Multimodal Concept Mapping in teaching and learning: a MirandaNet Fellowship project

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Abstract: This paper outlines an eighteen-month project undertaken by the MirandaNet Fellowship from 2006 – 7 to explore the ways in which multimodal concept mapping and ICT could enhance teaching and learning. Visual thinking and learning tools such as Mind Mapping and Concept Mapping have long been used in classrooms. They support (and in many cases underpin) visual learning. Findings from all of the projects indicate that the use of such tools has a significant impact on the learning environment, on pupil perceptions of learning, and on attainment. Visual learning describes an approach to teaching in which diagrams such as concept maps, mind maps, tree diagrams, organisation charts and spider diagrams are used to help students of all ages think and learn more effectively. They are all used for storing, processing, organising and presenting information graphically. These techniques can be used across the curriculum and through all phases of education, from K – 12. The most popular elements of visual learning are Concept Mapping and Mind Mapping.

Maps for teaching and learning

This paper outlines an eighteen-month project undertaken by the MirandaNet Fellowship from 2006 – 7 to explore the ways in which multimodal mapping and ICT could enhance teaching and learning. Visual thinking and learning tools such as Mind Mapping and Concept Mapping have long been used in classrooms. They support (and in many cases underpin) visual learning. Findings from all of the projects indicate that the use of such tools has a significant impact on the learning environment, on pupil perceptions of learning, and on attainment. Visual learning describes an approach to teaching in which diagrams such as concept maps, mind maps, tree diagrams, organisation charts and spider diagrams are used to help students of all ages think and learn more effectively. They are all used for storing, processing, organising and presenting information graphically. These techniques can be used across the curriculum and through all phases of education, from K – 12. The most popular elements of visual learning are Concept Mapping and Mind Mapping.

Concept Mapping

The Concept Mapping™ technique was developed by Novak at Cornell University in the 1960s. Concept maps graphically illustrate relationships between information. In a concept map, two or more concepts are linked by words that describe their relationship. They encourage understanding by helping students to organise and enhance their knowledge on any topic and help students learn new information by integrating each new idea into their existing body of knowledge. Concept maps are ideal for measuring the growth of student learning. As students create concept maps, they reiterate ideas using their own words. Misdirected links or wrong connections can alert teachers to gaps or misunderstandings in their students' knowledge. In this way concept mapping provides an accurate, objective way to evaluate particular areas requiring additional explanation to complete students' understanding.

Mind Mapping
Mind Mapping® was first coined in the UK by Tony Buzan in his 1974 book and BBC TV programme "Use Your Head". A mind map is a visual representation of hierarchical information. Students follow a process of building a mind map, to represent an entire concept or an idea with branches of associated thoughts. As with other visual learning techniques, mind maps provide a simplified overview of complex information allowing students to better understand relationships and to find new connections. Mind maps include a central idea or image surrounded by branches of associated topics or ideas. Subtopics are then added to the branches as ideas flow freely. Typically in a mind map, topic and subtopic text is one to two keywords, to provide a reminder for what the idea is. More information is then detailed in attached notes. Mind mapping is a commonly used tool for brainstorming and note taking. The process of building a mind map is very fluid and nonlinear, making the expansion of ideas similar to the natural way of thinking. Symbols and images, along with keywords, are used to quickly retain and recall information. Branches are often in different colours to help students to remember the different branches and their associations.

Supporting learning through Concept Mapping and Mind Mapping
The use of visual learning techniques, such as mapping, is achieving growing recognition in education. Whether we believe that the mind is organised into left and right-hand sides, or whether it is a less organised structure of various skills, mapping utilises a greater part of the brain, resulting in more effective thinking. Imagination and association are the keys to high-level memory and creative thinking and mapping supports this. With many students being visual or kinaesthetic learners, this approach makes the teaching more enjoyable and effective and the learning more successful and fun. It is an educational win–win that multiplies its benefits over time and with use. Concept maps and mind maps are quick to review and are ideal for revision. Remembering the shape and structure of a visual diagram can provide cues necessary to remember the information within it. They engage much more of the brain in the process of assimilation and connecting facts than conventional notes or summaries.

The use of ICT in Mapping
The application of ICT can act as a catalyst for change in teaching and learning. In terms of visual learning, technology takes the student from a 2D paper based map into a multi-layered environment. With ICT Visual Learning tools graphics and symbols can be used to highlight the nodes; labels that can be attached to the links; maps can easily be re-organised in a variety of ways to make the picture clear; maps can be hyperlinked to other maps creating a complex multi-layered system for understanding an idea; elements within the map can be "hyperlinked" to files, websites and other digital resources; multimedia files, such as MP3 and Movie files, could be inserted and played directly from the document and cross curricular templates and resources provide a quick start for teachers and students. ICT also helps to support the development of higher order thinking skills.

The MirandaNet Mapping and Visual Learning Project

A number of MirandaNet fellows came together to research the ways in which younger children learn to use both language and images to make meaning of the world, and the ways in which they source and choose the images to represent their ideas. Multimedia functionality now enables students to insert and play video and sound directly from their maps to enrich projects. Inspiration Software Inc. provided Inspiration and Kidspiration software for participants to use and donated resources to the schools involved.

Elements of the Inspiration functionality were found to support students in building diagrams, concept or mind maps and then enable them to transfer their work into text outlines. This meant that students who struggle to write down their thoughts in a linear fashion can pour all their ideas onto the page, reorganise them, link them up and, by transferring to the outline view, have the satisfaction of seeing their ideas made into a structured story or argument. Teachers have commented on how this can raise the self esteem of students who struggle with writing, especially with boys who are initially engaged by working with ICT, but who come out of the process having gained valuable thinking and learning skills. The program Inspiration contains a Word Guide, a dictionary and a thesaurus, which also aid writing and literacy by providing students with more scope for expression.

These ICT tools can also enhance the experience for auditory learners. Inspiration (and Kidspiration for younger pupils) both have audio tools, which enable auditory learners both to hear their spoken words at the same time as seeing their visual ideas. The Listen tool reads aloud any text a student inputs; the Record tool allows emerging writers to record their own words and hear it spoken aloud and, last but not least, the talking interface will

read aloud all program elements to the students, so if a student scrolls over an item anywhere in the program, the voice will say it aloud, providing an additional element of learning support.

Ultimately, ICT allows you to expand your ideas by visualising connections and concepts, in a way that you cannot on paper. With paper based mapping you can run out of space or find it is frustrating to add ideas or move them around. The functionality of ICT means that the area for expression is expanded so that space issues do not get in the way of the thought process. The choice between concept mapping and mind mapping is one of personal preference; however what is clear is that ultimately teachers seem to agree that both are powerful thinking skills that can offer benefits to all students. What is also clear is that using ICT to undertake this process has the potential to extend the flexibility and scope of this approach even further.

The range of projects

From 2005 to 2007 eighteen MirandaNet Fellows worked on projects related to Multimodal Mapping and Visual Learning. Some of these used Kidspiration, looking at the development or oracy and literacy in Mexico, the ways in which mapping could raise group achievement, and the ways in which it supported collaborative learning through talk with pupils under 11 years of age. Other projects used Inspiration for older 11-19 learners and adult learners in conjunction with PDAs, with effective learning dialogues and with supporting teacher education.

Oracy, Literacy, Conceptual Maps and ICT as Mediators of the Social Construction of Knowledge Among Peers

Rojas-Drummond, S.; Tapia, A. A. (2006)

In their paper, Oracy, Literacy, Conceptual Maps and ICT as Mediators of the Social Construction of Knowledge Among Peers, Rojas-Drummond and Tapia provide an account of how primary school children collaborated over time to develop a team project which involved the co-construction of knowledge. In particular, children worked on a writing project using diverse cultural artefacts, including oracy (talking and listening), literacy (reading and writing), Kidspiration® conceptual maps and ICT. The project involved researching, writing, illustrating and eventually delivering a multimodal conference on a topic of their interest.

The paper describes the context in which the children interacted to create their projects. This context refers to a "learning community" developed as part of an innovative educational programme called "Learning Together". The programme sessions are organised in modules. Each module is designed to target general and specific abilities in the students. The initial modules provide the students with general basic abilities necessary to advance in the programme, including collaboration, effective communication and problem solving. The rest of the modules involve promotion of more advanced and specific abilities, which enable students to prepare specific creative team projects.

These projects involve the dynamic integration of several functional uses of oral and written language. The multimodal representations of knowledge are formed in Kidspiration conceptual maps. Students construct their Kidspiration maps in a procedural and continuous way, refining their maps as their research project progresses over time. Thus, in each session they leave tracks of their collaborative processes, the discussions they engage in, as well as their questions, comments, doubts, arguments, etc. Overall, the work reveals the dynamic functioning in educational settings of some central socio-cultural concepts. In one example, children discussed how to replace concepts for images in their conceptual map on tobacco addiction. Thus, while they talked they simultaneously created a conceptual map using ICT (Kidspiration and Power Point), which included text as well as images. The data also illustrates how these relations helped children negotiate meanings, comprehend and organise the concepts of the topics under investigation.

From black boxes to glass boxes: the application of computerised concept mapping in schools

Bevan, R. (2006)

Computerised concept mapping allows students to represent their learning through adaptable diagrammatic structures on-screen. This project investigated how computerised concept mapping can be effectively deployed in student learning, in two secondary schools during 2003-6, with over 200 participants; and more specifically addressed to what extent the effectiveness of computerised concept mapping is enhanced by (a) peer collaboration, and (b) providing scoring feedback.

It was set in a context where the rapid pace of developments in computer technology has provided schools with extensive opportunities to exploit approaches to learning through ICT, but where this is rarely achieved.

Research across a number of separate disciplines had recently been combined to provide teachers with increasing pedagogic knowledge. In this project theories concerning learning and the construction of knowledge have been used to inform the design and deployment of knowledge-mapper software. The implementation of the main study allowed the use of computerised concept mapping to be examined in randomised control trials involving three experimental groups, and a control group. In one experimental group, the students used the knowledge-mapper individually. In the two other groups, the students worked collaboratively; but in only one of these groups was scoring feedback provided. The students' learning was measured and compared with an essay task.

The classes who used the software individually showed almost no gain, relative to the class who had no access to the software at all. In contrast the groups who were allowed to collaborate in creating their computerised concept maps both outperformed the other mapping groups by a significant margin, whether or not they received the automated scores.

It appeared that the knowledge-mapper had minimal effect on individual scores, but that it was effective in promoting constructive collaboration between students, which - in turn - enhanced their performance on the essay task. This finding does not appear to be dependent on the choice of software, which was CRESST, and would equally apply with other comparable computerised concept mapping tools, such as: Inspiration, Mind Matrix, and Smart Ideas. Further research may show different results if Kidspiration is used which is specifically designed for young learners.

Collaboration, ICT and Mind mapping

Ralston, J.L. and Cook, D (2006)

In their study, Collaboration, ICT and Mind Mapping, Ralston and Cook focus on an example of collaborative activity in Primary schools and aims to explore the ways that visual material helps children establish shared meanings. The study took place over six weeks in two English Primary schools with twelve 11 and 12 year olds. Both schools introduced Kidspiration®, created by Inspiration Software®, to help students plan a party. They first used paper and pencil maps then used Kidspiration to create concept maps. Each class also used Kidspiration to explore a Key Stage 2 History topic: 16th Century Explorers or similarities and differences between two towns.

Data on student use of Kidspiration were collected over a six week period using observational schedules and field notes. In the working sessions, one of the authors acted as observer while the other encouraged and supported the groups. Because of our interest in the type of spoken language used in the group activity, samples of the informal task discussions were recorded, transcribed and anlysed, as well as the more formal presentational session. Kidspiration software was chosen because of the user a friendly interface, manageability, ease of use and flexibility. Kidspiration also provides a range of templates to be used when a more structured approach is required. The use of images and text supported in Kidspiration are alternative forms of iconic and symbolic representations, which was particularly appropriate in this study.

Copies of each group's maps were also saved at the end of each session. The authors thought the maps would help pupils recall their actions and decisions across the time interval from one session to the next , as well as support them in the final feedback. Additionally, the teachers felt it would be valuable for the children who had not been involved with the activity to hear about the work. The maps created by the children proved to be more of an attempt to represent a 'shared viewpoint' or consensus. Therefore, the author felt the term 'consensual maps' seemed to be more appropriate. These maps were intended to display children's joint representation of their thinking about the tasks. Maps among the groups were visually different, but showed many similarities.

One aspect observed in this study was the quality of the discussion among the students. When talk is 'exploratory' in nature it supports thinking and learning in a hierarchical manner. The things you might find could include actions such as recording, reporting, generalizing, speculating hypothesising and theorising. In conclusion, the use of multimodal-mapping software, such as Kidspiration proved to be successful in supporting the students' exploration and presentation of ideas, as the language generated shows. The use of ICT provided a screen focus enabling pupils to organise their thoughts, make use of colour and imagery to present information clearly and attractively and facilitate discussion. The analysis of the maps showed that the students were working with a clear organising principle in mind.

Introducing ICT-based Multimodal Mapping

Riley, N. (2006)

Riley examines the eight functions of multimodal mapping, and the ways in which they can be integrated within the Primary curriculum The first is to direct thinking: as a teaching presentation tool, to organise topic coverage and group activities. The second is to stimulate discussion and dialogical learning: to promote speaking and listening skills. Multimodal mapping can also be used to generate creativity: to identify ‘conceptual spaces’ and stimulate ‘possibility‘ thinking, and to facilitate higher order thinking: to generate thinking skills through finding relationships and identifying gaps in understanding.

Multimodal maps can generate writing by scaffolding ideas: ideas can be represented through strong visual images and can contain pictures and graphics, and promote collaborative learning: mapping can be used to generate group work in discussion activities or map production activities. As an assessment tool, mapping can provide evidence for formative assessment in assessment for learning activities and as a learning self-evaluation tool in personalised learning, whilst for publication and display, visual and text representations provide a stimulating form of presentation.

Vision Mapping in Practice. Using Inspiration to support learners and teachers

Finch, J. (2006)

The Worcestershire Vision Mapping project focused on the Forest of Feckenham and aimed to involve and encourage the community to shape the future of its biodiversity heritage. The project encouraged appreciation and awareness of the importance of biodiversity to quality of life to as many sectors of the community as possible, and encouraged participation in developing a 'biodiversity vision' for their area. Communities were encouraged to explore both past and present, for example, surveying the area and collecting reminiscences of older residents, together with aspirations for the future, aiming to identify what matters most to the community regarding their local wildlife. This hoped to generate a sense of stewardship and responsibility for its future welfare, exploring new and innovative ways to engage community interest, and so develop a template to use in the future throughout the county. The school based aspects of the project will used Inspiration to support both teachers and learners to develop the creative responses local children have between people and place on a variety of levels, but with a specific focus on local biodiversity.

Inspiration(al) use of concept mapping on PDAs. A study of the impact of the introduction of PDAs, Inspiration 8 to a primary classroom

Finch, J. (2006)

This study involved the introduction of 10 PDAs to a first school (YR to Y4, pupils aged 5 to 9 years). The pilot focused on the use of PDAs to support aspects of writing with all children, but with a particular interest in the impact on a group of reluctant writers causing concern in Y4 (aged 9 years). Neighbouring Local Authorities were beginning to report interesting results on their studies in this area, which justified the support for a local pilot project. This was also an opportunity to develop the author's observations in two other dimensions i.e. that of flexible, personalised learning and multi-modal mapping. The teachers involved had no experience of using PDAs or multi-modal mapping in a classroom context so they were learning these technologies and techniques with the students. When using multi-modal mapping tools to scaffold the writing process the web-like structure seemed to give the learners permission to start writing wherever they preferred. Links guided them along a particular path, but these were changed, added to and deleted as the writer progressed. The learner remained in control of their writing environment.

The impact of this process on one child in the group was clear. When he moved from the Inspiration Diagram View to the Outline View he exclaimed "Did I write all that?" Transferring the work onto a word processor provided further encouragement when he discovered that he only had to add connectives and punctuation to create a piece of prose... "So I just add 'ands' and full stops and I've done it?" There were a number of other significant interactions which demonstrated ways in which the children were highly motivated by the resources and were supported to develop their thinking beyond prior performance with paper and pencil. Over the whole class teachers noted a significant improvement in output, quality of writing, motivation and engagement. The school was so convinced of the efficacy of the investment that they purchased a further 20 PDAs in the following term.

Investigating the impact of ICT-based multimodal mapping in developing effective learning dialogues

Riley, N. (2006)

Assessment of children's writing shows a deficiency in developing coherent ideas. More often than not, student writing follows the prompts of the teacher and shows little individual extension outward. The author of this paper is looking for an intermediary tool between talk and writing to provide structure for thought, revision, refinement and finally presentation. The study explores the use of Inspiration® from Inspiration Software® and other ICT tools and their use in the area of writing.

In writing, composition involves retrieval and evaluation of information, the evolving and synthesis of ideas and drafting, which promotes writing as 'revising inner speech' (Moffett, 1981). Concept mapping provides a means by which such compositional ideas are made explicit. Further, it is recognised that ICT can produce discussion of a type that has educational significance when children work in small groups at computers (Fisher, 1997:81; Wegerif, Littleton and Jones, 2005). This practice based case study investigates the use of Inspiration, an ICT-based multimodal mapping software, to stimulate and develop learning dialogues that enhance thinking and ideation that transfers into compositional expository writing.

The sample is a group of 22 students aged 10-11 years old within a large urban primary school in the United Kingdom (UK). The students have a wide range of academic attainment and social backgrounds. The intention was to use Inspiration -based concept mapping as normal routine in whole class teaching and in group work, where the class is familiar with using laptops individually and in small groups. Concept maps consist of "concepts" linked together by descriptive words or links which show relationship. The more descriptive the link, the better students can understand the concept.

Data for this study is collected from transcribed discussions of groups while concept mapping, Student maps were analysed for complexity based on the number of nodes and links. The pre-test and post-test scores were compared, wherein students used concept mapping in the post test. The number of propositions and concepts in writing and in the discussion increases post-test. When comparing the examples of writing by the same groups it is noted how the pattern of mapping has increased in concepts formed and links labelled. Further, the ideas are more developed post-test. These findings suggest that Inspiration maps increase the incidence of higher order thinking during the compositional process.

A Survey of Teacher Inclusion of Graphic Organizers in Classroom Instruction
Antonius, E. (2006)

This study surveys teacher use of Graphic Organizers in their classrooms. It reviews research on the effectiveness of Graphic Organizers with students. It examines how visual learning techniques are supported by theories like dual coding and multiple intelligences. Experimental research also supports an increase in retention and in test scores when graphic organizers are introduced. Computerized graphic organizers are included and show that they positively affect student scores. A survey was conducted with 62 teachers who are currently getting their Masters of Education at George Fox University. These teachers respond to a 14-question survey ranging from fill-in-the blank demographic questions to open ended questions on their application of Graphic Organizers. The results found that a majority of teachers did include graphic organizers in their classrooms. Elementary school was the highest level of inclusion. A number of educators responded that they include graphic organizers in their classrooms. Questions for future study might focus on Special Education teachers, student use interactively versus teacher use for presentation, and student assessment when graphic organizers are used.

Engaging Learners through Critical Thinking Scaffolds
Coombs, S. (2006)

Coombs focuses on personal learning and how it is developed through the use of critical thinking scaffolds. Through his research, Coombs suggests that the basis of the critical thinking scaffold consist of managing, focusing and eliciting reflection as a method of personal learning (Coombs, 2000). Coombs sites the merged theories of ‘systems thinking' and Self-organised-Learning (S-o -L) (Thomas & Harri-Augstein, 1985) as the philosophical and pedagogical basis for using critical thinking scaffolds to improve personal learning. The S-o-L theory explains human learning as developed through the construction and reconstruction of meaningful reflective experiences. The S-o-L theory includes three phases: brainstorming to capture ideas, focusing key issues to develop ideas and, finally, project control through operational management. Graphic organisers, like Inspiration® from Inspiration Software®, can be used in all three phases to simplify and digitise the process. The second theory of systems thinking is based on Knowledge Elicitation Systems (KES), which focuses on idea capturing, sorting relationships and displaying a final pattern. Graphic organisers are again suggested for this structure.

"Taxonomies and flowcharts clearly provide two different kinds of knowledge. The one represents the world in terms of a hierarchical order. Its main concern is the ranking of phenomena from the perspective of a single unifying turn.... the other describes the world in terms of an actively pursued process with a clear beginning and an end. It has a sequential progression and is goal-orientated... System networks... attempt to combine the two perspectives" Kress and Leeuwen (1996). Inspiration allows for the building of the hierarchical order of taxonomy and the process structure of a flow chart.

Coombs continues on to share his use of scaffolding created in Inspiration to develop this paper, as well as provide some practical examples used with his post graduate students (teachers, trainers, etc.) in the form of generic case study templates used as support. Psychological schemas manifested in the form of practical visual learning templates to help guide and structure critical reflection have been developed and integrated into the Professional Master's Programme at Bath Spa University. These templates operate as professional learning tools to help professionals critically engage in work-based projects. These critical thinking tools have also been adapted to both support and assure quality in the master's level work-based professional development capability of participant professional learners via the university's virtual learning environment system.

Other projects from the MirandaNet working group

A number of other projects from the multimodal concept mapping project, are outlined in the e-journal, but are not yet fully reported.

Berry investigated the literature on the use of Concept Mapping in schools, and disseminated his findings to the group during the workshops and seminars. This served to inform the work that was in progress. Clark's work looked at the use of mind mapping to enhance learning in ICT at AS Level, and had two key aims: to establish whether - and if so, how – mind mapping software could usefully contribute to learning and, in particular, whether collaborative linking significantly improved thinking; to identify student desires (what they want the software to do) and ways of achieving greater dynamicity or interactivity in digital mind mapping by combining different types of software.

Preston explored the effectiveness of encouraging teachers to express the quality of their learning in a more visual way through mapping. The first objective was to explore the potential of multimodal mapping in evaluating the effectiveness of ICT courses from the perspective of the tutors. The second objective was to compare the quantitative results between teachers taking an ICT skills course and teachers undertaking a year long practice-based research project. The third objective was to refine the quantitative methodology to provide a replicable model for other teacher educators. Findings suggested that the multimodal mapping could a useful tool for encouraging innovative self-assessment and group assessment of the quality of learning through discussion and debate.

Thomas examined the tools that can be used to promote this dialogue, and the ways in which concept mapping can be used as part of an "online tool set" for critical thinking development and assessment for learning. Thomas also examines social networking software and its link with possible assessment for learning tools, which opens up the wider issue of what non-linear really means, and what is this collaboration really means. The use of concept maps to support mathematical problem solving was investigated by Piggot, who explored the question of whether concept mapping software can act as a tool to mediate and support learners' independence in "stepping into" mathematical problems.

Conclusion

The evaluations of and critical reflections on the teaching and learning activities demonstrate the complex interactions between the learners' experience of the mapping tools, the focus of the tasks, and the practical issues to be addressed. Riley's study indicates positive developments in the pupils' higher order thinking skills, changes in the nature of the talk and indications of transfer from talk into writing, and while Clark notes the generally positive response of the students, she also acknowledges some of the frustrations of accessibility to resources and skills that arise. These studies did not introduce the mapping activities as 'one-off' experiences, but incorporated them into a series of sessions to give learners time for practice, reflection and, 'gestation' of ideas. Rojas-Drummond and Tapia refer to the 'gradual appropriation by the children of the various cultural artefacts', including the concept mapping

tools. Ralston and Cook describe the role of 'consensual maps' as a scaffold for the intertwining of talk, thinking and visual representation.

A key theme in the consideration of the pedagogical issues associated with this work is the development of the teachers' own professional knowledge. It is not just the mapping tools, which bring about the responses and changes for the learners, but the pedagogical context in which their possibilities are introduced and modelled. The teachers actively engaged with the nature of the teaching and learning problem, the theoretical framework for approaching the activities, the methods for investigation, and the critical reflection on the evidence emerging from the study. Their pedagogy shaped, and was shaped by the teaching and research activity with the mapping tools, providing us with insights into future planning, teaching strategies and themes for reflection.

Digital mapping software now offers sophisticated features in multilayered diagrams which encourage learners to express their concepts by creating multimodal artefacts and by refashioning existing artefacts to attach to their maps. Web enabled maps offer an even greater range of possibilities. The implications for the profession in interpreting, storing and assessing these maps are substantial. Dissemination and publishing decisions about learning artifacts are a new dimension of learning which have not been offered to learners until the omnipresence of the internet. It also creates a new situation in which the Internet audience may judge the success of a map by diverse criteria, which bear no relationship to the judgements a teacher might make. Under these new conditions for learning maps appear to offer a tool which might be important in rethinking ways of teaching and learning.

These commentaries, papers and case studies provide a snapshot of a range of different perspectives and different uses of digital concept mapping in the practice of teaching and learning. Thanks are due to the members of the MirandaNet Visual Learning Group, who initiated the project.

Source materials

Full details of the projects can be found on the MirandaNet site (http://www.mirandanet.ac.uk) at http://www.mirandanet.ac.uk/cgi-bin/journals/search_ej.pl?runtype=news;ejtype=ins. Presentations from project seminars are also available to download. A number of papers from the project have been published in the journal 'Reflecting Education' Volume 3 Issue 1, 'Fascinating cultural objects: multimodal concept mapping in teaching and learning', http://www.reflectingeducation.net/index.php/reflecting (Ed. Pachler, N., Institute of Education, University of London ISSN 1746-9082

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