Learning from Children about their Learning with and without ICT using Video-Stimulated Reflective Dialogue

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The Interactive Teaching and ICT project explored the process of interactive teaching and learning with and without ICT. A key technique in our methodology was the use of video-stimulated reflective dialogue to assist teachers to reflect on key episodes in their teaching. In this paper we discuss how this technique was extended to encourage pupils between the ages of 5 and 14 to reflect on their learning of mathematics. Analysis of the reflective dialogues indicates that even quite young children were able to articulate opinions about the ways in which they learned and the ways in which ICT supported this.

In recent years there has been significant investment in the provision of ICT resources for schools in England and Wales in the expectation that this will lead to improvements in teaching and learning. In particular, there has been significant investment in presentational tools such as data-projectors and *Interactive White Boards* (IWBs). However, research indicates that the impact of ICT on pedagogy and learning within mathematics classrooms has been limited (Becta, 2003; Smith, Higgins, Wall, & Miller, 2005; Smith, Hardman, & Higgins, 2006; Moss et al., 2007).

The Interactive Teaching and ICT (ITICT) project (Kennewell et al., 2005) is investigating the processes of effective, interactive teaching with and without ICT. A variety of ICT resources were used in the project schools, however all the teachers used presentational tools such as IWBs or data-projectors and the extent to which these tools could be used to support effective interactive teaching was a focus of the research.

Changes in teaching and learning practices impact directly on pupils, however, and the project privileges pupils' voices by ascribing to them a key role in the analysis of their own learning. A range of quantitative and qualitative data was collected over the course of the project, including pre- and post attainment tests, interviews with teachers and pupils and lesson observations. However, a key research technique for qualitative data collection and analysis was *video-stimulated reflective dialogue* (VSRD) (Hargreaves et al., 2003). The project extended the use of the VSRD technique to include pupils' voices in the discourse. Video-clips of lessons selected by their teachers were shown to focus groups of pupils as a prompt for generating a reflective dialogue

This paper examines the efficacy of VSRD as a research tool to stimulate children to reflect on their own learning of mathematics and expose their perceptions of teaching episodes. It examines the extent to which children are able to identify those pedagogies that are most effective in helping them to learn. In particular, the paper probes children's perceptions about pedagogies associated with interactivity and the use of ICT.

Interactive Teaching and ICT

Recent policy initiatives in England and Wales have been concerned with the development of whole class teaching approaches that are intended to be "oral, interactive and lively" (DfEE, 2001: 1.26). This was intended to be more dialogical than the traditional recitation script of Initiation, Response, Feedback (IRF) (Tharp & Gallimore, 1988).

However, the nature of interactive whole class teaching was not clearly defined in the Strategies and is widely interpreted in practice (Mroz, Smith, & Hardman, 2000; English, Hargreaves, & Hislam, 2002).

Although pedagogical interactivity may be seen as implying bi-directional communication, with children developing independent voices in discussion and experiencing higher levels of autonomy (Burns & Myhill, 2004), interactive whole class teaching has largely been implemented as pupil participation in fast, teacher-led question and answer sessions (Moyles, Hargreaves, & Merry, 2003; Hargreaves et al., 2003). Although teachers now ask more questions most pupil responses remain very short, just 5 seconds on average, and involve three or fewer words. There is little opportunity for pupils to engage in extended responses or to express and evaluate ideas of their own (Moyles et al., 2003; Hargreaves et al., 2003; Smith, Hardman, Wall, & Mroz, 2004).

The teacher-centred approaches encouraged by the Strategies contrast strongly with more pupil-centred approaches more often associated with the use of ICT. In the context of ICT, interactivity usually refers to its facility to provide rapid and dynamic feedback and response. Such technical interactivity has been shown to afford increased learner autonomy and effective independent learning by pupils (Harrison et al., 2002).

The use of interactive whiteboards (IWBs) in particular, is claimed to motivate students because of "the high level of interaction – students enjoy interacting physically with the board, manipulating text and images" (Becta, 2003). We should distinguish, however, between the technical interaction of the IWB as an interface with the computer and the pedagogical interaction that is required for effective learning.

Presentational tools such as data projectors and IWBs do not naturally afford an increase in learner autonomy in the way that, for example, individual or paired use of laptops to sustain interaction with learning resources does. In fact, IWBs may be used to "tame" ICT, bringing it more tightly under the control and mediation of the teacher.

A potential drawback of the introduction of IWBs is the reinforcement of a transmission style of teaching that reduces pupil autonomy and interaction, sometimes reducing the role of the pupil to that of "spectator" (Moss et al., 2007). Recent large scale research reports that in lessons involving IWBs, initially there is an increase in the pace of lessons but fewer uptake questions are used and pupils' responses remain short. The traditional pattern of questioning (IRF) persists in spite of the Strategies and is more prevalent in IWB lessons (Smith et al., 2006).

Teachers were most likely to incorporate the more visible "surface features" of the Strategies, such as pupil engagement or inviting children out to the board into their pedagogy; "deeper features" including formative assessment, the co-construction of meaning through dialogue, and the development of thinking and learning skills tended to be less well developed (Hargreaves et al., 2003; Moyles et al., 2003; Smith et al., 2004). Similarly, when using IWBs, teachers sometimes focus on technical interactivity and over-value relatively mundane activities that pupils perform at the board (Moss et al., 2007).

It is perhaps unsurprising then that large scale studies report that the introduction of IWBs does not lead to general improvements in pupils' attainment (Smith et al., 2006; Moss et al., 2007). The introduction of technology does not in itself encourage the development of more dialogical approaches.

Several thinking skills projects, which achieved significant improvements in pupils' learning, have included dialogical teaching approaches as key aspects of their intervention

strategies, Significantly, the most successful interventions also included metacognition as a major feature of their approaches (see McGuinness (2005) for an overview).

Metacognition

We are interested in metacognition in this paper for two reasons. First, because of its significance for learning – meta-studies of interventions based on metacognition report improved learning with large effect sizes (Hattie, Biggs, & Purdie, 1996). Second, we are interested in metacognition because our intention was to use VSRD to explore children's awareness of their own learning processes and the extent to which they considered the affordances of ICT could be used to support their learning.

Metacognition is a "fuzzy" and elusive term that refers loosely to the knowledge and control that individuals have of their own cognitive systems (Brown, 1987). This dual nature includes both (a) the awareness that individuals have of their own knowledge, their strengths and weaknesses and their capabilities and preferences as learners; and (b) their ability to regulate their own actions in the construction of new knowledge (Flavell, 1976).

The association between some aspects of metacognition and reflected abstraction has led to debate about whether primary age children are able to think metacognitively or benefit from metacognitively based interventions as reflected abstraction is characteristic of formal operational thinking (Georghiades, 2004). However, Adey, Robertson, and Venville (2002) have reported the success of a cognitive acceleration programme with 5- and 6-year-old pupils that included a significant metacognitive component. This accords with Kuhn's (1999) suggestion that metacognitive processes are developmental in character.

Metacognitive knowledge about one's own thinking and learning processes is often described as "late developing". It is usually stateable and requires a higher degree of understanding than does regulation of cognition. Metacognitive skills, used to regulate learning and problem solving, are less conscious processes which are often invoked in an implicit manner and rarely stateable; "knowing how to do something does not necessarily mean that the activities can be brought to the level of conscious awareness and reported on to others" (Brown, 1987, p. 68).

The literature is unclear, however, on whether metacognitive skills are age dependent. The lowest level of self regulation is to be found in quite young children but the capacity for reflected abstraction is suggested to develop between the ages of 11 and 15 (Piaget, 1978). It may be that the extent to which young children are aware of and are able to articulate their use of metacognitive strategies is limited.

Methodology

The ITICT project examined teacher controlled interventions in a number of subjects within a quasi-experimental design of control and intervention classes. This paper reports on the results of the 12 classes that focused on Mathematics. There were two matched pairs of classes in each of the first three *Key Stages* (KS1 to KS3) of the Welsh education system (KS1: 5-7 years, KS2: 7-11 years and KS3: 11-14 years).

In each pair of classes, one teacher used ICT as and when thought appropriate. The other teacher taught the same topics without ICT. The teachers who had volunteered to participate in the project had been selected on the recommendation of their head teachers as effective practitioners who wished to explore and develop their use of interactive teaching approaches and the extent to which the affordances of ICT supported these approaches.

Each research cycle included lesson observations by two members of the research team, and group meetings of teachers and researchers at which issues were discussed, tentative hypotheses formed and new focuses decided.

During lesson observations, the lead researcher took written notes in an open, but semi-structured framework for analysing teaching and learning activities (Kennewell et al., 2005). The second researcher was responsible for creating a video-recording of the lesson.

The teachers analysed their videos after the lesson and selected sections that they felt exemplified their best practice. In the case of the teacher using ICT, one focus was always on the ways in which the affordances of ICT were supporting interactive teaching. The lead researcher returned the following week and engaged in a reflective dialogue with the teacher that was stimulated by the teacher's selected clips. The dialogue was recorded for transcription and analysis.

Following the VSRD with the teacher, the lead researcher met with a focus group of pupils from the lesson. Focus groups generally consisted of between four and six boys and girls who had volunteered to participate. The focus group was shown the episodes of the video that the teacher had selected for their reflective dialogue and after each episode were engaged in semi-structured discussion about the learning that might be occurring.

Pupils were invited to comment on the features of the episode and setting that helped them to learn or inhibited their learning. Follow up questions were asked to probe why they thought that their learning had been helped or hindered by the approach taken in the episode. If it had not already arisen, they were invited to discuss whether the use of ICT had assisted their learning (or would have assisted their learning in the non-ICT lessons).

Results

Pupils of all ages were generally keen to participate in the VSRD. The types of classroom interactions identified by pupils were similar across subject areas and occurred in both ICT and non ICT classes. The following key themes emerged from the VSRD case studies.

Preferred Teaching and Learning Approaches

There was a clear preference for interactive oral work with a strong dislike of lessons where pupils were "writing all the time and copying off the board" or "teachers are talking all the time and you're just listening". Pupils preferred the use of pictures and animation rather than just writing and, with particular reference to IWBs, appreciated "bright, coloured displays that hold your attention". This preference for interaction was partly associated with the boredom that arose from a lack of variety in some teaching approaches but it also points to pupils' awareness that active participation may result in more effective learning.

In KS2 and KS3, pupils in the case studies could identify the value of discussing alternative viewpoints to challenge and clarify their learning. In one mathematics lesson, the teacher had deliberately designed questions to expose common misconceptions and generated a class discussion in which pupils argued through their solutions. During the VSRD, pupils commented on how this had made them reflect on their own thinking:

> P1: When the first couple of pupils said it [the misconception answer] I thought no, that's not right, but then after more pupils said it I'm thinking, hang on now, I used to think this but now they've made me confused.

P2: It does sway you a bit, doesn't it.
P3: That actually got me thinking, why are they thinking that?
R: So what do you do then?
P1: Well, I'd really check it through in my head and then after I did that I thought no, they are wrong…

The Importance of "Fun"

In nearly all the discussions, pupils commented on whether the classroom activities were "fun" or not. Many pupils recognised that their teachers were trying to make activities "more funner" for them in order to motivate them to learn. However, unpicking the nature of fun revealed a number of different factors. Often fun was equated with the variety and novelty of the tasks. Boredom was often associated with lack of variety, although it was also used to describe a lack of understanding.

Many "fun" activities were described as "games". Competition was a feature of many games, but it was not a necessary feature. Competition was sometimes seen as "fun" but this was not always the case and sometimes was viewed negatively. Sometimes activities were described as games because they included a random element and the fun arose from not knowing what would happen next. Children also valued an element of farce or silliness. Often activities were described as games because they involved a degree of personal control of strategy within a challenging context.

Older pupils, particularly at KS3, were able to distinguish between fun and the value of the task for their learning.

P: I don't really mind whether we use it (IWB) or not. I honestly think that, yeah, it's a bit of fun but I don't have my learning improved by it.

Affordances of ICT

The IWB was perceived to have clear advantages over a static board for presentation. They appreciated the accuracy of diagrams and the neatness of writing on IWBs.

P: You can actually understand the writing because you can't usually understand Mr X's writing.

Pupils claimed to be more motivated by working with the technology they saw as belonging to their generation such as IWBs instead of "old technology" such as OHPs.

The transitory, provisional nature of work done on IWBs was considered useful. Pupils also valued the use of mini-whiteboards for the same reason: "You can just rub it out. It's not untidy". Pupils seemed happier to "have a go" and to make errors in these transitory formats rather than in their exercise books which were seen as "best work" that ought to be a neat, finished product.

KS3 pupils distinguished between occasions when technology was used to present solutions as opposed to facilitating active participation with the support of a teacher.

R: So why aren't you convinced about IWBs?
P1: `Cos on the whiteboard they would just load up a calculator, they'd type it in and they'd hit the equals and it would come up with the answer and you don't know how it came out, so if you're not allowed a calculator you can't get it. Whereas, if it's just a plain whiteboard they have to show you how to work it out otherwise you can't just work it out.
P2: Yeah `cos Miss shows us how to work it out. We'll know what to do in a test then.
P1: `Cos the normal whiteboard, it isn't all like, you know, pre programmed, you have to work yourself step by step through it.

P1: Instead of just clicking a button then 'Ooh look, it's happened.

The Value of Feedback

Feedback was identified by many pupils in KS2 and KS3 as important for their learning. The ease with which computers could give instant and individual feedback was valued but a distinction was made by many pupils between being told merely whether their answer was correct or not, and the explanation that they would get from discussion with the teacher or with their friends.

Pupils reported liking learning from their friends not just the teacher. They described working with a partner as motivating. They liked to work collaboratively, often sharing the load, but they also recognised the value of the occasions when disagreements led to views being challenged and refined through discussion

In some contexts, teachers were seen as mediating information that had been originally taken from the internet. In such cases, the computer was seen as a more reliable source of information than the teacher. However in other contexts, such as dedicated teaching software, the computer was seen as a limited source of information and restricted in its teaching potential, with the teacher being viewed as having a more elaborate knowledge and being a source of alternative explanation. Pupils talked of computers and IWBs in an anthropomorphic fashion, for example claiming that "The board thinks that…" or "The board's method is…"

Pupil Interaction at the Front of the Class

In most classrooms, irrespective of whether an IWB was available, pupils were expected to go out to the board; how children felt about this depended on the classroom culture. In some classrooms, pupils said that they did not mind making a mistake at the board because they knew that no-one would laugh at them and that they could learn from their mistakes. In other classes, pupils were scared of making mistakes in public as they knew they would be laughed at. Some said that they would laugh at their own mistakes to get in first before someone else laughed at them.

Most pupils enjoyed going to the board to participate in the lesson, however, sometimes their contribution required only low cognitive demands. On the other hand, some teachers used the affordances of ICT to challenge and develop higher order thinking, using the board as a site for the co-construction of knowledge.

Pupils' Metacognitive Awareness of their Learning

Although these themes were common across subjects and Key Stages, the quality of pupils' comments about their learning differed according to their age and ability. Pupils' responses could be classified into four categories: affective comments, recall of lesson, description of intended learning, and metacognitive comments about their learning.

In KS1, pupils' responses were generally of the first two categories. When they watched the video, the children often re-lived the moment. They responded as if they were in the lesson, placing themselves back in the action again. They put their hands up as if to answer the teachers' questions or called out answers. Alternatively, they described superficial aspects of the lesson, e.g., "Simon's at the board now". Many pupils were able to comment about the importance of working together in social terms and needing to be

kind to each other, but this was usually using forms of words that had been used explicitly by their teachers.

As Kuhn (1999) suggested, pupils were often not aware of how or what they had learned and struggled to describe their thinking. One lesson in KS1 focused on the use of a number square to subtract two 2-digit numbers, for example, 49 – 37. Initially, one pupil had been unable to calculate such questions yet in the VSRD appeared not to recognise what or how he had learned, claiming instead that he had always known how to do it.

No explicit metacognitive reflection on the learning process was observed with KS1 pupils. However some precursors to metacognition were seen from the most advanced pupils who were beginning to be able to pause and reflect on how they had performed a particular task. Some pupils were aware of some of what they knew and could indicate how they had learned it.

One KS1 pupil was asked a particularly challenging question. He sat in silence for several seconds then gave the correct answer. After congratulating him the researcher asked how he had arrived at the answer. The pupil replied that he had thought about it. At the end of the lesson, before the researcher left, the pupil came up unprompted and explained how he had worked out the solution. The delay suggests that he was not fully aware of his own knowledge but that he had chosen to reflect on his thought processes and had been able to reconstruct his thinking sufficiently to explain it.

In KS2 and KS3, pupils were more able to use the video to facilitate reflection. More children were able to comment on which learning activities they enjoyed and which motivated them to learn. They were able to talk about the value of working together in learning as well as social terms. Pupils were more able to talk explicitly about their learning processes in schools that had a focus on thinking skills and learning to learn.

At KS2, pupils' comments about learning often echoed phrases commonly used by their teacher, for example: "You have to make at least one mistake every lesson otherwise you aren't learning". However, although derivative, these aphorisms were applied in appropriate contexts, indicating a degree of internalisation or appropriation. However, in most cases, knowledge about their own learning processes was implicit rather than explicit.

At KS3, far more children were able to talk explicitly about their learning. Many were able to use the video as a prompt to reflect on their learning, not only during the specific episodes shown, but also in more general terms. All were able to describe their feelings about activities, which they enjoyed and which motivated them. Some were able to analyse which teaching and learning strategies worked for them, separating enjoyment from learning potential.

Some KS3 pupils commented on the value of VSRD for making them aware of how their own learning had progressed.

P1: Oh, I remember this lesson. It seems so obvious now when we look at it.
P2: It is.
R: What seems so obvious now?
P1: How we got it wrong!
P2: Yeah, when you said [wrong answer] but it wasn't, it was…

Conclusions

ICT and Interaction

In our case studies, children's views about the value of ICT for their learning often focused on the superficial features of presentational tools such as IWBs. They valued the big, bright, colourful display and the neatness of type. They considered themselves to be a technological generation and are motivated more by modern technology than older tools. ICT and presentational tools such as IWBs in particular, were often described as being fun and were valued for their potential to include an element of play or game into school life.

However, when they were asked about how they learn, children tended to talk about interaction rather than the technology. The pedagogical approaches they described were generally not ICT dependent, although the affordances of ICT could be used to support them.

They valued the social and affective aspects of school life, such as working with friends, having work explained by teachers and feeling safe to make mistakes. Interaction was highly valued for learning, both in a whole class context and on a one to one basis with teachers or other pupils. Oral work was preferred to writing or "copying down from the board". However, "listening to teachers talk" was disliked and distinguished from more interactive approaches. In KS2 and KS3, some of the children were able to distinguish between what they enjoyed and what helped them to learn. Interactive approaches were considered to be more enjoyable and more effective.

Metacognition

Our case studies are consistent with the position that stateable metacognitive knowledge is relatively late developing in comparison with metacognitive skills and strategies. Metacognitive skills are evident, in implicit forms at least, in quite young children. In our case studies, metacognitive skills were more apparent in classes where there was an emphasis on thinking skills, discussion and reflection.

This research is unable to make claims about the conditions for the development of the different forms of metacognition, but the results are consistent with the position that the development of metacognitive knowledge and skills is responsive to dialogical and reflective teaching approaches.

VSRD

Children can offer important insights into their learning processes that are of interest to us as researchers and teachers. They provide a perspective on learning that arguably could be viewed as central to the business of education. The use of VSRD as a research tool helped us to gain access to these insights by providing a focus for collective reflection.

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