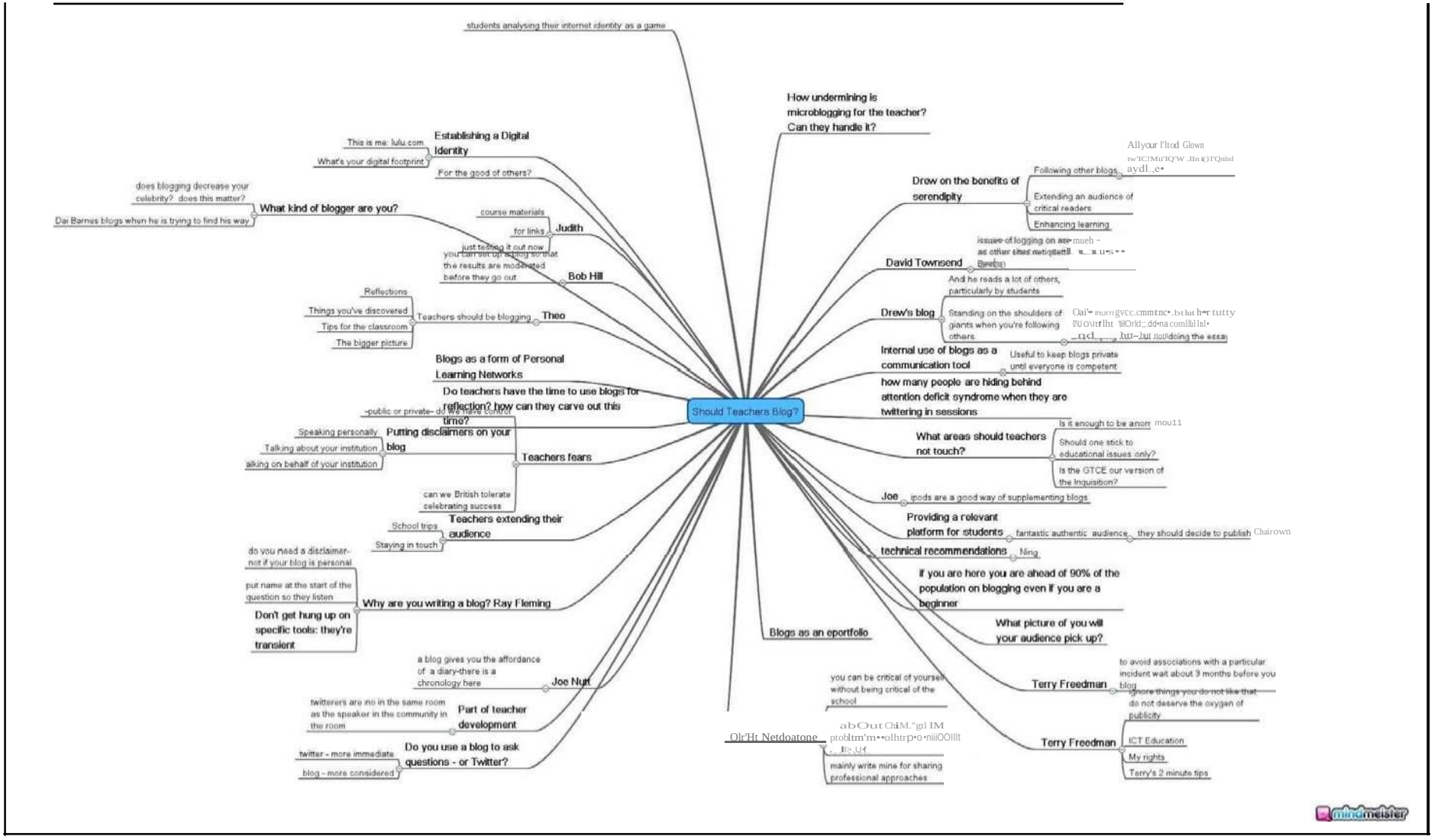

Figure1. Should teachers blog?

Available at: http://www.mindmeister.com/23248899

Four hours, therefore, had already been dedicated to different aspects of blogging, which included learning how to blog. When compared with the earlier maps it can be observed that the map-makers recorded in Figure 1 do not repeat the same issues again, but develop a new range of perspectives on the subject, such as: 'providing a relevant platform for students'; 'establishing an identity'; 'blogs as a form of personal learning'; 'internal uses of blogs as a communication tool'; and 'drawing on the benefits of serendipity'.

As would be expected, most statements couched in an informal, almost oral, rather than written, style and feature some combative comments such as: ' If you are here you are 90% ahead of everyone else even if you are a beginner'. Other comments are couched as a provocative questions; 'Why are you writing a blog?'; 'What picture of you will your audience pick up?'; 'Do teachers have time to use blogs for reflection? Do they care about reflection enough?

Some members were also sending out messages to their own Personal Learning Networks (PLNs) through Twitter as well – this had not been anticipated by the MirandaMod organizers at this phase of their development as this was a relatively new service at the time of the event. The power of microblogging and its attendant dangers are expressed on the map, as well as its relationship to blogging itself: 'Do you use a blog to answer questions or Twitter?' 'How undermining for teachers is Twitter? Can they handle it?' There is also an example of undermining members even if, in this case, it is meant in good humour: 'How many people are hiding behind attention deficit syndrome when they are twittering in sessions?' As a result of this thread Twitter was officially introduced into subsequent MirandaMods.

Another example of modifying the model is that on this map the speaker's names are not always noted. After this first pilot of the web-enabled concept map, all speakers, as a matter of course, were invited beforehand to add notes, resources and URLs that might be useful to educators. This strategy ensured that a branch existed that recorded their contribution.

Analysing collaborative maps

Results from the analysis of the MirandaMod series (Cuthell & Preston, 2009) seem to suggest that informal professional learning organised by members of a professional organisation might have a place in supporting and extending formal periods of learning and in stimulating higher order thinking as a group. In this context the maps serve 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.

However, the value of the events can be increased if effective methods can be established for analysing the maps to establish collaborative learning achievement. The MirandaNet community continues to work in order to establish collaborative maps as well as other digital artefacts as evidence for the formal accreditation of collaborative higher order thinking, but these are early days in measuring such a complex process of collaborative transformation.

Buzan (2002), who has patented the term 'mind map' for business use, has never tried to produce an analytical system. Novak is seen as the originator of concept mapping. His method of scoring educational concept maps is predicated on the concept maps being used

to test established concepts that a group has been taught. The concept maps are them used to test the effectiveness of student learning (Novak & Cañas, 2006). Map-makers are taught to draw maps in such a way that they gain maximum scores when group understanding is perfect. If the mark is low the group then re-examines their concepts and maps: this shows that as a group they have not understood the concepts.

The UK government-funded Impact 2 research used maps in order to establish evidence that digital technologies improved learning gains (Becta, 2008). The government wanted quantitative results, and as a result the Impact 2 team scored hand-drawn concept maps from more than 2,000 children from 8-14 to illustrate the theme *Computers in my World*. The maps showed an impressive understanding of the power of computers, but coventional map scoring systems proved inadequate because these individual maps were designed on the basis of original thinking – not on a pre-existing taught body of knowledge. MirandaNet members therefore rejected scoring as a method of analysing individual or collaborative maps that were exploring new knowledge (Preston, 2011). What was lacking was an analytical method in which map-makers were aware of how the mapping process could lead to higher-order thinking, in order to have ownership of learning and iterative improvement.

Findings

Unlike the other maps that day, in which the oral contributions and ideas from participants proceeded in a more linear and sequenced fashion, this final map of the debate was much less structured. Ideas were developed and built on throughout the session. The most important outcome was the identification of seven types of activity in the creation of the maps.

Figure 2. Should teachers blog? The Wordle

Table 1. Participants' actions in map creation

Action	Adding	Editing	Inserting	Moving	Removing	Renaming	Repositioning
Percentage (n=209)	0%	0%	46%	2.5%	5.5%	7%	39%

Table 1 indicates the frequency of actions undertaken in the creation of the map. These actions can be classified as:

- 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.

What is more interesting, however, is to see the inter-relationship of actions, particularly those of inserting and repositioning. Graphs plot the frequency of each activity across the process of the map creation (Cuthell & Preston, 2009).

The repositioning process is shown to be one in which nodes are moved across the map, from one side to another. 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. At the end of the process, and in the following days, much more restructuring and repositioning took place.

In the broad analysis of the interactions it was easier to see the general effect of debate as the concept map grew larger. Particularly what was seen in this map was the effect 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. This final stage was the result of rearrangement that took place in the days following the MirandaMod, and is more clearly sequenced. Working collaboratively in this way probably requires more community practice in order to move to the next stages of knowledge creation, which will form the next stage of our research.

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. Yet editing would seem to be the action that leads to such higher level cognitive processes as summary, evaluation and analysis. In order for the community to progress it seems that more explicit knowledge about how these maps can be developed, as well as practice in the process, would have benefits.

Discussion

This case study is very much a descriptive one, that illustrates the ways in which a range of participants in a MirandaMod, whether virtual or face-to-face, can inscribe and fix their experiences and learning in a liminal space. It also shows that that CPD can be facilitated through remotely authored digital concept mapping, which enables learners to transition personal and social liminal space, although there is limited evidence of higher order thinking in the collaborative final map *'Should teachers blog?'*. The first-stage analytical tools were not sufficiently sophisticated, and the map-making process had not been scaffolded with community members. If this had been undertaken there might have been agreement – and therefore evidence – of what constitutes achievement in higher order skills.

This collaborative development of theory could be seen as one layer higher than the thinking expected in formal and informal learning at postgraduate level.

Does this method of stimulating learning have benefits over the traditional face-to-face classroom? In the journey through liminal space the participants summarise, evaluate and analyse – all aspects of higher-order thinking. The evidence of repositioning of the mapping resources by the group shows collaboration and sharing, but there is only limited evidence of the editing, which one would expect of higher order thinking. Analysis of the words used on the maps shows much of interest in summarising and evaluating what is being explained. But when we examine the transitions of the map under discussion (Table 1) we find that there are no edits. If the editing process is seen in learning terms as the habit of analysis, summary and evaluation then these MirandaMods do not appear to have reached their full potential.

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. 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 at the time of the study the links themselves were 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. The main 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). 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 map 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 activities and stages of the maps described in the earlier section of this chapter. 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 (See Cuthell and Preston (2009) together with its commentary on each stage 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 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.

Further research

This paper describes the ways in which collaborative concept maps have been explored in the context of the liminal space of a MirandaMod activity that 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 liminal space – 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 backgrounds 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.

These participatory methodologies could be extended and developed 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 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 the 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, could gain agency in influencing local and national policy. Whilst it might be said that further research will need to develop these questions to inform a system for a more extensive evaluation of these multi-dimensional concept maps it may well be that what we have identified is merely one stage in the development of the ways in which Web 2.0 moves and is used. The analysis of the effectiveness of maps in identifying concept development and the formation of praxis in the context of work-based learning for education professionals may well be part of this, which should tell us more about the nature of collaborative professional learning.

The findings from this provide research data about the relationship between work-based learning and praxis and new knowledge and practice on concept mapping methodology. 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.

There is a need to refine the methods of analysis of the maps covered in an earlier paper by Cuthell, Cych and Preston (2010). The authors invite others 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.

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