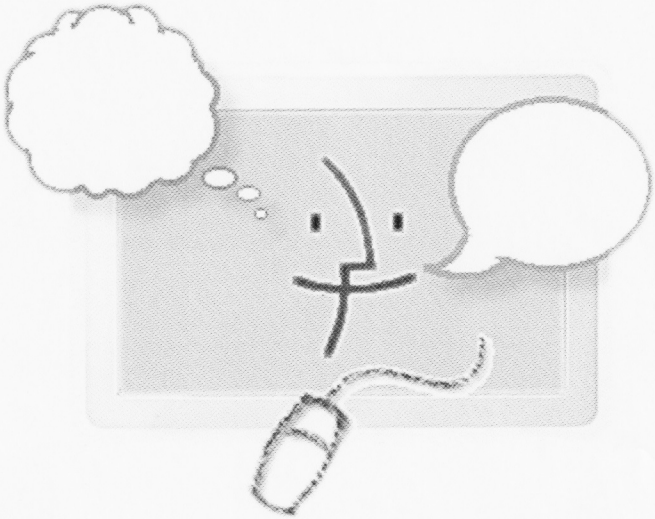
Thinking Skills



MAPE Focus on Teaching Thinking and ICT

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Teaching Thinking and ICT

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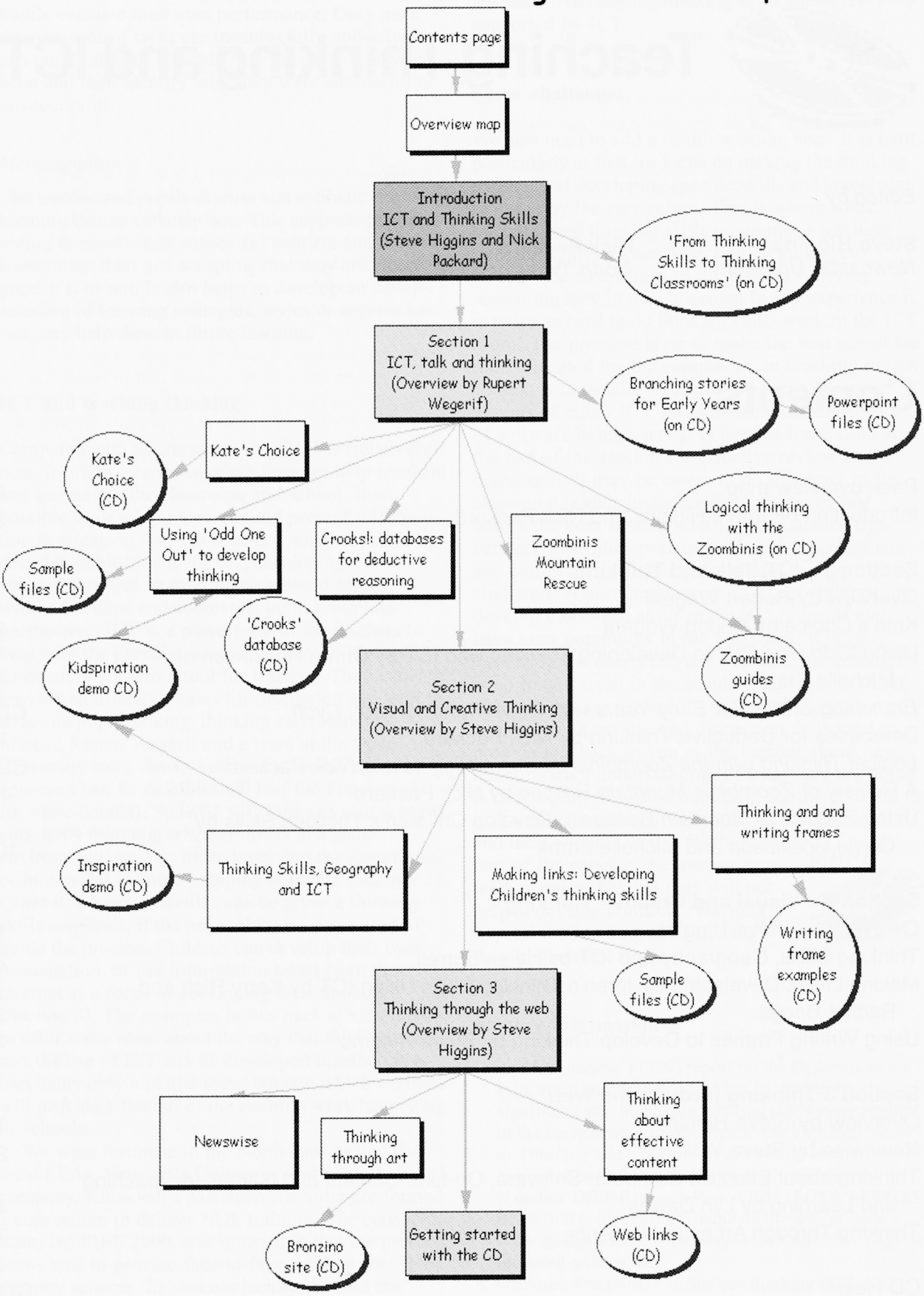

Introduction

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The inclusion of thinking skills in each of the subjects of the National Curriculum 2000 was a welcome step. It acknowledges that in an age when access to information is easier through computers, databases and the internet it is vital that learners are given the skills to think through the appropriateness and quality of this information. A curriculum that includes teaching thinking is also about developing children's understanding of what they are learning rather than focusing on their entitlement to receive or have delivered to them a particular body of knowledge. Teaching thinking also has another, more ambitious, aim. It seeks to enable children to become more effective learners and to develop responsibility for and self-regulation of their own learning through explicit discussion and review of how they have learned particular content.

Teaching thinking is not new. The idea that thinking is central to learning has a long history, some would argue its pedigree goes back to Socrates in ancient Greece! There has however been increasing interest in teaching thinking in recent years, culminating in the UK in Carol McGuinness' report for the DfEE and the inclusion of thinking skills in the National Curriculum. There are a wide range of published schemes, materials and approaches often developed by charismatic individuals. It is also not without its critics. Some argue that it is not possible to teaching thinking skills unless they are taught in a specific context, and that the details of this context then prevent the thinking becoming more generally applied.

Teaching Thinking and '*Thinking for Learning*' in the North-East of England

In the North-East of England we have taken a more pragmatic approach. The Thinking Skills Research Centre at Newcastle University began by examining what happened in classrooms when thinking skills programs and approaches were used. There was clearly something of interest in that teachers talked positively about the programs or materials and pupils seemed to be more engaged and involved in thinking skills lessons. One of the challenges in using published programs is that teachers need to find time in an overcrowded curriculum to fit them in or 'bolt on' the thinking skills lessons to what is taught already. At the same time we developed a range of thinking strategies with teachers that could be integrated or infused into everyday lessons that seemed to help to create some space in classrooms for talking and thinking about both the content of lessons and the process of learning. Since then, and with the support of enthusiastic teachers and schools across the North East and the support some of the LEAs in the North East, particularly Northumberland and Sunderland, literally hundreds of schools have become involved in using both the 'bolt-on' programs and the 'infusion' approach using teaching thinking strategies. *Thinking for Learning*, as it has developed in the region, is about supporting teachers in developing pupils' thinking and understanding of what they are learning. Some principles of teaching thinking emerged from our work that seem to apply whatever approach is taken.

Clear purpose

The purposes of tasks are made explicit and these aims are understood by pupils. This helps to provide pupils with specific goals that they can achieve and can reflect on. It is about helping pupils to understand not just *what* they have to do, but *why* they are doing it.

Articulation

Pupils talk about their work and are encouraged to describe and articulate their thinking. This has several benefits. From the teacher's point of view, you get a chance to see how pupils are thinking as they explain their reasoning. This is an opportunity to address any misconceptions or develop their thinking. For the pupils, talking is usually seen as 'easy', but they get the chance to change their minds in the light of what others say.

Mediation

The teacher intervenes to discuss the learning that is taking place (and perhaps involves pupils in this through modelling and collaborative work). In this way the teacher 'mediates' the learning. This includes whole class explanation and discussion as well as direct teaching.

Connecting Learning

The teacher and pupils make connections both within the tasks, between tasks and with their wider experience. This is sometimes described as 'bridging' of learning by the teacher or 'transfer' of learning for pupils.

Evaluation

Pupils evaluate their own performance. Only once the purposes of tasks are meaningfully understood, can pupils start to evaluate how successful they have been and then identify why they were successful or unsuccessful.

Metacognition

The teacher and pupils discuss and evaluate the learning that has taken place. This supports pupils in seeing themselves as successful learners and able to learn rather than just accepting that they are either good at it or not. It also helps to develop an understanding of learning strategies, styles or approaches that may help them in future learning.

ICT and teaching thinking

Compared with teaching thinking, ICT is (relatively) new. It offers a range of ways that can help teachers and learners in the classroom and school. It is possible to develop resources and present information in engaging ways to learners, whether this is by desk-top publishing materials, developing a *PowerPoint* presentation or web-based resources with video clips and contextual help. From this perspective, ICT is a powerful tool for teachers to help with the preparation and delivery of lessons. Computers are also a tool for learners. They can provide an effective focus for discussion and help to structure pupils talking, thinking and reasoning. Neil Mercer, Rupert Wegerif and a team at the Open University have shown just how effective this approach can be (see Section 1 of the Focus pack for more details). Specific software can also support children's thinking, whether this is in a game environment, such as those involving the Zoombinis, or in concept or mind mapping software (Section 2). Other ICT based activities can be given a thinking skills emphasis, if the principles above are used to guide the process. Children can develop their own presentation, or use information taken from the internet as a focus to developing their thinking (Section 3). The examples in this pack are intended to offer some ideas about the way that thinking skills and the use of ICT can be developed together. It is inevitably only a partial view, but one which we hope will provide a flavour of the exciting work happening in schools.

We were fortunate in the North-East in that five local LEAs, Newcastle University and a locally based company, Knowledge Management Software formed a consortium to deliver NOF training. The consortium, GridREF 2000, was unusual in that the prime focus was to provide face-to-face training for primary schools. Its success locally enabled the development of a thinking skills version of the training which was adopted by some of the LEAs involved and which has supported a number of teachers in developing thinking skills strategies supported by ICT.

Some challenges

We also need to add a health warning here. It is hard, particularly at first, to focus on making the thinking explicit and developing specific skills and knowledge required by the curriculum. This is where some of the published thinking skills programs or teaching thinking strategies can help, as they guide you through the first stages of the process in trying something new in the classroom In our experience it is twice as hard to do thinking skills work in the ICT room! The pressure is on to make the best use of the time allocated for the computers. In teaching in this context it is usually necessary to focus on some aspects of either ICT skills or the particular piece of software being used. It is hard to leave time at the end of the session for effective review and discussion. It may be easier to do this back in the classroom, either just after the activity, or just before the next session. Getting the balance right between individual practice and skills development and paired or small group discussion is a real challenge. Again the pressure is on for children to develop individual skills in the ICT room. If you have your computers in the classroom it is no easier. By the time everyone has done the activity, it is no longer fresh in the minds of those who did it first. We are convinced, however, of the importance of such review and discussion. It is vital to provide feedback to you as the teacher about how the children's understanding of what they are doing is developing. It is also important for the children to make the connections with what they have done and their wider learning. Without this part of the process the lessons may well be enjoyable, but they will not help to develop children's learning beyond the separate activities that they undertake.

Further information

Carol McGuinness' (1999) report for the Department for Education and Employment has proved to be a significant step in making thinking skills more explicit in the curriculum. It is entitled *From Thinking Skills to Thinking Classrooms: a review and evaluation of approaches for developing pupils' thinking* (London: DfEE Research Report RR115 (ISBN 1 84185 013 6)). It is (or was) available on the web at: *http://www.dfee.gov.uk/research/report115.html* . A copy is included on the CD.

A database of National Curriculum thinking skills objectives that can be searched is located at *http://www.nc.uk.net/LACcs_thinkskill.html* .

Section 1: ICT, Talk and Thinking

Overview

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Talking and thinking

Research based at the Open University has explored the potential for teaching thinking through teaching talking. Working closely with primary teachers, we have produced a series of 'Talk Lessons' in which classes establish ground-rules for collaboration such as listening with respect, responding to challenges with reasons, encouraging partners to give their views and trying to reach agreement. While these activities are concerned with improving the quality of children's working relationships the main focus is on developing their use of language as a tool for reasoning and constructing knowledge. The Talk Lessons encourage teachers to create a 'community of enquiry' in their classrooms in which children are guided in their use of language as a tool for both individual reasoning and collaborative problem-solving. The theory behind this, from the Russian psychologist Vygotsky, is that children learn to think individually through first reasoning with others in dialogues. The idea is that individual reasoning begins as a kind of conversation with oneself that is an 'internalised' version of conversations children first have with others around them.

Evaluations of this approach to teaching thinking skills have shown that:

a) teachers can help children understand how to communicate together effectively and increase their use of talk for reasoning;
b) the increased use of explicit, reasoned discussion improves children's ability to solve problems together working in small groups
c) the increased use of explicit, reasoned discussion also improves children's individual scores on a standard test of reasoning (Raven's Progressive Matrices test).

[1]Writing on behalf of an Open University based research team including Lyn Dawes, Neil Mercer and Claire Sams.

Teaching talk

To teach the children how to talk together more effectively we came up with a list of ground rules to support collaborative learning and devised a set of lessons to teach these. Some of these lessons have now been published (see the further information section at the end). The ground rules we sought to promote were:

- All relevant information is shared openly.
- Each group member should be actively encouraged to contribute to the discussion.
- Everyone should listen to others attentively.
- Each suggestion should be carefully considered.
- Group members are asked to provide reasons for ideas and opinions.
- Constructive challenges to ideas are accepted and a response is expected.
- Alternatives are discussed before a decision is taken.
- The group works together with the purpose of reaching agreement.
- The group, not the individual, takes responsibility for decisions made, for success achieved or for problems that may occur.

In a key early lesson in this series, after the children have had some experience of group work, the teacher leads the class to agree upon one set of rules for talking together. These emergent ground rules are written down by one of the children on the board as they are produced. The teacher goes through each rule to ensure all the children understand it. Some of the rules the children propose may be inappropriate for the group work setting they are being asked to consider (like '*don't talk unless you have your hand up*'). The teacher explains why these are not suitable for inclusion; and of course he or she has to lead them towards agreeing a set of rules which are suitable for generating effective talk. Surprisingly often, however, children do offer many rules that match the ground rules that we are looking for. The

teacher concludes this discussion with the production of a final set of 'class ground rules for talk'. This list of ground-rules is then displayed prominently on the wall of the classroom. The succeeding talk lessons are designed to enable the children to practice and evaluate these rules, in activities related to a range of curriculum topics.

The role of computers

Teaching children how to talk together and reason together is all very well in itself but how does this relate to teaching the curriculum? We have found that computer-based activities are an effective way of infusing thinking skills into subject area teaching and learning. This is because, with the right teacher input and software design group work around computers can turn reasoning skills into learning outcomes. The computer has a special role to play here. Computers can initiate, resource and frame a discussion as a teacher can, but unlike teachers they are never judgmental and have infinite patience. Once children had gone through our 'Talk Lessons' we found that when the computer prompted them with a challenge or a question they were able to sit back from the screen and discuss the issue together before reaching a shared decision about what response to make. In this way they construct their own understandings together but in a way that is directed towards curriculum goals by the computer software.

Software for collaborative learning

Our research analysing at video-tapes of pairs and small groups of children working around computers has given us some clues as to what software features help to establish and sustain effective talk:

- Challenges and problems which have meaning for the children, and which provide a range of alternative choices that are worth discussing. Such challenges should engage the children with the content of the software rather than its interface.
- A clear purpose or task which is made evident to the group and which is kept in focus throughout.
- On-screen talk prompts which ask the group to talk together, remind them to reach agreement and ask for opinions and reasons.
- Resources for discussion, including information on which decisions can be based, and opportunities to review decisions in the light of new information.
- No features which encourage individuals to take turns, beat the clock or establish competitive ways of working.
- Multi-choice answers to minimise typing (unless the children have been taught keyboarding skills which is really a very good idea!)

We have used these guidelines to design software. We have also used them as a basis for selecting software that can be used to support collaborative learning.

Working with ICT

The software alone does not define an educational activity. The way that teachers set up the activity and integrate it with the rest of their teaching is crucial. Our research found that the 'Talk Lessons' described earlier made a big difference to the quality of collaborative learning around computers. They gave the children guidelines for working together.

We suggest a three-part structure to lessons, with the teacher setting up issues and aims at the beginning and then returning to these in a whole group plenary session at the end after group work by the children. We find that this is a good way of integrating work with computers into the curriculum. The aim of group discussion needs to be made explicit in the aims for each lesson, and the plenary session is crucial for ensuring that children feel that they have achieved the lesson aims. Through this process they become aware that their talk together at the computer can make an important contribution to their learning.

Kate's Choice

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Kate's Choice (available from *www.thinking-together.org.uk* and included on the CD which accompanies this Focus pack) is an example of software designed by us to promote talking, learning and thinking within a curriculum area – that of PHSE and Citizenship. We have also been working with software in Maths and Science and had very good results. The PHSE and Citizenship curriculum emphasises the importance of discussion and of considering the perspective of others in reaching moral decisions. The aim of the *Kate's Choice* software is to encourage reflection about moral issues through stimulating exploratory talk about the conflict between personal morality (loyalty to a friend) and social morality (stealing is a crime). All the design principles given above were applied. There were potentially complex problems embedded in a narrative structure; decisions taken by the group made a real difference to the outcome of the story. This was achieved by using an interactive story in which different choices led to different consequences for the characters. Arguments for use in discussion are displayed on the screen when choices need to be made. Typing is kept to an absolute minimum. The story is that Kate's friend Robert tells her a secret after first asking her to promise not to tell anyone else. His secret is that he has stolen some chocolates from Mrs Cook's shop but he says he has stolen them as a present for his mother who is in hospital. Kate then has to decide whether she tells her parents or not. If she does not tell she comes under pressure from various people and is even accused of stealing the chocolates herself. If she does tell on Robert the police are called in and things do not look good for him. At the point where we join them (Figure 1), a group of children who have done the Talk Lessons described earlier were asked by the computer software to reflect on the decisions they had made and, all the different opinions of the different characters in the story were made available through icons of their heads which could be clicked on.

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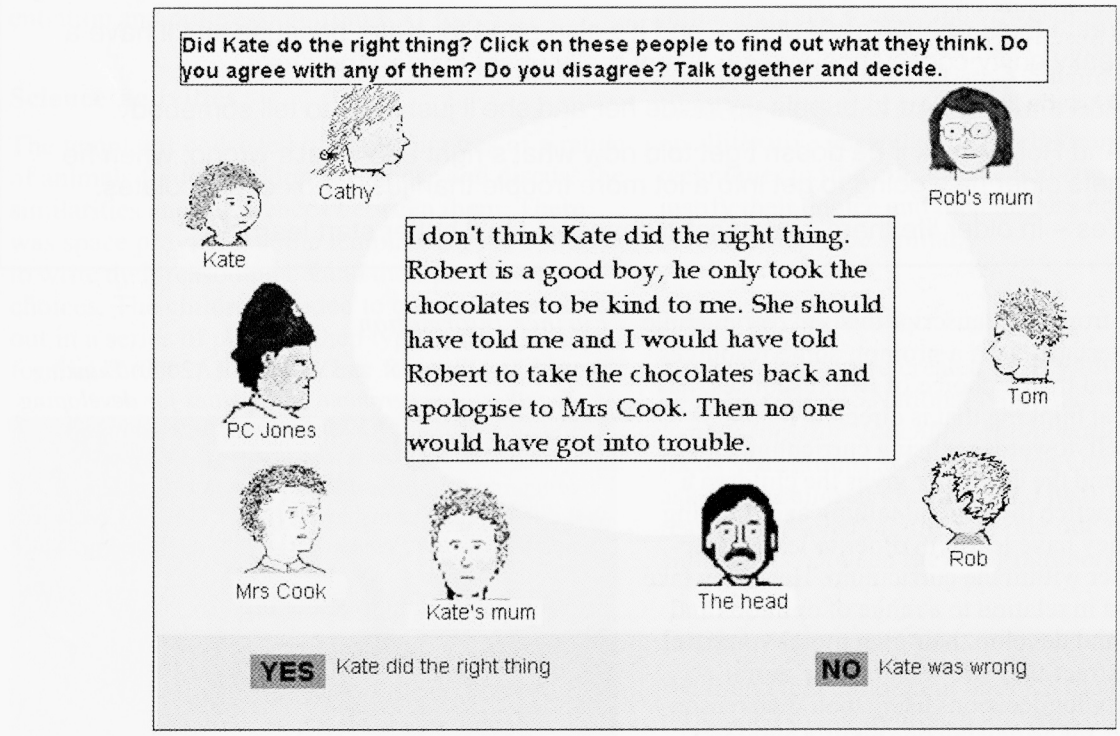

Figure 1. *Did Kate do the right thing?*

[1]Writing on behalf of an Open University based research team including Lyn Dawes, Neil Mercer and Claire Sams.

Transcript extract of children talking around *Kate's Choice*:

[*Computer initiation*: 'Did Kate do the right thing? Click on these people to find out what they think. Do you agree with any of them? Do you disagree? Talk together and decide'.]

Kath [*Clicks on Rob's mum and then reads the screen text shown in Figure 1*] 'I don't think Kate did the right thing, Robert is a good boy. He only took the chocolates to be kind to me'.

Alan No I don't agree.

Kath I don't agree with that –

Alan That's just wrong.

Kath Robert's Mum should be on Mrs. Cook's side really.

Alan Yeah. She should be more strict.

John Next round. Kate's Mother. [*Clicks on Kate's mum*]

Alan OK [*reads from screen*] 'Kate did the right thing to tell. She should not lie to me or hide things from me. I am her Mother'.

Kath Alright John – you go first this time

John I think that's alright actually, because if you don't tell her, and her mother finds out she's going to get really done because she ain't told her mum.

Kath Yeah, then Kate's Mum will go round to Rob's Mum's house and say 'You did this and you did that and your son is a bad influence to my daughter.'

Alan 'Cos he stole

Kath But that's wrong as well. I know Kate *should* have told her Mum – and that's what she did, but if Kate didn't tell her Mum, then Rob's Mum would sort of fall out with Kate's Mum because I think Rob's Mum and Kate's Mum are friends so I think Kate's Mum is right. I agree with Kate's Mum.

Alan Yes. I think about Kate's Mum – and it's also good for Kate, because she'll have a really guilty conscience and she'll feel really upset inside. And she'll-

Kath And it will all start to bubble up inside her and she'll just have to tell somebody.

Alan And Rob, I think if he doesn't get told now what's right and what's wrong, when he gets older he's going to get into a lot more trouble than just a box of chocolates.

Kath Yes – in older life there's no second chances. He'd better start learning.

We can see from the transcript that this very simple software interface, with a prompt, some resources to explore and then a choice of two responses, has provoked real thinking that is directed, by the program itself, towards realising curriculum aims. Talking around the computer gives the children a chance to practice the general talking and thinking skills that they have learnt in order to learn something together within the curriculum. Here they take up a position in relation to a range of opinions and so practice and develop their own moral voice. In this short extract they are seen to take moral responsibility for decisions using their own reasoning as a basis for criticising one adult's opinion while supporting that of another.

Further information

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

Mercer, N. (2000) *Words and Minds: How we use language to think together.* London: Routledge.

Wegerif, R., and Scrimshaw, P. (Eds.). (1997). *Computers and Talk in the Primary Classroom.* Clevedon: Multi-Lingual Matters.

http://www.thinkingtogether.org.uk

Using 'Odd One Out' in Developing Thinking with ICT

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We undertook the work described in this case study during a Spring term. We work in a First School teaching a Year 2 and Year 4 classes. The key focus for the work was to evaluate the use of ICT to further develop children's thinking. We looked at the comparisons between Key Stages to see how the children developed their thinking skills and whether ICT was an effective tool to support this.

Aims

Our aim was to create a range of 'odd one out' activities on the computer to develop children's thinking in Science, Literacy and Numeracy. The thinking skills strategy is based on ideas in *Thinking Through Primary Teaching*, though we were keen to see how the ideas could be adapted for use with computers. We decided to use Microsoft's *Publisher* as the children were reasonably familiar with the program. We created a series of templates together so that we could incorporate some differentiation and progression from KS1 to KS2.

Science activities

The templates consisted of some pictures of a range of animals for the children to choose and discuss the similarities and differences between them. There was space provided on the template for the children to write their reasoning behind their particular choices. The children needed to choose the odd one out in a series of pictures then type in their reasons for this choice. As a secondary focus the children were asked to develop this idea further and type their reasons why the other pictures were similar. To develop the children's thinking between KS1 and KS2, the Year 4 template included more animals and opportunities for the children to really extend their understanding of the variety of animals and the differences and similarities between characteristics, behaviour, habitat, prey and young.

Literacy activities

Again the templates were created by us collaboratively to ensure there was some progression and continuity in the thinking skills required. The activities were based around the National Literacy Strategy's *Framework for Teaching*, particularly some aspects of word level work and included a range of different spellings for the children to discuss which could be the odd one out. For the children in Year 2 the spellings required the children to look at blends, letter patterns, rhyme, initial and final sounds and vowel diagraphs. In Year 4, the templates used had the potential for the children to discriminate between word types including verbs and adjectives and included a focus on alliterative vocabulary. The children used similar techniques to find initially the odd one out and justify their choice and then discuss how the others in the set might be similar.

Numeracy activities

The templates were created to fit with the units to be covered in the National Numeracy Strategy's *Framework for Teaching Mathematics* and the focus year groups. The 'Odd One Out' template asked the children to choose and justify their reasons for selecting the odd one out and the similarities between the other numbers in the set.

Impact

We found that children in both KS1 and KS2 easily responded to this approach undertaking odd one out activities at the computer and using the templates to record their ideas. They could extend their particular knowledge in each of the subjects that we used and were able to justify their thinking.

All of the children regardless of their current level of attainment were able to participate successfully in these activities. After a couple of sessions the children became extremely motivated and enthusiastic and enjoyed the fact that there was no specific set answer with a right or wrong solution. They were able to discuss their answers in groups. This certainly helped develop their speaking and listening skills, as they needed to justify clearly to the rest of the group their choices and their reasoning. All children were able to offer some ideas varying from basic visual differences to more extensive and challenging comparisons and differences. Debating, challenging of ideas, reaching a compromise, listening to others, justifying choices were all observed in the working groups. All children were aware that any one choice was as good as another as long as their justifications clearly explained their choices.

The children worked in small groups, on the computer, and individually. The children needed to be supported in the early stages as we discussed with them the requirements of the task and techniques they could use to decide upon their choices and justifications. For some children their discussion and justifications proved fairly challenging but with support and praise the children soon became more familiar with this way of working. They enjoyed working in collaborative groups. This pupil-led debate proved an excellent extension of their understanding in the area of the scientific vocabulary and knowledge of the variety of life: a subject covered in Year 2 and in greater depth in Year 4. The children were also able to use appropriate vocabulary and could discuss properties of numbers, spelling patterns and other aspects of science.

In the number 'Odd One Out' activities the children's level of understanding could be assessed from the responses that they gave. The children's choices were very varied. Some chose basic differences such as number of digits to more complex properties or reasons involving calculation differences (one example for a reason was that one of the numbers was the only one whose digits didn't add up to 8). The older children were then asked to devise their own 'Odd One Out' activities. This task proved very successful in giving the children the opportunity to extend their own thinking about the properties of numbers. They needed careful planning and justification that the numbers could be similar in some way but so that there could be several choices for an odd one out too.

Their justifications were not only an excellent method of achieving collaborative work and extending their thinking, but it promoted assessment strategies to let us evaluate each individual's knowledge and understanding of the specific curriculum areas. The activities developed the children's interpersonal skills; promoting an enquiring mind and capacity to think rationally and to analyse their own solutions. The pupils were developing criteria and were valuing each other's ideas while developing confidence in their own judgements. From our standpoint as teachers these collaborative (and in some cases individual) thinking skills activities were a fantastic way of providing a stimulus for discussion which generated debate through extending and assessing the pupil's knowledge of the subject. Incorporating thinking skills into the curriculum as a means of infusion rather than stand-alone thinking activities can offer all children access to the curriculum and the opportunity to achieve success. We think that these activities have allowed the children in both key stages to have access to and to develop their own strategies for thinking, promoting awareness and control of their own thinking (metacognition).

Was ICT the best medium to support these thinking skills activities?

The main aspect of ICT which we used initially in creating the templates was the ability to make changes quickly and easily to develop a series of tasks. These templates were attractive to the pupils, bright, colourful, and easily amended and changed when we needed to differentiate for specific groups. A further benefit was that the same activities could be used with the children in our classes with special educational needs by selecting examples which suited their abilities in terms of the choices we provided. This aspect highlighted for us the benefits of *'Provisionality'* in using ICT as a medium (one of the functions of using ICT from the NOF outcomes). Also the templates could easily be created using clip art and sound (where required for children with reading difficulties) and images could be imported from photographs from the Internet (exemplifying '*Capacity and Range*'). The templates were created in advance which meant that the children could not alter the originals but could only make changes and add their ideas by typing in the areas specified. The use of ICT supported creating a document that can be arranged, changed, saved and printed to create a paper based resource easily and efficiently. The activities would have worked extremely well with a digital projector and software like Microsoft's *PowerPoint* to use as a starter or plenary to a lesson in any subject.

Further information

Higgins, S. (2001) *Thinking Through Primary Teaching* Cambridge: Chris Kington Publishing ISBN 1 899857 39 7

Databases for deductive reasoning

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Contained on the CD that accompanies this pack is a database activity called *Crooks!* You may have come across a similar idea on the MAPE website, called *Whodunnit?*. The idea is simple enough, a list of potential suspects has been compiled in a database, including information about physical attributes, background, legal history and so on. Would-be detectives are then presented with a series of crimes and they have to use the information contained within the database to identify likely suspects.

This particular pack contains a runtime database ('runtime' simply means that you don't need a database application to run it as it is self-contained and you can copy it onto as many computers as you like!) and a series of printable resources:

- some for the pupils, such as crime notes, a brief introduction to the activity and some information about searching the database,
- some for teachers, such as brief lesson notes and some background information about the activity, how to set it up and so on.

There is also file called 'My Solution' and it is here that the *Crooks!* activity and other related activities such as *Whodunnit?* diverge.

The intended purpose for most similar database activities is to 'find the right answer'. In the *Whodunnit?* database each crime is completed by a message saying 'You have found the culprit.... Next case'. Sometimes the right answer can be found by accident (what some people call the 'lucky keys' approach) or by exploiting the thing that computers are good at, trying roughly the same thing over and over with just a few minor changes to the criteria... good ICT, but not such good thinking skills.

With *Crooks!* a report is completed, highlighting what the detective thinks is information pertinent to the case. In other words, a justification for the conclusion they have reached. This is important because this activity is designed to focus on the deductive reasoning used in reaching a conclusion and this is the end product of this particular activity. By changing the emphasis from the right answer to the reason, pupils have to be more thorough in formulating their conclusions and have to focus on making their thinking overt.

Talking, thinking and justifying

I used this activity with mixed ability Year 5 pupils over a period of about three one-hour lessons. Initially, as you might expect, the class were very keen on getting the right answer and became quite competitive. At this point it became important to make sure that my responses to their work were clear and consistent. I refused to answer the question, 'Is it....?', instead deflecting the question by asking for a justification, 'Tell me why you think it is...'. Some of the class picked this up quickly and it was interesting to note that the content of their own discussions with their working partners changed significantly. They became far more reflective and began to try to refine their own search criteria and thinking. In short, they began to think critically about the information they were presenting and became more interested in their ability to justify their responses (I used a technique to make sure that all members of a working group were involved in this. I'm sure it has a fancy name, but I don't know what it is called. I made it clear that I was interested in a group response, but wanted a response to be presented by just one member of the team and I would pick a person at random, well, as random as a teacher's choice ever gets!).

It will come as no surprise that others within the groups I worked with did not manage to make the leap from 'answer' to 'response', though almost all made some progress towards this idea and almost all managed to change their approach to the task in the light of the responses I gave. Though it was never a planned element of the activity, the fact that the clues to the crimes become increasingly obscure did help some make this leap. As multiple potential answers seem to apply to simple searches pupils were forced to refine their searches and this often involved detailed debate about criteria to be used. Other times further searching did not help and what was required was careful and reflective reading of case notes in order to make (sometimes extremely tenuous) links.

Extending the activity is relatively easy. I allowed pupils to design their own case notes and try them out on their friends. This might seem like an easy link to make, but it is worth noting what this extension activity revealed. Pupils who focused on answers tended to give clues with only one 'cor-

rect' response and as such their challenges were easily met. Pupils who managed to grasp the purpose of the task a little better spent a lot more time reading notes about the suspects and using clues that had potentially ambiguous meanings or multiple matches. Finding the 'right' answer to these questions contained the same pitfalls as in the original activities, conflicting responses, which extended the thinking and debate. Again, this pushed those obsessed with getting it right to review their approach as well as acting as a fair assessment of progress made.

Bridging and transfer

This activity was 'stand-alone' in the sense that it was a single unit of work for ICT and I was working with pupils who were not in my class. It developed some basic ICT skills such as simple searching, some knowledge, such as the purpose of databases and some concepts relating to the nature and accuracy of information. We spent some time reflecting on these issues in the plenary for each lesson. However, because this unit was not related to other curriculum contexts, it did lose some of its impact. Bridging skills and concepts into 'real' situations is important and I regret slightly that this work was effectively divorced from reality, both in terms of the ICT skills it developed and in terms of the critical thinking it demanded. That's not to say that it wasn't worthwhile, however. I still get emails (three years on) from pupils using the resources with other teachers asking 'Was it...?'. But I still don't say!

Full notes for the use of the software and activities are included on the CD. They are in *Word* format, so can be edited but, whether adapted or not, they should not be sold. Have fun!

A Review of *Zoombinis Mountain Rescue*

Nick Packard

Anyone who has ever spoken to me about ICT stands a good chance of having been bored to death about *The Logical Journey of the Zoombinis*. It has to be my all-time favourite piece of software. If you've come across it, I'm sure that you'll understand that someone (such as me) with a mildly obsessive nature could easily find that it's two o'clock in the morning and they're still staring manically at their computer screen and muttering bizarre noises such as 'frnarharheehar' under their breath, clicking away and groaning 'I knew that would happen' as the little piece of on-screen blu-tak they've placed on a rickety bridge plummets into the virtual abyss!

For those of you who haven't come across the first Zoombinis adventure the above will paint a strange picture I'm sure, but the point is fairly straightforward. *The Logical* (or *Mathematical*) *Journey of the Zoombinis* is the most compelling puzzle (or series of puzzles) you're ever likely to encounter. An account describing classroom use of the program can be found on the CD.

Inevitably, I was one particularly excited individual as I approached the TAG stand at this year's BETT Exhibition to ask to be shown the new Zoombinis adventure (after a 7-year wait), *Zoombinis Mountain Rescue*.

It should be noted at this point that I've been using the original Zoombinis adventure with Primary age pupils for almost 4 years so not only do I know how to play the game, but I've also spent a significant part of my life trying to help children explain how they think the puzzles work, what strategies they might employ to help them progress, what they expect to happen next, whether it's appropriate to take a guess or whether they might be able to learn something from what happened before and so on. I know the puzzles about as well as any (theoretical) grown-up has any right to, and I've spent hours in debate with other (theoretical) grown-ups discussing the best strategy for tackling the Di-dimensional Hotel when the going is Very-Very-Hard, or the genius behind the development of the puzzles.

This is how the conversation went:

'I want to see the new Zoombinis program, what's it like?'
'It's good, it's much harder'
[Oh joy!]'What do you mean, it's much harder?'
'Well the puzzles are more difficult'
[Hmm!] 'What do you mean, more difficult?'...

The thing is, whether the puzzle is difficult or not is irrelevant. The point isn't to make the puzzle

harder, the point is to make you think, to make you employ new or different problem-solving strategies and to discuss your ideas and your thinking with others, to try out your ideas and refine your thinking for the next time and to engage you in the process by giving you the motivation to solve the problem, no matter what. Here, difficulty isn't an appropriate benchmark… but perhaps I was being too harsh.

The outcome of my discussions with some of the TAG team was that I got a brief introduction to the program and the scenario, which was a familiar one: to help 16 Zoombinis to solve a series of puzzles in order to bring about a desired outcome, that the puzzles are based largely around the attributes of the Zoombinis themselves and involve matching these attributes or finding and creating patterns with them, that the format was familiar but the presentation was much more up-to-date and visually appealing and that on-screen support was incorporated into the package. I also got a promise of a couple of evaluation copies… probably the highlight of the show for me!

They arrived. My plan was simple, I intended to have a bit of a play and then see what was missing and develop it! In the original program the only down-side was that a great deal of time could be wasted trying to find out what it was you were supposed to do. The clues were all there, but they could be tricky to interpret and in a school context you want to help pupils get on. I developed a guidebook for pupils for the Logical Journey, which was intended to ensure that progress could be made and that a few prompts for developing strategies or recording discoveries were offered. (A copy of the updated guide is available on the CD that accompanies this pack).

This sort of guide was not necessary for the new software as this level of support was provided as part of the package. Instead I decided to produce a guide for teachers that would help them prepare for the use of the software with their pupils by providing an overview of each puzzle, how it progressed and how it could be cracked. This might spoil the fun for the teachers, but there is no point pretending that you can use this software effectively with pupils unless you understand each puzzle pretty well. Therefore the intention is to make sure that a teacher can ask the right questions and steer pupils in appropriate directions when useful, but reduce the number of sleepless nights invested in this process. So, that's what I did. And in the process, I got to grips with the new puzzle. (This guide is also included on the CD that accompanies this pack).

So, was I impressed? Well, I have to say that it was a bit of an anti-climax, to be honest. Why? That's a little tricky. The individual issues were determined by the individual puzzles. Some were simple re-workings of puzzles in the original, some were new, but lacked the originality of those in the Logical Journey and some just completely missed the point, really. And the point is a simple one. Some of the puzzles are too easy to crack. If you can spot the pattern then you can solve the puzzle every time, without difficulty. Being able to find an answer isn't the same as having to develop a strategy. Developing a strategy is about trying out ideas, reflecting on the outcome of these experiments, refining those ideas, discussing your thoughts with others and justifying your proposals. You know, good thinking skills stuff!

Is *Zoombinis Mountain Rescue* good? Well, from my point of view the answer is a definite, 'Yes'. Is it a worthy successor to the Logical (and Mathematical) Journey? Here I have to admit that it suffers from exactly the same problem as the standard Hollywood style sequel – it's great, but it fails to be original enough to be acclaimed on its own merits. Without doubt it will engage pupils and will provide many opportunities for excellent 'Thinking Skills' development. It still leaves most similar simulation software wanting and if you can find the time and opportunity, will give you a whole new insight into the way your pupils think, collaborate and learn. It's worth a whirl, but if you haven't tried the original yet you'll have to decide whether you want the best first, or last!

Zoombinis Mountain Rescue was developed by The Learning Company and can be purchased from TAG Learning. The guide provides a good overview of the purpose of the software, so I haven't tried to repeat that here. The following article is a case study of the use of *Zoombinis Mountain Rescue* with children in Years 2 and 4 and includes some ideas about how it can be used to ensure that the potential of the software is exploited and that the pupils understand the point. Oh yes, and that they have fun too; it is all too easy to forget that isn't it!

Using *Zoombinis Mountain Rescue* to develop children's thinking skills

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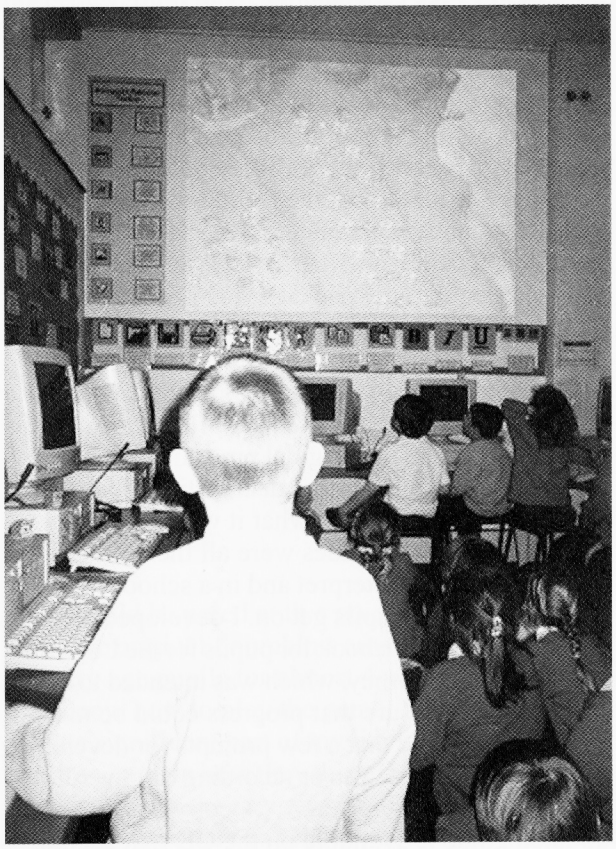
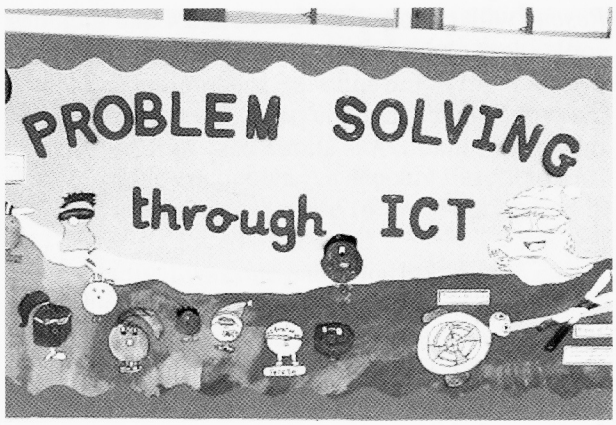
Introduction

The work described here took place during the Spring and Summer terms with our Year 2 and Year 4 classes. The key focus was to investigate the effectiveness of *Zoombinis Mountain Rescue* in developing children's thinking skills. This program was primarily used for collaborative problem solving in both key stages. *Zoombinis: Mountain Rescue* is an adventure program produced by The Learning Company. The user has to help sixteen Zoombinis through a series of puzzles in order to rescue creatures called Boolies and help them get back to their home in Booliewood. In an already overloaded curriculum why did we think that the children needed to develop their thinking skills? It is our belief that children need to be able to deal with a range of complex situations throughout their learning and their lives. They need to be equipped with a range of skills to enable them to judge, analyse and think critically in order to participate fully within the society in which they live. The program seemed to offer a motivating environment where we could try to cover some of these demanding skills.



Approach

In both year groups, this program was introduced to children as a whole class using an overhead projector in an ICT suite. This created a good forum for initial discussion and justification.



Children were immediately intrigued by the attractive nature of the program and the adventure story which complimented the graphics on screen. These were key motivating factors in stimulating children's interest and curiosity.

Both classes were shown the main map showing the whole journey that they needed to take and the puzzles they would encounter on their challenge to reach Booliewood. Children were introduced to the games by selecting a puzzle from the practice mode option. In Year 2 we focused upon the following puzzles: Turtle Hurdle, Pipes of Paloo, Chez Norf and Snowboard Gulch, as these games seemed to be more appropriate for this specific year group. By comparison, in Year 4 all puzzles were attempted with the children. Selecting games in this way in practice mode allowed a real focus on one particular puzzle as well as an opportunity for the children to evaluate and refine their thinking about the game itself and the strategies to be used. This

option also allowed children who had failed on a puzzle to keep enough Zoombinis and progress to the next challenge and succeed later on. Children really benefited from the whole class introduction to these games as this gave children the opportunity to think beyond 'where do I click and go now?' For both year groups, we found that plenty of practice was needed before the children could tackle the problems on a higher level that needed them to use more advanced thinking skills. The Teacher's Pack (there is a copy on the CD) really enabled the teachers to achieve quick familiarity with the game, to understand how the puzzles work and how to manage the program. This allowed us to concentrate more readily upon the educational features of the program rather than being preoccupied with technicalities, which can be extremely time consuming.

MAPE

In Year 2, children worked as a whole class, progressing to working in small groups of 2 or 3 on the games mentioned previously. In Year 4, this program was used as a stimulus to develop thinking skills with

- children working in pairs
- small groups
- whole class

In these situations, children were given the opportunity to share, question and discuss a problem through a stimulating medium. Children not only learnt to think for themselves but also how to learn from the thinking of others. The discussion with a partner or with a group was invaluable in deepening the children's understanding of the puzzles and refining their thinking. Children were very much encouraged to complete the tasks in their own way. To learn from their mistakes and to develop and readjust their ideas. Children were not afraid to take risks and to challenge thinking. Valuable time was spent reflecting upon the puzzles both at the start, during and at the end of a game.

The program was suitable for all abilities, given its depth in puzzles and differentiation in terms of level of difficulty. All children in the Year 4 class worked with a partner on the Green level – 'not so easy.' This proved a suitable level of difficulty to develop the thinking skills of the children. More able children did try various games on the Yellow level 'Oh so hard' but with the exception of Chez Norf and Aqua Cube these proved to be a little too demanding. Competition between individuals and groups became evident as children's familiarity with the game developed. Children would frequently compare their best stage reached on the journey and would use this as a target to try and beat on their next game. This proved motivating as children could foresee a real opportunity for success.

Children were asked to reflect upon their favourite games as well as which puzzles they perceived to be the easiest and the most difficult. These questions were used as the basis for discussion and helped children to come to a shared understanding of the game and of themselves as players. Some of their responses follow:

'My favourite game is Beetle Bug Alley because it takes a lot of hard work to figure it out but it's a fun game too.'

'I like Zoombinis because you learn a lot about problem solving while you are excited and having fun too. I don't have a favourite game. They are all brilliant.'

'I like Aqua Cube best because it is quite complicated and you have to really think carefully about which direction the ball will move.'

This program proved successful in encouraging children to approach the puzzles with an open mind and involved them in critical thinking, risk taking and problem solving. Children were able to find a variety of solutions to a problem through:

- Critical thinking: children would examine, clarify and evaluate an idea
- Decision Making and Problem Solving: linking ideas, organising information and looking at problems from different perspectives
- Creative thinking: creating new ideas

The main skill that children developed in this collaborative working was effective communication. Children really had to develop their ability to explain and justify their thinking to someone else, even if

that someone else disagreed with their logic. This was the main aspect that children found most difficult. How would they come to a compromise in solving the puzzle when there were two or more opposing ideas? Children had to understand the importance of using the most appropriate vocabulary as well as being really clear in their explanations. They had to learn to listen to and respect others ideas. This program definitely offered a co-operative dimension, and a real medium in which to develop moral understanding and practise social skills.

The Year 4 class devised and agreed the following strategies for solving the puzzles on this program:

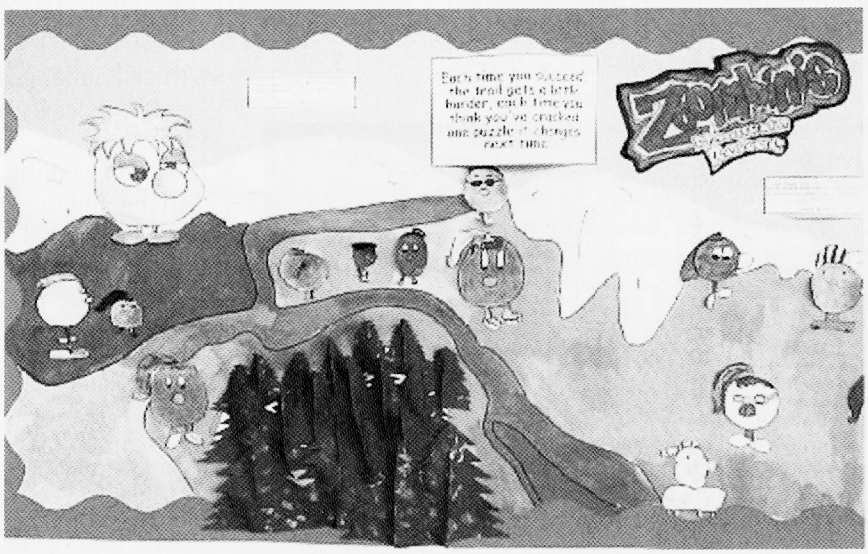
- Work with a partner
- Discuss possible strategies
- Try things out
- Use what happens to readjust your thinking
- Be logical in your thinking
- Think ahead
- Identify any patterns
- Take a risk
- Make connections and comparisons

While working on this program, a number of important elements of thinking were observed by the children. These included:

- **Questioning:** Children were continually asking questions to provide a focus for their enquiry
- **Reasoning:** Children had to be logical to support their argument and judgement.
- **Defining:** Children clarified their ideas by making connections and comparisons
- **Speculating:** Children generated ideas and alternative ways of thinking
- **Expanding of ideas**: Children extended their lines of thought to solve more complex problems
- **Summarising:** Children abstracted key points from a number of ideas

Conclusion

We think that the main benefit of this adventure simulation is that it involves practising a number of skills, developing concepts and strategies for problem solving in an enjoyable game environment. This program definitely generated enthusiasm, excitement and put real fun into the children's learning. Its compelling and interactive nature had a significant impact in motivating children's interest and activity. A key aim of the work going on at Langley is to develop children's thinking skills throughout the school, and this program added variety to what was being taught and learned in other thinking skills approaches. We very much feel that this is not a game to be played passively: it requires co-operation with others to be played most effectively. If children are puzzling out together how to tackle a problem this has the advantage of co-operative learning, learning from and discussing with each other, sharing a challenge and more often succeeding together than if they had worked on it alone. It is difficult to say that playing this game will automatically improve thinking and reasoning skills, but from our own investigation in using this program there has been a definite improvement in children's verbal reasoning abilities and their participation in a variety of group problem-solving activities. A whole-school approach to promoting and developing thinking skills is needed if there are to be real and lasting benefits to children's thinking and learning.



Section 2: Visual and Creative Thinking

Overview

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ICT is a powerful tool that can help a user or learner to visualise relationships that are difficult to explore in other ways. Interpreting data in a table by representing it as a graph or chart can help to make the information more meaningful. Using *PowerPoint* to 'build' a diagram on a slide in a presentation helps to get children to focus on the relevant features of the diagram as they are introduced. ICT can also help with visualisation of processes or supporting the development of mental pictures or models of situations. In science, a diagram of the life cycle of a butterfly can help to reinforce the cyclical nature of the process. An animation of the circulation of blood around the body, or cutaway sections of a human showing the skin, then the muscles, the internal organs and then the skeleton can powerfully support or scaffold an understanding of the structure of the body. One of the features on some of Multimaps' aerial photos is a dynamic overlay of a street map, making it possible to see the links between the features on the photograph and the more abstract representation of the street plan. ICT can enable virtual experiments to be undertaken or modelled where either it will take too long or is too complex or dangerous to do practically. In addition it is possible to experiment with variables in an ICT based model to develop understanding both of the particular experiment, but also the concept of a variable, without having to re-run a practical experiment several times.

The provisional nature of information on computers is also a powerful feature. Being able to make changes to a picture or piece of writing easily is a real incentive to improve, adapt and develop ideas (provided you learn the difference between the 'Save' and 'Save As...' commands!). This can support children's creativity as they try out, save and compare different versions. One area where the power of these visual relationships and the provisionality of ICT can be combined is in concept mapping and mind-mapping. These are related thinking skills strategies. They are both visual ways of organising ideas and can be supported very effectively using ICT. The CD contains some demos of commercially available software designed to create mind-maps and concept maps.

Mind-mapping

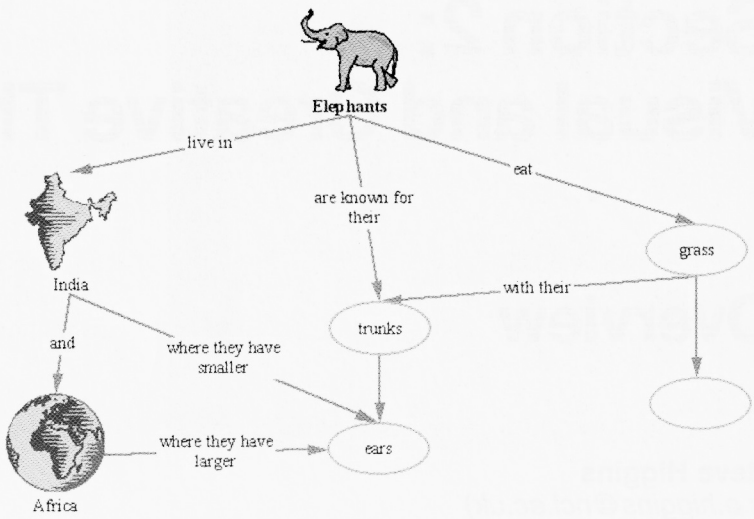
In mind mapping the idea is to create a picture or diagram of an idea or theme by writing down the words and recording the links between the ideas as branches. It is clearly related to brainstorming, though it can also be used as a technique to take notes, summarise or revise ideas or topics. The main difference from brainstorming is that the ideas are not written in a list, or as a series of unrelated ideas anywhere on the page. A typical mind-map may well look like a tree or river with lots of branches and sub-branches. To create a mind-map, the idea is to start with a key theme or idea and write down the sub-ideas or themes, then work down each of these sub ideas to note down further related ideas, creating new branches as you go. Where a mind-map is used to take notes, the diagram structure or 'map' keeps track of the developing themes in a talk or the reading matter that is being summarised.

Concept mapping

With concept mapping the idea is that the relationships between ideas are explored more precisely. The links between ideas are labelled. A typical concept map will look more like a web with the

relationship between ideas made explicit. Concept mapping purists would argue that such labels should be grammatically correct so that such maps can be 'read' along the connecting lines.

Concept mapping has been used in many areas of the curriculum, but particularly in science where it is often used as an assessment tool, or pre and post teaching to try to identify the development of understanding. The depth of links and the connections between ideas on the map can all be used to assess understanding.



Concept or mind mapping software, such as *Inspiration*, really comes into its own when you need to revise or update a map (there is a demo version on the CD). You can also usually generate lots of ideas to create a branching structure of ideas easily (such as in *Inspiration's* 'Rapid Fire' mode). Another major advantage of using computer software specially designed for concept mapping is that when you move ideas around you keep the links, unlike in a desk-top publishing environment. In addition some of the software lets you see your mind-map or concept map in different ways, such as a writing or outline view. These can even be exported to other programs, such as *Word* or *PowerPoint*, to develop writing or a presentation on a subject.

Using Mind Maps and Concept maps in the classroom

These techniques can be used in many ways. Although we have made a distinction between the two approaches, in practical terms they are closely related. Mind-mapping a theme is often a good way to get started on a concept map. With younger children they will need some introduction and practice in using the techniques. To get them started it is often better to use partially completed concept maps and ask them to add ideas or to label links. Once they are familiar with what is expected, the maps can be used to discuss their understanding of the ideas on the map. The examples which follow show how these techniques can be adapted for use in primary classrooms.

Thinking Skills, ICT and Geography Unit 10 – A Village in India

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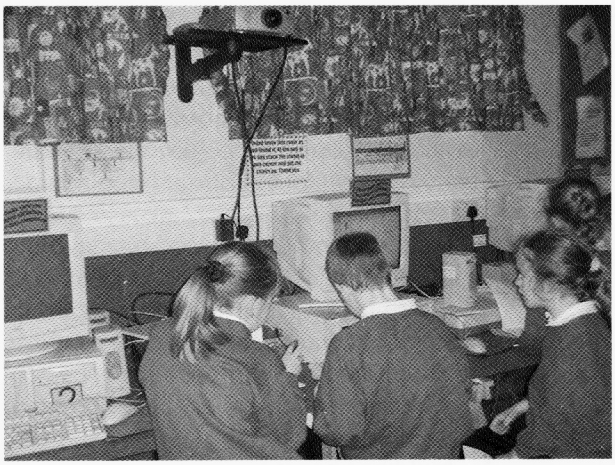
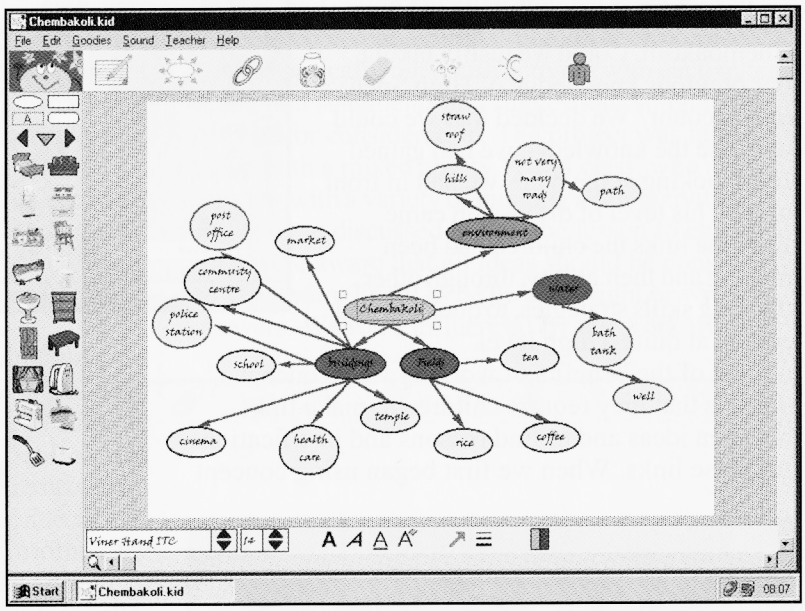
The challenge for this mixed year 3/4 class with a wide range of ability was to look at the similarities and differences between our own village and Chembakolli in India.

We began by looking at maps. The class were used to looking at maps of High Spen and the Year 4 pupils had studied the history of the village and changes in it over time. In order to get them to focus on the physical aspects of Chembakolli and its relative location within India we began by playing what the children have called 'the 5-second game'; a thinking skills strategy also know as 'Maps from Memory' where children collaborate to reconstruct a map by taking it in turns to see the complete map a few seconds at a time (for more information about this strategy see David Leat's *Thinking Through Geography*). In mixed ability groups they took it in turns to look at a completed map which was held by the teacher. They had just 5 seconds to study the map and then return to their group and fill in a blank copy. The important elements of this task are that the groups work out a strategy. At this stage they were beginning to talk about which parts of the map they need to focus on



saying things like '*we've got the fields, you look at the rivers.*' Exchanges like this show that they had begun to work together and had devised strategies for completing the task. This collaborative work is a favourite of the children and over the year they have become much better at focussing on different areas and planning what to look for. As all of the words were unfamiliar the spellings were imaginative! However the landscape and the main geographical features were shown more accurately.

Using this approach helps to develop co-operative and discursive skills but it also a very useful tool for making children look carefully at the features of a map. By working together children noticed features they may have otherwise missed and the opportunity for using geographical language then occurred in the discussion afterwards. For example one group found all of the *landscape* features but another group focused more on *habitation*. Collaborative group work like this is a feature of the approaches recommended by Alistair Smith. In *Accelerated Learning in Practice* he talks about building a sense of success in the classroom by 'using co-operative learning techniques to build team skills'



Once they had a grasp of the location and the region we looked at the map of the village using the large screen. We pulled up a map of High Spen beside it and as a class began comparing the two. Different children came out and pointed to aspects such as churches and temples. The children were in their already established ICT pairs/threes in the ICT suite and as we discussed they began making notes on the similarities and differences we were finding.

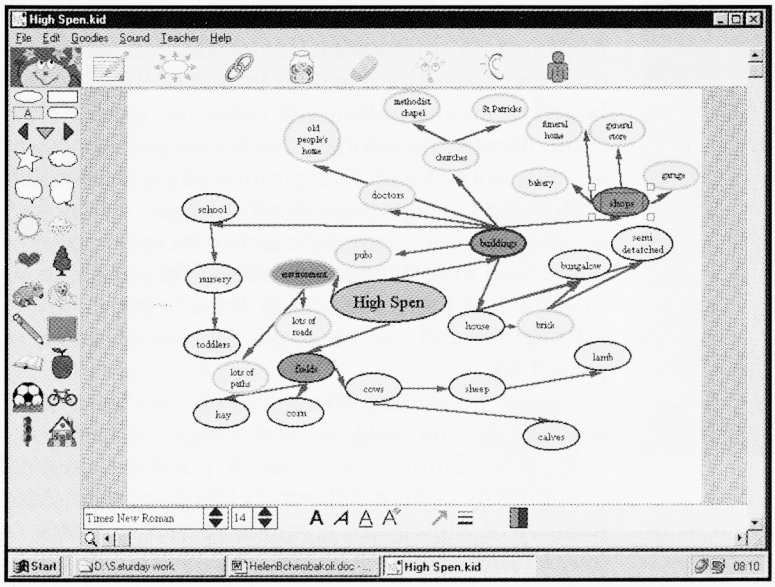
To prepare for the next session I took the notes that certain groups had made and put them into *Kidspiration* (Inspiration, Inc) with each idea in its own text box. As a class we looked at these on the large screen and a discussion arose as to how we could present the information. As the children had already worked with Kidspiration and were familiar with using concept maps in most subjects, they had some very good ideas as to how concept maps could help to sort the information. They were keen to show that there were many links between information and eager to explain how it could be presented.

Just by presenting information in text boxes as separate statements generated a high level of discussion. Children were able to point at boxes and explain why certain statements fitted together. An interactive whiteboard would have been a bonus here to allow children to join statements themselves either in colours or by manipulating the boxes. We used a large sheet of white paper pinned to the wall the computer was projecting on and coloured markers. Children were able to justify their choices with reasons such as:

> 'These are all buildings so we could group them and link them together, then these two are for leisure so they could link.'

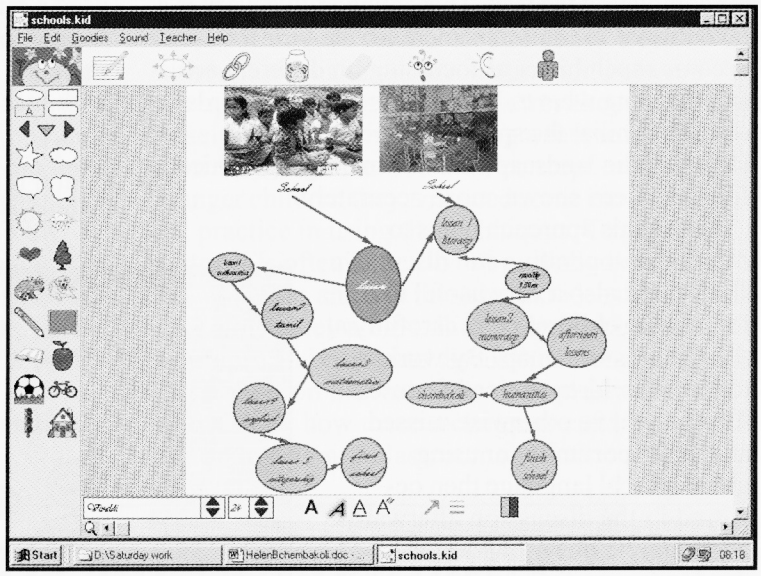
We decided that two concept maps needed to be created, one for each village, then we could compare and put explanations in the text part of the program.

We had already established pairs who worked well together on the computers, usually a poorer reader with a better one. Using the frame on the screen as a guide they began creating their own concept maps. Starting with High Spen seemed logical, as they didn't have to refer to the map very



maps the children would join everything to the central idea and there would be no thought in their attempts to link ideas. This activity took place half way through the year and the maps show that children have begun to make links between ideas and concepts and discussion showed that they could justify and explain their links clearly. (If children are required to justify and explain their maps a 'pole bridging' improvement is made which means that the children are reinforcing their own learning and building upon it.)

The children also used photographs to enhance their maps and spent a long time deciding which pictures were suitable for which aspect of the maps. Some even insisted on using the digital camera to take pictures of our school to use as a comparison. This pair decided just to compare school life and their maps were complex but informative.



The concept maps that the children produced were informative and focused their thinking on the similarities and differences between the two villages. We use concept mapping like this at the beginning and end of most topics and the children are keen to see their own knowledge expand in a logical way. The benefits of concept mapping can be seen in most topic areas; children extend logical ideas and begin to think carefully about groupings and links. This activity in particular raised the skills and knowledge of the children in Geography. They were motivated to learn about life in Chembakolli from looking at the map and from seeing their own words on the large screen ready to be turned into a useful tool. (They are keen to see themselves as

often to check ideas. Discussion between Year 3 and Year 4 pupils began on whether we should include things that used to be in the village. The Year 4 children had looked at the history of the village in depth and they knew there used to be a cinema and more shops. This led to a discussion on our knowledge of the history of Chembakolli. Could we justify taking our previous knowledge of High Spen into account? We decided that we could only use the knowledge we had gained from looking at the maps we had in front of us. This level of discussion came from the links the children had been making and their ability, through other thinking skills strategies, to question and reason at quite a high level.

One of the benefits of working with concept maps is that they require children to make links between ideas and to find reasons and justifications for these links. When we first began using concept

facilitators of their own learning and love the idea that what they produce will help not only themselves, but others, to learn.)

By adopting this thinking skills strategy the children not only became much more focused on the similarities and differences between themselves and children in Chembakolli but they were motivated to find out more. As a teacher I couldn't ask for more than for the children to be motivated, keen learners and the feedback from the children during our weekly 'what I have achieved' sessions proved that they too are proud and pleased with what they have accomplished.

Further information

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Kidspiration (Inspiration Software, Inc. www.inspiration.com).

Making Links: Developing Children's Thinking Skills using ICT

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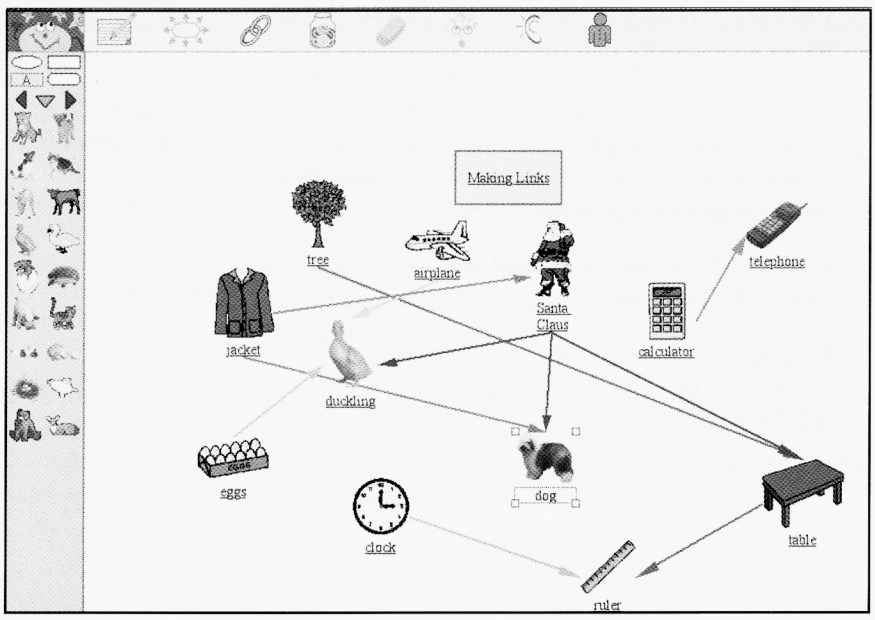
Introduction

The work described in this section looks at the effectiveness of using ICT in developing children's reasoning and creative thinking skills. The particular focus of this activity was to develop information-processing, reasoning, creative thinking and evaluation skills. The activity was undertaken using the visual learning software *Kidspiration* (Inspiration, Inc.). *Kidspiration* enables pupils to envisage their working ideas, revealing patterns and interrelationships with pictures, text and links.

tory talk (see Section 1) through working in small groups, and making explicit connections between ideas using visual prompts. The children were to engage critically but constructively with each other's ideas, and statements and suggestions sought and offered for consideration. The project was undertaken with a mixed ability Year 4 class, who are familiar with a variety of thinking skills activities. Rules were discussed before the lesson to ensure they were aware that all ideas should be considered, as there were likely to be no clear right or wrong answers. We were influenced by the work of the

The activities

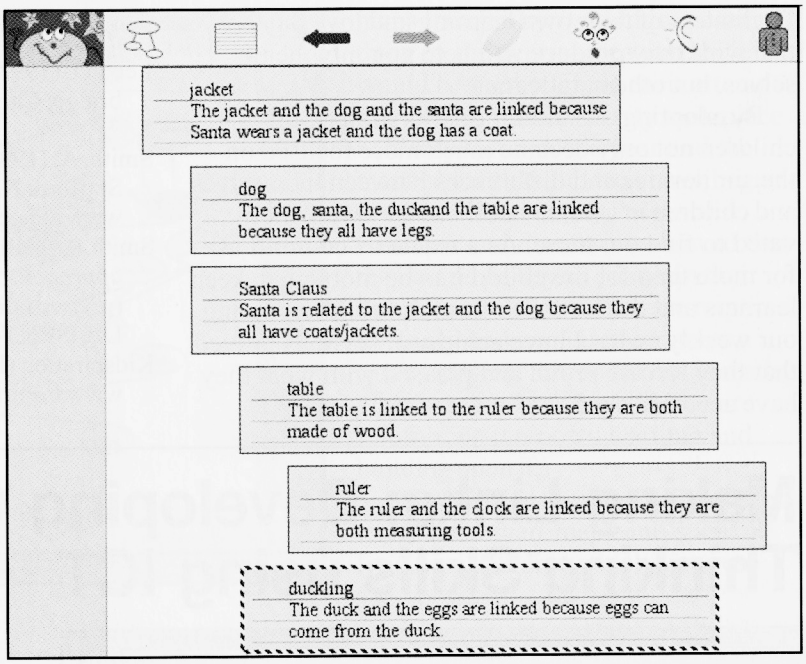
As pressure upon the curriculum mounts, teachers are obliged to deliver the core areas of the curriculum, with key emphasis on reading and writing skills. Less time can then be devoted to developing the children's thinking, speaking and listening skills. This is a key issue at our school, and we have heightened its profile by making it one of our whole school curriculum targets. The aims of our project were to develop the children's use of explora-



Open University research and used their guidelines for talk rules (Section 1, p. 1) explicitly.

The activities were carried out in the computer suite, where the children worked in groups of three. They were encouraged to make connections between twelve objects on screen, and to use the mapping tools in *Kidspiration* to create visual links to organise their ideas.

The software enables the children to move between the visual diagrams to a writing view where the children can expand upon their ideas and give reasons for their links. Children were already familiar with the format of the software and had previously used its tools to create an explanation text to illustrate the life cycle of a duck.



To lead the children into the lesson and to encourage the children to think creatively, the teacher led a range of short thinking games such as Odd One Out (from Thinking Through Primary Teaching) and Consequences (from Top Ten Thinking Tactics). The children were reminded of the talk rules and then given thirty minutes to discuss and make the relevant links between objects on screen. Groups were able to print out their work, giving them instant access to the ideas to be used in a whole class debate.

Outcomes

To bring the work to a conclusion, the children were brought together to share their reasons for the links they had made. They were encouraged to challenge and counter-challenge each other, as long as they could justify their reasons and offer alternative hypotheses. The work did engage the children in exploratory and creative talk, and provided an enjoyable level of challenge. Ideas were considered by all members of the class, and reasons given to support their views.

> *Claim: 'The calculator and the phone are linked because they've both got buttons'.*
>
> *Counter-challenge: 'But what about the clock, the phone and the calculator as they all have numbers?'*

This really got the children engaged in conversation, finding reasons why their links are justified and seeing how other children have linked the objects together for different reasons. The children also came up with more analytical and creative reasoning such as:

> *'The clock and the egg-box are linked because the clock has twelve numbers on it, and the egg-box has twelve eggs in it'.*

Further information

Dawes, L., Mercer, N. and Wegerif, R. (2000) *Thinking Together: A Programme of Activities for Developing Thinking Skills at KS2.* Birmingham: Questions Publishing (see also their web site http://www.thinkingtogether.org.uk/).

Fisher, R. (1997) *Games for Thinking.* Oxford: Nash Pollock.

Higgins, S. (2001) *Thinking Through Primary Teaching.* Cambridge: Chris Kington Publishing, ISBN 1 899857 39 7.

Lake, M. and Needham, M. (1993) *Top Ten Thinking Tactics.* Birmingham: Questions Publishing Company.

Kidspiration (Inspiration Software, Inc. www.inspiration.com).

Writing frames and thinking skills

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Writing frames support children's writing in many ways:

- writing frames can help pupils by asking them to select, and think about what they have learnt. By encouraging pupils to re-order information and demonstrate their understanding rather than just copying out text all pupils can be helped to achieve some success at writing, a vital ingredient in improving self-esteem and motivation.
- writing frames help some pupils by preventing them from being presented with a blank sheet of paper – a particularly daunting experience for those for whom sustained writing is difficult.
- writing frames give pupils an overview of the writing task. Before the introduction of the National Literacy Strategy, writing in primary schools had traditionally concentrated on narrative – writing frames can extend the genres of writing that pupils are introduced to and which they learn to master.

Writing frames and ICT

Completing writing frames on screen usually increases pupils' motivation. They are more easily engaged in finishing and printing the frame than when the task has to be written on paper. Additions and changes can be more easily incorporated in to the task. For the teacher it is easy to create templates for pupils to use on screen and to differentiate either by the structure of the frame or the supporting vocabulary that is supplied. ICT also makes it easier to withdraw the support of the frame by progressively simplifying the structure. If you have access to a projector, then modelling writing on a large screen makes it much easier for all pupils to see.

Teaching with writing frames

- Teacher models or demonstrates using large version of the frame or with a digital projector;
- joint construction by teacher and pupils using writing frame as an interactive activity;
- supported 'scaffolded' activity (i.e. pupils' use of writing frames which is treated as a draft, writing on a computer can be easily edited and improved);
- independent activity: the genre and its language features are added to pupils' writing repertoire;
- debriefing/plenary discussion of how writing frames help make the process of writing explicit

It is important that writing frames are *always* used within appropriate curriculum work rather than in isolated study skills lessons. In other words, the use of a writing frame should arise from the pupils having a *purpose* for undertaking some writing and an appropriate frame introduced if needed.

They can be used simply as a way to support explicit teaching of writing in different subjects. This works by breaking down the writing process into stages where the frame maintains the cohesiveness of the text and pupils can concentrate on the content and coherence of the text. Pupils see that there are separate small chunks to complete, this makes the task more manageable

The 'teaching thinking' slant on writing frames is then to make the mastery of this process explicit, to discuss how the writing frame has supported the teaching and learning so that the pupils see that writing is something that you learn, rather than something that you are just 'good at'.

Writing frames can be used across the curriculum. There are three examples of writing frames on the CD designed for use on screen (with drop-down forms) as well as a range of writing frames to print out (using text boxes). These have been provided by GridREF 2000, a North-East based NOF provider. Two teacher activities from their training materials for primary teachers are also included. The first is a guide to creating writing frames using *Word 2000* (TableFrames.doc); the second is a guide to using drop-down forms (DropDown.doc) to make these frames easy to use on a computer.

For further information about the theory and practice of using writing frames see 'Writing Non-Fiction' (Chapter 4) in *Extending Literacy* by Maureen Lewis and David Wray, (1995) Routledge.

Comparative Report Writing (historical)

Name

Title

Date

A comparison between and

Conclusion

Help words

Sentence starters
Modern day
Nowadays
Today
In....times
Many years ago
In (date)
They both
They are alike
They are different
If we compare

Possible links
although
but
whilst
in contrast
however
whereas
but then

Possible endings

In conclusion
Finally
In comparing
We can see
Having looked at

Section 3: Thinking Through and With the Web

Overview

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The internet is a radically new medium which offers a wide range of ways that can support teaching thinking. In this introduction I'd like to draw a distinction between three different perspectives on internet use. Thinking *through*, thinking *with* and thinking *about* the www.

Steve Williams describes 'Newswise', an internet resource aimed at primary and secondary pupils which offers access to appropriate texts for discussion, a forum for exchanging ideas and support for teachers in developing strategies to help engage their pupils in different aspects of the stories and texts. This exemplifies (for me) thinking *through* the WWW where the internet is used effectively as a medium for exchanging news stories (accessed by teachers and pupils) and exchanging ideas about those stories. It would be difficult to provide such information and exchange information as effectively using other forms of communication.

Thinking *with* the internet is where the internet itself is the tool (rather that just the medium of communication). The benefits of using html with hotspots and links to create non-linear texts or pictures and diagrams that can be explored to support teaching and learning. Ian Patience's innovative exploration of a painting by Agnolo Bronzino is an example of how teachers can develop such interactive learning resources (though it should be noted that this painting was used with Year 8 pupils as part of the PSHE curriculum and the content of the painting and the issues it raises need to be handled sensitively with pupils even of this age group). A wealth of teaching resources can be developed and shared using the particular features that the environment of the internet offers. The interactive relationship with information is being exploited in other ways too. The search engine Kartoo offers visual results and shows the results of its metasearch with sites being interconnected by keywords (http://kartoo.com). This starts to blur the boundaries of some of the distinctions that we have used in this Focus pack.

Thinking *about* the internet is where pupils (and teachers) reflect on the internet itself. The information it can provide, in terms of capacity and range (to use terminology from the NOF outcomes) and in terms of evaluating its purpose and quality. Lyn Dawes' article highlights a number of issues in this area and suggests some principles for effective educational use of web content and computer games.

Thinking Through the Web: Newswise

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Newswise is an online educational resource based on topical news stories. It is designed to improve the literacy and thinking skills of children and young people aged between 8 and 18. It can also be used to encourage thoughtful discussion and provide an online forum where children can go to follow up ideas with help from experienced teachers. Newswise can be used in the literacy hour or for subject lessons such as English, PSHE and Citizenship. It is also a valuable resource for teaching English as a foreign language.

It is quite a task for a teacher to read newspapers, select articles and then prepare and present them to the class. It also seems a waste of time for many teachers to be following a similar procedure up and down the country. Resource files are available to teachers for this purpose, but they inevitably lack immediacy of appeal, being published some time after the currency of the topic. They also, in our view, lack the richness and depth that a reflective approach to such topics can provide. We feel that young people need to think beyond factual stories to be aware of the assumptions, contexts and concepts that lie behind them. We feel there is a demand for having a 'live' current affairs topic tailored to classroom needs.

We also think that Newswise Internet and online discussion projects should be used to encourage and develop dialogue away from the computer. Too many computer programs try to replace live discussion with tricks and tests. If such discussion is to be effective at the computer, children will need to learn to collaborate and listen to each other effectively. Newswise has a similar format for each edition so that teachers can plan a series of lessons in advance.

The story

Each Newswise story is especially written for children. The theme for each story is selected from recent news stories. We suggest that the class reads the story together at least once. The teacher will be able to give support on vocabulary or grammar that any learners find difficult. Articles have included issues about pocket money and happiness, the Twin Towers tragedy and asylum seekers.

Also included are a series of structured activities to develop different skills. These include:

Headlines

Literacy lessons require children to predict from headlines. This is not so easy because a single headline may focus on only one angle of the story. As an alternative, Newswise provides a collection of possible headlines, each with a different angle. This exercise encourages learners to identify the main idea of the story and choose language that expresses it, to work out their own opinions and develop sensitivity to the language and intentions of the writer.

Bare bones

The purpose of this section is to check that everyone understands the basic plot of the story – the 'bones' of the argument – by completing selected sentences correctly. But it can be used for much more than this and can help develop understanding of chronological sequences, awareness of fact and opinion and the relationship between grammar and logical structure of sentences through activities such as classifying the conjunctions (until, when, where, because) according to their meanings like addition (and), opposition (but), time sequence (when, until) or reason (because).

Reporter's deadline

This task encourages learners to attempt a summary of the story. Summaries are difficult so learners are offered the support of a popular underlining technique that is useful in many situations where notemaking, summarising, or rewriting are required.

Hotlines

This activity puts students in the imaginary position of interviewing a significant person in the story. It helps learners to create questions in context. Explanations are given as part of the activity. It is important to give learners the opportunity to decide on questions for the interviewer's clipboard together, in small groups or as

a whole class. This encourages the giving of reasons and lessens the possibility of repetition if a 'live' role-play is attempted. Such a role-play, often called 'hot-seating', sets up the teacher or an able student to answer questions in the role of the interviewee.

Think before you vote

Voting is a way of collecting yes and no answers from a group of people to find the most popular choices. However, votes are often taken with little prior thought. This activity delays the voting process so some thinking can happen even though a full-scale discussion is not required. Both the delaying techniques used in this activity can be used in other contexts.

Key sentences, key questions

Literacy lessons often require children to pick out 'key sentences' that convey information in news stories. But what counts as information? It could be a fact, a guess or an opinion. And what counts as a key sentence? Is a key sentence one that contributes to the bare bones of a story or one that points to the most important issues? A key sentence might also be one that stimulates the most questions and prompts us to think deepest. This activity tries to combine some of these approaches to picking out key sentences.

Hidden Gold

News stories not only contain facts and opinions, they provide a gateway to all kinds of important ideas, values and assumptions. We believe strongly that children will be more likely to gain from reading news stories if scope is given for them to explore some of these concepts in depth. If discussion is followed by writing, this kind of space for exploration will be well rewarded with higher quality work.

In each of the Hidden Gold activities we pick out some key concepts from the story and provide a set of starter questions. These questions can be used in two ways:

1. Read the questions as a preparation for what might emerge from a classroom enquiry where learners choose their own questions.
2. Ask the learner to chose from the questions as a 'menu', though it is also open to the teacher to pick out any ideas that might link well with other curriculum work.

Some whole class discussion, guided by the teacher should be attempted. Children need models of how to discuss well. In particular they should be shown how to recognise generalisations and make distinctions. It is hoped that children as well as teachers may soon appreciate that plain ideas become 'gold' often by virtue of the creative thought that is produced in a group thinking together – what we designate a 'community of enquiry'.

Classroom use

The materials can be used in at least three ways:

1. Read the story through with a group and then choose some of the activities for them to work through. In this way, Newswise can be fitted into a variety of lessons to meet curriculum demands.
2. Use Newswise to stimulate extended classroom enquiry and discussion .
3. Combine the previous two. Use the activities provided but also try one or two extended discussion sessions where learners choose their own questions and explore them.

Good classroom discussion stems from questions that learners find interesting. There should be no impulsion to move quickly from question to question in an attempt to finish an activity. A discussion is generally the better for going more deeply into a question than just skimming over the surface – though this may very well demand more patient and careful thought than people habitually give to tricky questions.

Students should be encouraged, therefore, to find and reflect upon the assumptions behind the questions, including the assumption that the key concepts have the same meanings for everyone. In looking deeper, they might, curiously, find themselves looking wider. At least, they should be encouraged to ground their reasoning in examples, and to use comparisons to help them establish generalisations or to draw distinctions.

Further information

http://www.dialogueworks.co.uk/

Thinking about Effective Computer Software, On-line Content and Games for Teaching and Learning

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What is educationally effective content?

With any type of software or on-line content, educational effectiveness is heavily dependent on the context of use. So, for example, the Science Museum on-line resources can be used to support learning of specific science vocabulary and concepts within a course of study, or can be used more casually to provide supplementary information for pupils. Either is a valid use of the material, but the discernible outcomes for learners may be very different. The teacher's structuring and framing of a pupil activity based on and around content strongly influences learning outcomes, as does the pupil's perception of the purpose of the activity.

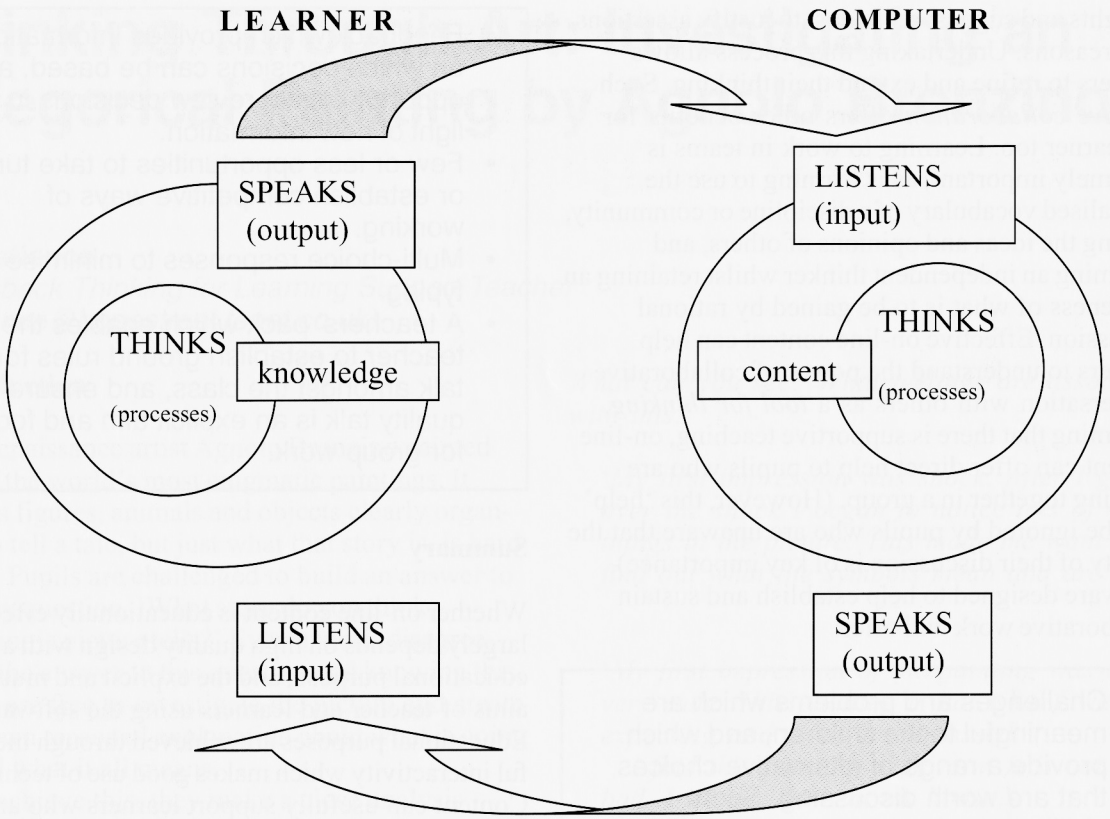
There are some features of on-line content which can be specified as of the utmost importance. Getting these key aspects right is crucial if the resource is to be of use in education. These features can be identified as criteria for evaluation of content by teachers; and they are also likely to be useful as criteria for design by developers. (http://www.becta.org.uk/technology/software/curriculum/evaluation1.html)

Some criteria for evaluation of on-line resources for education

- Does the content make its educational purpose explicit?
- Is the content accurate, up to date, free from bias and presented in appropriate vocabulary, reasonably comprehensive, objective, and contextually relevant for the learner?
- Or, if these first two criteria are not met, can pupils identify the purpose, bias or failings?
- Is the interface clear and intuitive, with well-organised material and good navigation?
- Can the resource enhance collaborative learning?
- Is the learner provided with feedback which checks for understanding and provides support?

Interactivity and collaborative learning

Definitions of interactivity abound as the word evolves and makes its way into common vocabulary. The term 'interactivity' is currently used to describe anything in which an action has an immediately discernible effect. In software for education, meaningful interactivity is what is required. One of the main reasons why computers have enormous potential for education is that they offer real opportunities for meaningful interactivity. That is, computers can allow learners to engage with content in ways which promote learning. 'Interactivity' is often used to describe superficial engagement with the computer interface or with meaningless, albeit harmless, activity. A useful metaphor for the best sort of interactivity is that of a *conversation* between the computer and the learner. The conversation is a turn-taking dialogue of **listening** (input) **thinking** (processing) and **speaking** (output), as illustrated in the diagram opposite.



Interactivity as conversation has the potential to promote learning. The 'conversation' works best if all three operations are well done, by both participants. So, software designed for group work should be able to accept input, process it and provide output which promotes conversation, with no loss of quality at any stage. At the same time, software can support the learner or group who have the purpose of making meaning from the content. A good 'conversation' is therefore one in which concepts are generated and formulated, ideas understood and information assimilated, memorised and contextualised. So, effective software can provide the learner with simultaneous access to content and to the ideas of others, which is one reason why the integration of ICT into classrooms has created such interest and enthusiasm within the teaching profession and society generally.

In classroom settings, two ways that computers can be used are:

1. The individual learner interacts with the computer.
2. Pairs or groups of learners talk about their interaction with the computer.

Some of the best software will not only interact with the learner but encourage learners to interact with each other. Computers can support productive interaction between the teacher and the learner, or between learners. This facility, to support learner interaction, is one of the most exciting options that computers offer education. The potential for learning and development is transformed as learners converse with each other and interact with the software, pooling their joint mental resources to allow each learner to do better than they could alone.

The conditions which affect the quality of this process are:

1. Provision of *good quality software* or *on-line content* with educational purpose, which offers support for collaborative learning.
2. The *teacher's structuring of the task* or activity to create the conditions for educationally effective interaction between themselves, computers and learners.
3. *The ability of the learners to interact effectively through talk* and *on-line communication*, and their understanding that this is a critical aspect of their work.

Computers support learning as a social activity. Individuals working on separate computers may confer with one another in a range of school, library, home and workplace settings. Encouraging such social thinking is educationally effective in that talk allows people to put thoughts into words, to defend and elaborate their ideas, to recall previous

thoughts and suggest revisions, to justify assertions with reasons. Undertaking this process allows learners to refine and extend their thinking. Such *creative collaboration* offers other benefits for the learner too. Learning to work in teams is extremely important, as is learning to use the specialised vocabulary of a discipline or community, valuing the ideas and opinions of others, and becoming an independent thinker whilst retaining an awareness of what is to be gained by rational discussion. Effective on-line content can help learners to understand the power of collaborative conversation with others as a *tool for thinking*. Assuming that there is supportive teaching, on-line content can offer direct help to pupils who are working together in a group. (However, this 'help' may be ignored by pupils who are unaware that the quality of their discussion is of key importance). Software designed to help establish and sustain collaborative work will offer:

- Challenges and problems which are meaningful to the children, and which provide a range of alternative choices that are worth discussing. Such challenges should engage the children with the content of the software rather than its interface.
- A clear purpose or task which is made evident to the group and which is kept in focus throughout.
- On-screen talk prompts which ask the group to talk together, remind them to reach agreement and ask for opinions and reasons.
- Feedback which provides information on which decisions can be based, and opportunities to review decisions in the light of new information.
- Few or less opportunities to take turns or establish competitive ways of working.
- Multi-choice responses to minimise typing.
- A teachers' pack which enables the teacher to establish ground rules for talk amongst the class, and ensure that quality talk is an explicit aim and focus for group work.

Summary

Whether on-line content is educationally effective largely depends on high quality design with a clear educational purpose, and the explicit and mutual aims of teacher and learners using the software. Educational purposes are achieved through meaningful interactivity which makes good use of technology. Content can usefully support learners who are working in collaboration so that thinking together allows high achievement for each individual.

Further information

The Becta Curriculum Software Initiative has the aim of supporting the generation of high quality resources for teaching and learning.

http://www.becta.org.uk/technology/software/curriculum/index.html

Thinking Through Art: Investigating an Allegorical Painting by Agnolo Bronzino

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Introduction

The Renaissance artist Agnolo Bronzino painted one of the world's most enigmatic paintings. It depicts figures, animals and objects clearly organised to tell a tale, but just what that story is, is hard to say. Pupils are challenged to build an answer to this key question, 'What story do you think Bronzino's picture tells?' Even experts disagree about the answer to this question and knowing this, pupils are free to investigate the picture and create their own reasoned explanation about what is going on and what it all means.

To achieve this, they make a close analysis within Bronzino's painting, attending to its rich detail, identifying participants in the 'drama', and exploring the possible relationships between them, as well as making comparisons between this painting and other works of art. I have used the website with Y8 mixed classes in the context of PSHE lessons and as part of Art modules relating to symbolism. In the course of its development, some pupils asked for set questions and a record sheet that would help them organise their investigations, whilst other pupils found one or both of these things unhelpful. Consequently, two versions are presented on the CD, one with supporting questions and 'online notebook', and one without.

Managing the activity

Lesson 1

An approach based loosely on a 'community of enquiry' model works well. A plenary, focused on an A2 print of the painting, provides a good start to the investigation. But don't hurry this part of the investigation! Invite first reactions and ask for clarification and explanation.

What are your first impressions? Why is this so?

Next ask for observations.

What can you see? What feelings are associated with this?

> '*My first impression was shock. After I got over the shock I began to notice lots of other things in the picture. This made me want to find out what the symbols mean and are.*'
>
> *Katie*

> '*My first impression of the painting was it is very rude. This painting is not what I was expecting and I felt embarrassed.*
>
> *I find this painting okay now. It is not that bad. I would like it at my house.*'
>
> *Samantha*

Collect and record pupils' questions about the picture. Explain that the activity aims to develop skills in 'close looking' (analysis) and in 'making sense of things' (synthesis). Connect the planned learning outcomes of this activity with both the present understanding of the pupils, remember how we found out that advertisers use symbols to help sell their products... and with your plans for the future, This work will help you to use symbols in your 'This Life' painting.

Introduce the pupils to the website focusing attention on:

- their choice of recording method (online 'notebook' or handmade notes)
- the brief introduction to Bronzino and his painting
- the key question
- how to use the 'notebook'

Demonstrate how the pointer is used to explore the images. After this initial introduction, most pupils will be keen to 'click around' to find out what's there. Allow pairs to get on with it, visiting them at their workstations and engaging them in talk about their methods and ideas. There is always much talk between groups as discoveries and theories are shared. Allow some time for this, but then bring everyone back for a second plenary that might bring the first lesson to a close.

Encourage the class to share findings, and to describe their different approaches.

The teacher's role in all of this is to ask questions, seek clarification and require evidence in support of claims. A table recording the various symbols seen in the painting along with suggestions for their meanings and feelings can support the enquiry. It is important that the teacher refrains from explaining all. Disagreements on matters of taste or understanding require those involved to support their arguments with evidence and reasons. Return to the key question reminding pupils that we are not looking for the 'right answer' only 'better' answers.

Lesson 2

An initial whole class discussion focusing on the table of findings and the print of the painting will provide pupils with the opportunity to recall the previous lesson and the key question. This also provides the teacher with the opportunity to clarify what is expected by way of a response to the key question. Pupils can then continue their investigation of the painting. After 10–15 minutes, call another whole class discussion. Additions to the table will help keep everybody on task, supporting pairs who are struggling to make sense of their findings, and challenging those who are forming explanations to provide clear, well-reasoned arguments. Remind pupils of the expected outcome and provide time for each group to make preparations. The lesson concludes with the pupils presenting their answers to the key question.

> *'I think that everybody in the picture is hiding something, like the truth, and the picture is trying to show both sides like: Love and hate, the truth and lies, kind and selfish, pain and no pain. That's my idea of the painting, it's trying to teach you a lesson.'*
>
> *Amy*

Finally reflect on the activity, on the skills and dispositions it required and developed, and when these might be useful in other areas of life.

> *'I found investigating the painting quite fun as I haven't done anything like that before. It was like solving a mystery.'*
>
> *Amy*

> *'I think that studying and investigating this painting was quite fun because I have never looked at a painting like this and I found the computer website really helpful.'*
>
> *David*

If you would like to try out the activity for yourself the web site is included on the CD. It is intended for secondary pupils but shows the potential for exploring an understanding of paintings using a web environment.

MAPE