Vol. 3, No. 1, November 2007 pp. 61-73

Reflecting Education
http://reflectingeducation.net

Collaboration, ICT and Mind Mapping

John Ralston and Deirdre Cook
Faculty of Education and Language Studies, The Open University

This study looks at an example of collaborative activity in Primary schools and aims to explore the ways that visual material helps children establish shared meanings. It focuses on three distinct questions:

- What are the ways in which multimodal-mapping software can support children's exploration and presentation of ideas?
- How can the maps produced by the children be analysed?
- Do samples of the children's talk in groups sessions indicates evidence of collaboration and negotiation?

CONTEXT OF THE RESEARCH

This exploration took place over a period of six weeks in two English Primary schools, in each case, about twelve ten to eleven year old children worked with us. Because we wanted the software to fit into each school's planned curriculum we identified, in discussion with the teachers, a number of possible topics which might provide a focus for the practical work. All the activities were ones that encouraged discussion and negotiation.

In one school, a Key Stage 2 History topic was selected. Here, the children were investigating discovery and exploration in the 16th Century, when early adventurers set out on long and dangerous voyages, establishing new trade routes or searching for new lands to conquer. Pupils were set the task of being 16th Century explorers, planning a voyage of discovery. Pupils were encouraged to think about such things as what provisions would need to be taken? What skills would be required of the crew? What likely hazards might emerge?

The project selected in the second school involved pupils comparing and contrasting two English country towns. This involved pupil visits to both towns, during which, considerable information was collected about the key features- types of shops, restaurants, cafes, inns, businesses, churches and tourist attractions. The idea was to investigate and identify the similarities and differences between the two towns.

In each school, on the first visit, we adopted a 'getting to know you' approach since we were not known to the children and we needed to find out a little about those who were going to help us explore the software. We also needed to establish some common ground between the children and ourselves and find out about their previous experincces. Next we wanted to encourage pupils to explore the use of the mapping software in a relaxed way. To achieve this an introductory topic, 'Planning a Party' was used, firstly using pencil and paper – an approach with which the teachers said the pupils were already familiar, then with the software and here they worked in small groups to produce their party planning map using *Kidspiration.* This mapping software had been chosen by the teachers, from a number of mapping programs available. Subsequent visits focused on developing the map creation in each of the tasks described earlier, and each group of children spent about forty minutes involved in the activity. They worked in groups of three, selected by the teacher. The schools had established class rules for group working on computers: *Remember – listening, sharing, taking turns.* To these we added some other rules more specific to the software:

- Use a maximum of two clip art images for each ‘thinking bubble’.
- Always title and save your work frequently.
- Make sure you can explain your map to others.

All of this practical activity had to take place somewhat opportunistically when the schools could accommodate us and we were able to visit them. Although the rules existed they were not enforced, but the children were sometimes reminded about them to encourage them to stay on task. We included the ‘thinking bubbles’ as a device to encourage the children to be as explicit as possible. For this we used the cartoon convention of ‘thought bubbles’, which displays a character’s thoughts above their head. In this way we hoped to gain more insight into why particular decisions were made. Data were collected over a six week period using observational schedules and field notes. In the working sessions, one of us 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 talk were recorded, transcribed and anlysed, as was the more formal presentational session. Copies of each group’s maps were also saved at the end of each session. We thought that the maps would help pupils recall their actions and decisions both across the time interval from one session to the next and to support them in the final feedback. However, the teachers felt it would be valuable for the children who had not been involved with the activity to hear about the work. The final feedback session, therefore, became more formal than originally planned as it now involved both the other class members and the teacher- this change in fact proved a valuable addition.

INFLUENTIAL IDEAS FROM RESEARCH

We have always had an interest and enthusiasm about understanding how children’s thinking can be stimulated and encouraged. A principal influence on the work we describe here has been research into developing thinking and additionally how mapping software, in particular, might help in this process. This focus on thinking is an important and necessary concern of all teachers and as a key element of childrens’ learning has led to a multiplicity of interpretations and the emergence of a range of proposed ‘techniques’for its development. As long ago as 1985, Nickerson, Perkins and Smith listed thirty different thinking related programmes. Writers like de Bono and Buzan have ensured constant interest in thinking 'development' since that time. Research by Dawes, Mercer, and Wegerif (2000) and others has emphasised the importance of language and discussion in developing thinking. The McGuiness review and evaluation of research into thinking skills (McGuiness, 1999) has also been influential. Subsequent to this review the DfES categorised approaches to thinking development in terms of philosophical, cognitive intervention, and brain-based learning (DfES,2000). 'Mindmapping', for example would be seen as part of brain-based learning. The McGuiness study also drew attention to the role which ICT had to offer in developing thinking skills. In a 2002 review of the literature, Wegerif summarised the role of ICT in teaching thinking skills '[…] as providing 'mindtools' and as a support for learning conversations.' and also stated that 'the evidence also suggests that collaborative learning improves the effectiveness of most activities'(Wegerif,2002,p2). It was for this reason we recorded the children's task talk.

In their 1997 study, Wegerif and Scrimshaw looked at the impact of different factors on the quality of children's talk when using computers. This included the type of software, screen interface design and the role of teachers. Software, they concluded, when well constructed and used in meaningful contexts, proved very productive in encouraging problem solving and helping in the development of the children's reasoning capabilities**.** Wegerif and Mercer (1996) influenced our ideas. They take a dialogic view of collaboration, that is, they see meaning as being created through interaction between individuals. Meaning is created, in this view, by the sharing of different perspectives and by 'the ways children communicate as members of a group with joint goals'. We feel that in the work described here the groups were engaged in a joint enterprise focused on the creation of a product which they were to share with their peers on completion through a group presentation. Although the term group is used here to describe an organisational arrangement, the idea behind all such joint work is that social and collaborative interactions are valuable aides to learning. Talking, thinking and visual representation are so closely interlinked in this project that it is difficult to tease them apart. The practical work was formulated around the idea that in group work there are more talk spaces for children, there may also be a sense of security in as much as the shared end product is the work of group rather than an individual. Talk space provides the opportunities for the children of explaining, questioning, reminding, imagining, listening, thinking out-loud, exploring partly formed idea and making sense of the tentative suggestions of others. The model of group work here is that of Reid, Forrestal and Cook (1989) which sees the stages of development of interactions within groups as engagement, exploration, transformation, presentation, and reflection.

Using ICT in the form of 'concept maps' or 'mind maps' in stimulating thinking has been a widespread an important area of investigation not only in education but also in other areas. The software applications used to develop 'mind maps' can be described in numerous ways – as advance organisers, story webs, graphical organizers. Many of those available have been designed for a specific purpose-some to resolve a business problem, others as a research or assessment tool. Mind maps have also been used as a means of communication, to help others understand the rationale of an argument or the structure of student's knowledge, illustrating how ideas are interrelated(Novak and Gowin, 1984). The term 'mindmap' was created by Tony Buzan in his work to promote this mapping technique as a tool to help improve memory and to generate ideas. In our work, we felt that the maps being created by the children did not quite fit into the categories outlined above, but rather were an attempt to represented a ‘shared viewpoint’or concensus. Therefore, we 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.

We wanted to use mapping software from the wide range available, which was easy to understand, and quick for the children to learn. In selecting a program for use by children, an important factor, we felt, is the degree of freedom available to the user to design and manipulate their maps. It is also possible that many choices presented in complex menus can be confusing. In discussion with the class teacher we felt that we needed multimodal-mapping software which would enable pupils to organize their thoughts and use colour and imagery to present information attractively in a style that suits them.

There are many commercial ‘concept mapping’ programs available, some of which are less intuitive than others; some contain over busy ‘icon complex’ screens. Others with a ‘business’ focus are less appropriate for children. We chose *Kidspiration* that offers the user a friendly interface, manageability, ease of use, and flexibility. It also provides a range of templates to be used when a more structured approach is required. *Kidspiration* software, generating as it does, images and text, which we see as being alternative forms of iconic and symbolic representations, was particularly appropriate. The software affords plenty of opportunities for pupils to speedily modify and revise the images, colours and structures of their maps, to represent their discussion and save the result. This means that the maps can be manipulated until the children feel it best represents their ideas. We felt that such ‘maps’ would provide a visual representation of the children’s understanding about the task which would be both efficient and succinct.

ANALYSING THE MAPS

A number of approaches have been put forward to analyse or ‘score’ maps (Novak and Mussonda, 1991; McClure and Bell, 1990), most of the techniques used relate specifically to the mapping of concepts or propositions. For example, one approach is to look at the hierarchy of concepts within the map, grouping these in order of significance and awarding points depending on whether the concept is positioned at the top, middle or bottom. A second approach awards points based on an evaluation of the validity of a ‘pair’ of concepts. A third method is to scrutinise cross links on a map, and add points for links that return to higher level ‘key’ concepts. A further method takes account of the overall organization of maps, awarding points for creativity in design and the cohesiveness of the overall structure (for examples of approaches to the analysis of childrens maps see Mavers et *al.* 2002: Pearson and Somekh, 2003:Somekh and Mavers, 2003).

We felt that although providing useful ideas for us to draw upon, none of these techniques was quite suitable for our particular context of ‘consensual maps’. However, we did feel when looking at the maps carefully that although these were visually quite different they demonstrated some similarities. Therefore, we felt there was value in giving the children appropriate recognition for their achievements, so an alternative method of analysis was necessary.

The first strategy was based on the differing features of the eight maps which could be clearly seen such as the use of free and attached icons, label descriptors, list of items, qualifying statements or questions, different types of nodes and links and illustrative or analytic use of colour. The maps were then codified so that each different feature was identifed in a specific and stylised way, that is by using a different icon for each text type (see Figure 1).

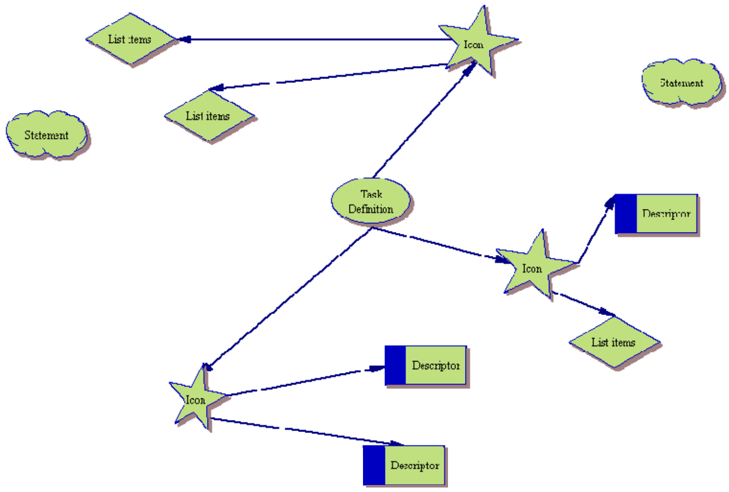

Figure 1: Task definition

This revealed much more clearly the systematic way the children had taken to creating their map and also made it possible to compare maps in each task group and across both tasks in a more realistic manner. By giving each identified feature a nominal score of '1' it became possible to rank the maps in a way that reflected their complexity. Athough it was clear that colour was sometimes being used to discriminate between categories rather than for aesthetic purposes so far we have not found a way to include this in a numerical way. While the stylised representation of the maps made them comparable it still does not seem to fully capture in an adequate measure the overall intricacy of the children's efforts.

The second approach we adopted, analysed the 'nodes' of the maps, identifying the 'busiest', the ones with most connections or links to other nodes. For example, Figures 2-5 show a small section of the children's maps.

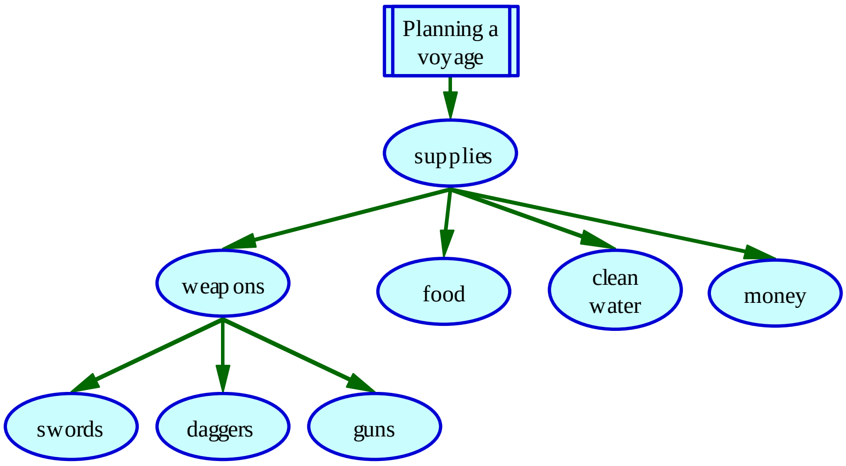

Figure 2: Planning a voyage 1

In Figure 2, the ‘supplies’ node is a 5-node, having five ‘connectors’ to other nodes; ‘weapons’ would be defined as a ‘4-node’. The discussion about ‘supplies’ shown in the map was clearly an important one in this example. Nodes were categorised in all the maps from a 1-node, with one link to another node, up to 11-nodes, with many connectors. Using *Inspiration* software, a more advanced version of *Kidspiration*, maps were rearranged with the busiest node(s) at the top and subsidiary nodes lower down. In Figure 2, ‘Weapons’ would be a subsidiary node.

Here is an adapted extract (Figure 3) from a different map, which has the main node ‘planning a voyage’ and a number of subsidiary nodes:

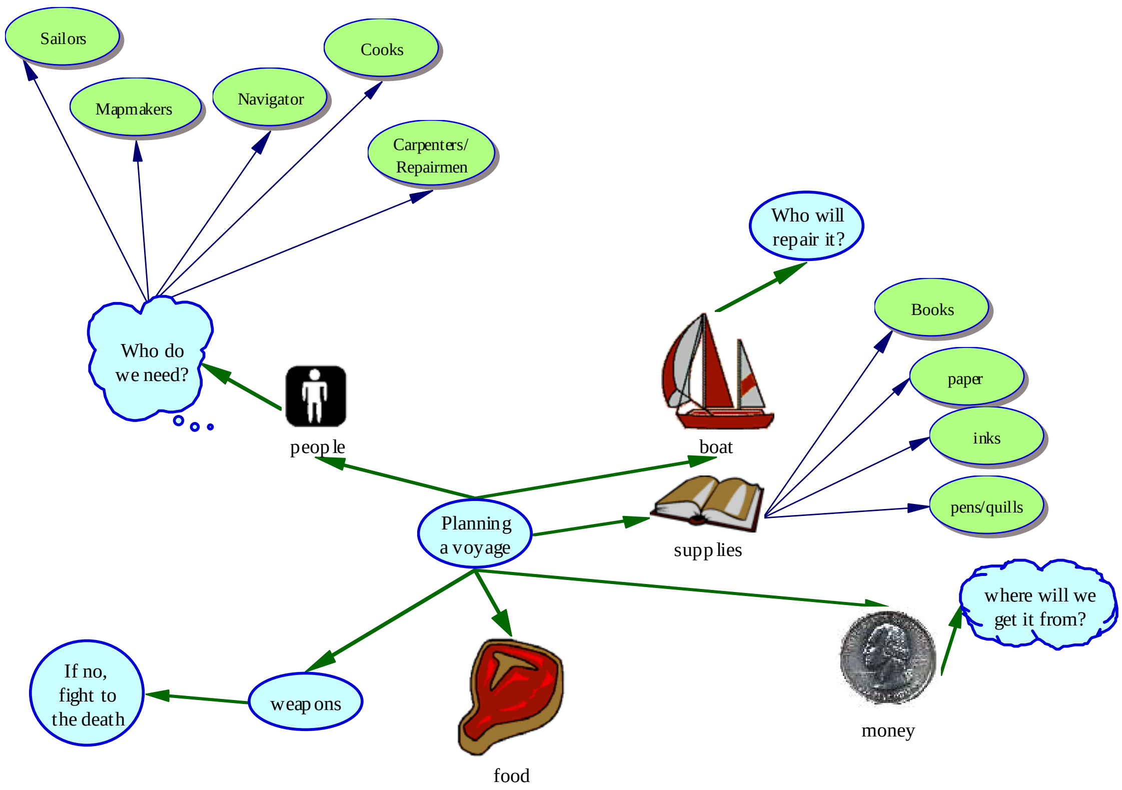

Figure 3: Planning a voyage 2

When rearranged using *Inspiration*, we have this result (Figure 4)

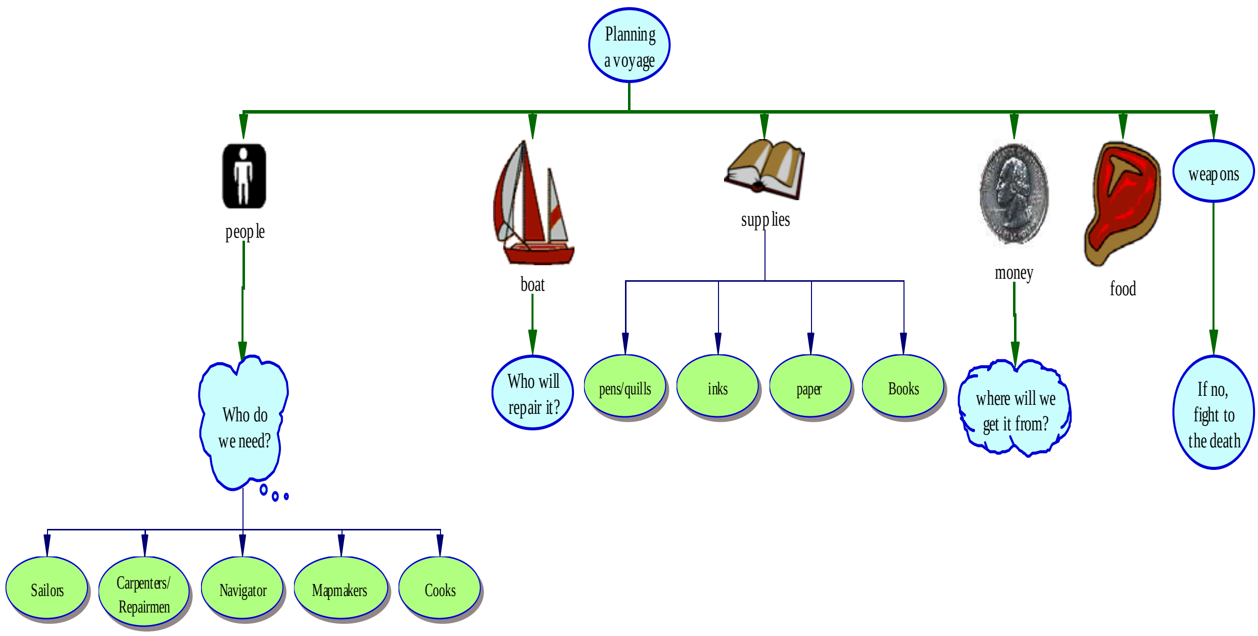

Figure 4: Planning a voyage 3

This rearrangement helps the analysis by showing quite clearly the different 'levels' or stages of each map's 'development'. Each level of this hierarchy of nodes was then identified and scored, giving one point of the first level node, two points for a second level node and more points for subsidiary nodes, providing a higher score for more 'fully developed' nodes. A numerical sum could then be obtained for each map and a comparison made between the maps. As with all scoring methods, there is clearly a degree of arbitrariness in the way that values are allocated to the nodes in this technique. However, both these approaches to map analysis did help obtain a sense of the complexity of the structure of each map. To do justice to the thinking behind each map we needed to look more carefully at what the pupils had to say, to give additional insights into how the maps were created and how they helped the children organise and express their ideas.

SPOKEN LANGUAGE

The link between talking and thinking can be described in various ways. 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.

Across the projects and within each of the tasks groups operated in different ways. Because groups were mostly triads they tended not to break into sub-groups. The field notes showed evidence of both 'fragmented' and 'integrated' approaches to the tasks but the examples used for talk analysis come from integrated groups. The talk data and field notes for these groups, the notes about the preparation for, and the actual presentation, show that while the children carried out a considerable amount of discussion about technical moves and about vocabulary items (for example, a search for the word 'compass' starting from a geometry set and working towards the navigational instrument), and about spelling and content, none of the group members felt a need to challenge to any serious degree the views expressed or the actions suggested by their team. Any differences that occurred were resolved quickly and smoothly as if all concerned were anxious to avoid conflict and get the job done. In the presentation there was some discussion about who would speak first and where changeovers should take place but this was amicable. Taken together the elements of the task produced plenty of talk although in the map creation process much of this was directed through the screen and many utterances were very short, often single words. Noticeable amongst these are many "cool", "looks good to me", "right", and "ok". There were several examples of tag questions, for example, "right, that needs to be moved down, doesn't it"' and "Oh yeah we need a ship, that's supplies isn't it?" This type of language use is often associated with the seeking of confirmation or affirmation,

Any conversation amongst any group of people is, in a sense, collaboration. It is impossible to prepare oneself for a conversation as this type of talk is essentially an improvisation between the participants in the context in which they find themselves. Not only do the moves build upon each other, but, in the course of the process, the participants also shift and change their ideas and their words. The process talk used during the task time of the two groups considered in this sample appears very collaborative. Although separating out specific items is in a sense inappropriate, it is noticeable that group members mostly use ‘we’ to direct action. This suggests they felt and acted as a collective rather than individuals.

The samples used for the detailed analysis were about the same length, sample a) contained about 250 utterances and sample b) slightly more, although these utterances were frequently single words rather than phrases or sentences. In the recordings there were also many examples of overlapping voices, echoing of each other’s words and sometimes the talk was confused, as one would expect in a normal conversation. In order to look for evidence of negotiation and agreement some detailed word counts were done, but because the recordings were made in the normal classroom without microphones they are illustrations only. The first search was for the term *‘like’*. Sample a) contained approximately 24 uses of this word and sample b) had 28 similar uses: this speech form is one that is used in conversation when we are concerned with relationships with others. *‘Need’* another closely associated form, was also frequently used in a variety of uses ‘*we need*.’ or ‘*they need…’* –that is the explorers or ‘*it needs*…’ -where it was the map itself). This word was used 24 times in sample a) and 25 times in b), again a co-operative style of talk. In addition sample a) revealed 24 uses of the words such as: -*why*, *so, but, because*, *well* and *if*, and sample b) revealed 15 examples: these are most often words associated with thinking and reasoning. There were quite long exchanges around spelling, even though we had said not to worry about this, for example 23 conversational turns to work out if ‘*maintain*’ or ‘*repair*’ could be accurately spelled. Software was often seen in anthropomorphic terms ‘*it*’*s not letting me do that!*’

The talk was undoubtedly productive as all groups completed their map and presentation. The process talk is probably best described as ‘cumulative’ rather than ‘exploratory’, but it is dialogic. The sample analysis suggests the group were thinking about what they were doing, acting collaboratively, concerned to seek agreement and conscious of the product they were creating. They were able to adopt different styles of language use to fit the differing contexts in a relevant way. By contrast to the task talk, the presentational talk is typified by much longer utterances (mostly of 90-100 words but one example of 208) and is *monologic*: that is no interruptions were anticipated or occurred.

USEFUL OUTCOMES

At the beginning of the project we were concerned that time might be wasted. The range and variety of images available in the software could provide an easy distraction for pupils and we discouraged excessive image manipulation. However, we came to realise that this was a ‘useful’ activity. Creating consensual maps involved groups having the space in a supportive environment and sufficient time to explore differences in image, colour and structure. For this opportunity to be available, it was necessary to maintain a ‘light touch’, enabling pupils to derive their own solutions to situations. This freedom to explore the use of the software did not create difficulty in completing the tasks. When deadlines were set, such as the need to present what had been developed, pupils responded speedily adopting a specifically chosen strategy to use.

Young children can often appear as confident users of technology, exploring and investigating the use of hardware and software without the use of any handbooks or instruction, a contrast with more tentative adult users. This process of interacting with computers, often by trial and error, is an important and accepted characteristic of classroom practice and is sometimes given the name of 'bricolage' or more recently, the term, 'futzing'. This 'playing around' provides the opportunity for pupils to explore and investigate the possibilities of the technology with minimum external intervention.

Being able to effectively organize the use of ICT in teaching, sometimes with limited resources, can be a challenge for the teacher. This study suggests that building in classroom time for 'futzing' needs to be part of the approach adopted and can play a significant part in promoting meaningful talk.

The software provided the opportunity for pupils to make their own choices developing the maps. These could be captured to be worked on in later sessions. The use of a common screen meant that information could be shared and jointly owned. Pupils recognized the contribution of ICT, when asked to comment:

Has the software helped you? 'Oh yes' 'Yes, I think more when you doing something that is fun you just think more'

Little difficulty was experienced by the children who used the software intuitively, showing enjoyment at the wide range of clip art image available. To avoid too many distractions the number of images to be used wasrestricted, resulting in this response from one child:

Child: 'putting two pictures to each cloud thing was hard'

Adult:'so you felt that the rules made it a bit harder because we said you could only use one or two pictures each time you used a speech or thought bubble.'

(The child's comment is expanded slightly by the adult in line with the 'rule'about two images in relation to each 'thought cloud or bubble'.)

A number of groups spent time searching for or altering images, *futzing* skillfully, to match the effect they wished to create, commenting:

'some of the pictures were modern day… but if you changed the colour it made…' (overlapping voices)

'so on the book we changed the blue to like browny and the colour of the paper… creamy' (overlapping voices)

'…and then on the ..instead of bright red for the…'

'we changed the chop…it was bright red and we…changed it to a kind of blood red with...you know…brown instead of white...because, I mean, we felt…'

Multimodal-mapping software proved to be successful in supporting children's exploration and presentation of ideas as the language generated showed. The software is flexible and easy to learn; children are soon able to manipulate the maps with ease, and can focus on the tasks. The use of ICT provided a screen focus enabling pupils to organize their thoughts, make use of colour and imagery to present information clearly and attractively and to facilitate talk as well.

The analysis of the maps showed that the children were working with a clear organising principle in mind, although there were sometimes inconsistencies, for example in the direction of arrows or how nodes were distributed. Lists or items were logically arranged; icons were used to show relations between nodes, the use of these images often requiring considerable searching to obtain one the group felt gave an appropriate representation of what they had in mind. Images and the structure of the maps were modified and evolved as group discussions proceeded. All the groups were able to complete their maps and solved the problem they had been set of devising a method of sharing the outcome of their discussions with their peers in a meaningful way.

REFERENCES

Cook, D. and Ralston, J.L. (2005) 'Building the cognitive bridge: children, information technology and thinking'. In *Education and Information Technologies*, *10*(3), pp207-223.

Dawes, L., Mercer, N. and Wegerif, R. (2000) *Thinking Together: A Programme of activities for developing thinking skills at KS2.* Birmingham: Questions Publishing.

DeBono, E. (1970) *Lateral Thinking.* London: Penguin.

DfEE (Department for Education and Skills) (2000) *Thinking skills in Primary Classrooms. A*vailable at http://www.standards.dfes.gov.uk/thinkingskills/ (accessed 2 April 2007).

Feuerstein, R., Rand, Y., Hoffman, M.B. and Miller, R. (1980) *Instrumental Enrichment: An Intervention Program for Cognitive Modifiability.* Baltimore, MD: University Park Press.

Higgins, S. (2001) *Thinking Through Primary Teaching.* Cambridge: Chris Kington Publishing

Mavers, D., Somekh, B. and Restorick, J. (2002) 'Interpreting the externalized images of pupils' conceptions of ICT: methods for the analysis of concept maps'. In *Computers in Education*, 38, pp 187- 207.

McClure, J.R. and Bell, P.E. (1990) *Effects of an Environmental Education-Related STS Approach Instruction on Cognitive Structures of Preservice Science Teachers*. University Park, PA: Pennsylvania State University.

McGuinness, C. (1999) *From Thinking Skills to Thinking Classrooms: a review and evaluation of approaches for developing pupils' thinking.* London: DFEE Research Report RR115.

Nickerson, R., Perkins D., & Smith, E. (1985) *The teaching of thinking*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Novak, J.D. & Gowin, D.B. (1994) *Learning how to learn*. New York: Cambridge University Press.

Novak, J.D. and Mussonda, D. (1991) 'A twelve year longitudinal study of science concept learning'. In *American Educational Research Journal*, *28*, pp117-153.

Reid, J., Forrestal, P. and Cook, J. (1989) *Small group learning in the classroom*. Western Australia: Chalkface Press.

Somekh, B. and Mavers, D. (2003) 'Mapping Learning Potential: Students' conceptions of ICT in their world'. In *Assessment in Education*, *10*(3), pp409-420.

Somekh, B. and Pearson, M. (2002) 'Concept-mapping as a Research Tool: A Study of Primary Children's Representations of Information and Communication Technologies (ICT)'. In *Education and Information Technologies*, *8*(1), pp5-22.

Wegerif, R. (2002) *Thinking skills, technology and learning: a review of the literature for NESTA FutureLab* (www.nestafuturelab.org)

Wegerif, R., & Mercer, N. (1996) 'Computers and Reasoning Through Talk in the Classroom'. In *Language and Education*, *10*(1), 47-64.

Wegerif, R. and Scrimshaw, P. (1997) (Eds.) *Computers and talk in the primary classroom*. Clevedon: Multilingual Matters.

Note

This study is part of a longer term project on multimodal-mapping.

A fuller account is available in these papers:

Cook D. and Ralston, J.L. (2005) 'Building the cognitive bridge: children, information technology and thinking'. In *Education and Information Technologies*, *10*(3), pp207-223.

Cook, D and Ralston, J.L. (2005) '*Hogyan épül a megismerés hídja?* Gyerekek, információs technológia és gondolkodás'. In *Új Pedagógiai Szemle július-augusztus*. Available at http://www.oki.hu/oldal.php?tipus=cikk&kod=2005-07-in-tobbek-hogyan (accessed 28 August 2007)

John Ralston

John's background is in both industry and education, working in computer management as well as teaching in Primary and Secondary schools. For 15 years he was a local authority adviser, with responsibility for the implementation of numerous ICT related activities, looking at how technologies might be exploited to give added value to teaching and learning. He established a special opportunities centre in the use of ICT to support children with special educational needs, especially those with sensory and visual impairment, as well as those able and talented.

As a Senior Lecturer at the Open University, he chairs a number of Masters degree courses and has been involved in European projects, developing innovative approaches to teachers' professional development. As well as authoring and developing materials to support a national e-learning project, he is currently researching virtual communities and how they might be developed and supported.

Correspondence: John Ralston, J.L.Ralston@open.ac.uk

Dr Deirdre Cook

Coming from a background in Primary and Early Childhood education, Deirdre worked as a classroom practitioner, curriculum developer, teacher educator and MA programme leader before moving to the Open University where she has been involved in a number of projects at postgraduate level concerning the use of ICT in supporting learning in schools, higher education and teachers' professional development. Her research interests and publications reflect these experiences: she has published work on the semiotic activities of young children in literacy and numeracy and other aspects of early childhood and primary education especially those involving the use of new technologies to support learning. She has also been involved in a project creating and developing online multi media-materials for teacher's professional development. Current research relates to various aspects of teachers' professional development.

Correspondence: Deirdre Cook, deirdre.cook@tiscali.co.uk