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Researching classroom interactions: A methodology for teachers and researchers¹

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Introduction

Teaching and learning in schools is a complex social process which involves both the teacher and students in distributed knowledge-building activities. Research into this process includes researchers exploring from the outside and teachers exploring from the inside (Bassey, 1995). Jaworski (2003) draws on the work of Wagner (1997) to elaborate a form of research which she calls co-learning, in which research on classroom learning is “conducted jointly by outsiders and insiders” (p 250). The work we present in this chapter fits very much into this co-learning paradigm, and our emphasis here is on presenting a methodology for engaging in such co-learning. In this respect we present an approach to investigating classroom interactions which incorporates the perspectives of both classroom teachers and educational researchers, drawing on their different cultural backgrounds and particular areas of expertise. We explain how we use digital video to enable both researchers and teachers to distil the complexities of teaching and learning through creating video-linked commentaries of classroom practice.

Teachers are the main agents of change in the use of technology enhanced learning in the classroom. As such they are often required to adopt technologies that involve transforming their teaching, with little scope for developing understanding about the relationship between the use of digital technology and the learning activities (Lankshear, Snyder and Green, 2000; Lim and Barnes, 2002). This expectation to both understand the potential of a new technology and at the same time to incorporate it into classroom practice is clearly difficult. The work we discuss in this chapter presents a way forward in that the active engagement and perspectives of teachers are combined through collaborative work with researchers, to make sense of unfolding classroom interactions. We describe our evolving approach through presenting and analysing the work of three teachers, all involved in developing understanding of how they could use interactive whiteboards to enhance learning in their classrooms.

Theoretical Considerations

Technology in the classroom. The work discussed in this chapter aims to develop and theorize the interrelationship between technology, learning and classroom interactions, with a particular focus on the ways in which technology changes the classroom dynamics.

The underlying assumptions for this research are derived from socio-cultural theory, that learning occurs through interaction – both with people and with tools. The idea of ‘tools’ includes a wide range of artefacts and semiotic systems, where “cultural artefacts are both material and symbolic; they regulate interactions with one’s

¹ Chapter to appear in, Ludvigsen, S., Lund, A., Säljö, R. and Rasmussen, I. (Eds.) (2007), *Learning in social practices*. Pergamon Press: EARLi Advances in Learning.

environment and oneself. In this respect they are 'tools' broadly conceived, and the master tool is language" (Cole and Engeström, 1993, p.9). The interactions we focus on are the communications that take place between people, in this case between teachers and pupils and between the pupils themselves as they occur in the classroom.

In a discussion on distributed cognition, Pea extends this notion of tool use to include the idea that knowledge, or intelligence, can be thought of as residing within a tool's function (Pea, 1993). For example, in using a calculator to find the square root of a number you only need to press the square root function key. The knowledge of how to perform the square root calculation may not be known by the person pressing the key, however it is through interacting with the tool that the calculator takes over some of the knowledge processing. We consider classrooms to be 'distributed cognition' environments. In such situations pupils learn through their interactions with the teacher, each other, and these are mediated through their use of tools (which includes language).

In their book, *Rethinking teacher education: Collaborative responses to uncertainty* Edwards, Gilroy and Hartley (2002) argue that the skills teachers need today have changed and that trainee teachers need to develop reflective and interpretive practices that foster interactive and collaborative approaches to learning. This requires teachers to be able to "assist learners' participation in communities where knowledge is used and constructed" (Edwards, et. al, 2002, p. 108). Teachers also need to develop skills in their use of tools, in particular the pedagogical skills of incorporating technological tools into their teaching and learning practices. Edwards et al argue that because the use of technological tools in the classroom is related to an interactive style of learning, teachers need to shift from a transmission model of teaching to a model which facilitates the construction of knowledge. To do this requires not only a different set of skills but also a different conception of knowledge. "Training for this interactive interpretative pedagogy cannot be based simply on sending novice practitioners into classrooms with lesson plans and seeing how well they deliver them" (Edwards, et. al, 2002, p 113). We would argue that the same shifts are needed for experienced teachers who may have a strong repertoire of teaching skills but lack the experience of working with new digital technologies. For both novice and experienced teachers, being part of a community which encourages the use of mediational tools, the sharing of experiences, of risk-taking, and of reflective practice can support the development and consolidation of skills to teach with technological tools (Sutherland et al, 2007).

The work reported here is based on studies which investigated how teachers create classroom environments which support the use of technology through interaction and the exchange of ideas (cf. Mercer et al., 1999; Rogoff, 1998), so that students are more likely to become "engaged in learning by participating in communities where learning is valued" (Greeno et al., 1996, p. 26). The teacher plays a crucial role in orchestrating the way in which learning is mediated by language, other semiotic systems, tools and activities. In this sense learning is inextricably linked to tool use (Säljö, 1999).

Collaborative research. To develop a collaborative research approach we are attempting to create a 'community of practice' (Wenger, 1989) of teachers, teacher educators and educational researchers who have an investment in understanding how digital technologies may be used to enhance learning, with a particular focus on

the role of interactive whiteboards. By participating in joint research activities the aim is to build new relationships and links between the participants, in which they develop common understandings and ways of working. It is not clear whether the general cohesion which builds within a long-standing group (e.g., primary teachers in one school) is a “community of practice” but it is probable that as a stable cultural group they may have ‘standard’ ways of looking at the world. However, when temporary communities come together there may be disjunctions, confusions or clashes when the group begins to work together (Lindkvist, 2005; Sutherland, et al. 2003). These tensions can provoke an imbalance within the group resulting in problems that need to be resolved (Engeström, 1987; Engeström, et al., 1999). For example, as exemplified later in this chapter, when teachers and researchers work together to analyse classroom interactions it is likely that teachers will interpret the data differently from researchers. These different perspectives relate to a person’s implicit and explicit theories of teaching and learning.

Sutherland, et al. (2003) suggest that points of disjunction are where learning and boundary crossings become possible, if not inevitable. The process of engaging with points of disjunction can lead to new ways of working and to the development of new understandings. In this respect a more open and collaborative way of working allows for multiple perspectives to be made explicit, providing the basis for changing practice. Within a community of practice, knowledge and know-how is distributed across the participants, and it is through the process of interaction between participants that individuals begin to develop, use and build on the knowledge and skills of each other.

In the projects reported in this chapter, each classroom teacher brought their knowledge and experiences of the classroom cultures within which they worked, which included knowledge of curriculum and assessment constraints knowledge of their students, knowledge about subject matter and knowledge about teaching and learning. The researchers brought knowledge of research methodologies, and analytic practices and knowledge about teaching and learning. Each brought a culture and way of working which was possibly alien, certainly unknown, to the others, and it was through the process of paying attention to differences that these (often implicit) perspectives were made explicit. For example a primary school teacher, Sarah Curran (discussed below), did this through the questions other teachers and researchers asked of her. As she said:

“The collaboration between researchers and teachers I feel is important. As a teacher you do some things instinctively and when talking to colleagues you do not justify these. But by talking with an outsider and explaining what you have done and what you think is happening means you have to really unpick what is going on. Also by using the video tapes allows you to replay incidences and each time you hear different things.” Sarah Curran (Armstrong and Curran 2006)

An Evolving Collaborative Approach

Through two research projects, we have evolved a partnership model of research to explore the use and conceptualisation of technological tools in classroom settings, incorporating the different perspectives of classroom teachers and educational researchers. In this work, the merging of cultures provides a space and sounding

board for teachers to systematically consider the impact their actions have on teaching and learning in the classroom.

i) The Interactive Education Project

The first project, the “Interactive Education Project” (Sutherland, 2004; Sutherland et al, 2007) was designed from the outset to bridge the divide between research and practice. At its heart was a partnership between university researchers, teacher educators and teachers. The project operated as a multi-levelled set of overlapping communities of practice (John and Triggs, 2004). At the meso-level, the project was organised around Subject Design Teams (SDTs) in the areas of English, mathematics, science, modern foreign languages, music, history and geography. Much of the working through of these design initiatives was further developed at a local micro-level, where a teacher and researcher worked intensively together on the design, realisation and evaluation of a Subject Design Initiative (SDI). Design was informed by theory, research-based evidence on the use of ICT for learning, teacher’s craft knowledge, curriculum knowledge, policy and management constraints and possibilities. The design initiatives started out as relatively simple ideas which exploited the use of the available technologies in a classroom. Over time and with iteration SDTs transformed SDIs into powerful new uses of ICT for learning.

Each design team (SDT) developed a common language which all participants could understand and work with. Through the analysis of video-recordings, teacher interviews with different subject teams, and pupil interviews of different age groups, it was apparent that each participating teacher, teacher educator and researcher had different perspectives on what was unfolding in the classrooms (Gall and Breeze, 2005; Taylor, Lazarus and Cole, 2005; Sutherland, et al., 2004).

Through working together members of the team were challenged on their beliefs about classrooms, pedagogy, pupils, even their own roles. Each participant had to be thoughtful and reflective about their own practice and to find a form of words to explain it to the others in their group. These open reflective discussions gave participants of an SDT a glimpse of the world through another person’s perspective as illustrated by the following quote from one of the partner teachers:

“Working closely with my university partner and the whole team was without doubt the biggest influence on my learning. I was introduced to new subject knowledge and new theories of teaching and learning. I was reading new things on language and research on language learning, as well as discussing ideas”
(Partner Teacher)

Within this project 16 researchers, and 59 teachers worked together over a period of two years. Whereas all teachers were actively involved in the process of developing and evaluating Subject Design Initiatives, only a minority became involved in the research process of analysing data and writing up the research.

ii) Distilling the complexity of teaching and learning

As a follow-on from the InterActive Education project we developed a second project, “Distilling the complexity of teaching and learning”, in which four practising teachers worked with researchers to investigate the holistic impact of technology on teaching and learning (Armstrong et al., 2005). In this project we worked as a collaborative team to analyse and interpret the video data. The participating teachers developed their own questions about the interrelationships between teaching, learning and the

use of digital technology and then tested these out through analysis of video recordings of their classrooms. The papers and reports which have emerged from this project could only have been achieved through the multiple perspectives of teachers and researchers (see Armstrong et al, 2005; Armstrong & Curran, 2006).

This follow-on project was different from the InterActive Education project in that its overall objectives were methodological. However, in order to work in partnership with teachers, it was decided to centre the classroom-based research around the use of interactive whiteboards for teaching and learning, because this was of major interest to both the researchers and teachers in the team (Armstrong and Curran, 2006; Armstrong, et al., 2005). At the time of the start of the project, IWBs were being promoted and installed in schools around the country through a government initiative (see also Mercer, et al, this volume). The project teachers were all beginning to use IWBs and were interested in learning more about how they could impact on their teaching activities. However, it has been noted that IWBs are not necessarily used interactively and may reinforce transmission approaches to teaching (Levy, 2002; Kennewell, 2004; Knight, Pennant and Piggot, 2004). Glover and Miller (2001) suggest that rather than transforming teachers' pedagogy, the interactive whiteboard can be relatively easily assimilated into existing ways of working. One aim of the study, therefore, was to explore further the ways in which teachers think that their use of IWBs has transformed their practice.

We worked in partnership with four teachers: Simon Mills² and Ian Thompson³ who had previously worked with us on the InterActive Education project, Adam Williams⁴ who was introduced to us by another teacher who had been involved in the same project, and Sarah Curran⁵ who approached us after a presentation we gave in Bristol about our work.

Roles for collaboration

The approach developed within the 'Distilling the Complexity' project supports teams to collaborate openly through every phase of the research including: development of research questions, development of methods, data collection techniques, development of instruments, focus for observations etc., through to joint analytic sessions, writing (re-writing) and dissemination practices. Each participant has a role to play in this classroom based-research. The teacher carries out his or her regular professional role of teaching the class as well as reflecting on the decisions they make concerning curriculum choices, the role of technology, etc. The researchers are responsible for recording classroom interactions, interviews with teachers and pupils and observing the lesson as it unfolds. What is important to note is that the design of the learning initiatives and the research design are worked out in joint discussions, although the teacher makes the moment-to-moment decisions about teaching and the researcher decides on the way the information is collected.

Teachers' inside knowledge of the classroom and school cultures were critical elements in making sense of classroom interactions. For example, in Ian's class (discussed below) it was not apparent to the researchers why one boy was allowed

² Teaching at Teyfant Community School and in the dissertation phase of MSc in Education, Technology and Society at the University of Bristol

³ Teaching at Sheldon Secondary School and studying for a PhD at the University of Bristol

⁴ Teaching at John Cabot City Technology College

⁵ Teaching at Whitehall Primary School and studying for an MEd at the University of the West of England.

to be working at the IWB for much of the lesson. Through the group discussions it emerged that Ian encouraged this as a way of ensuring that this particular boy's behaviour problems did not impinge on the other pupils' work.

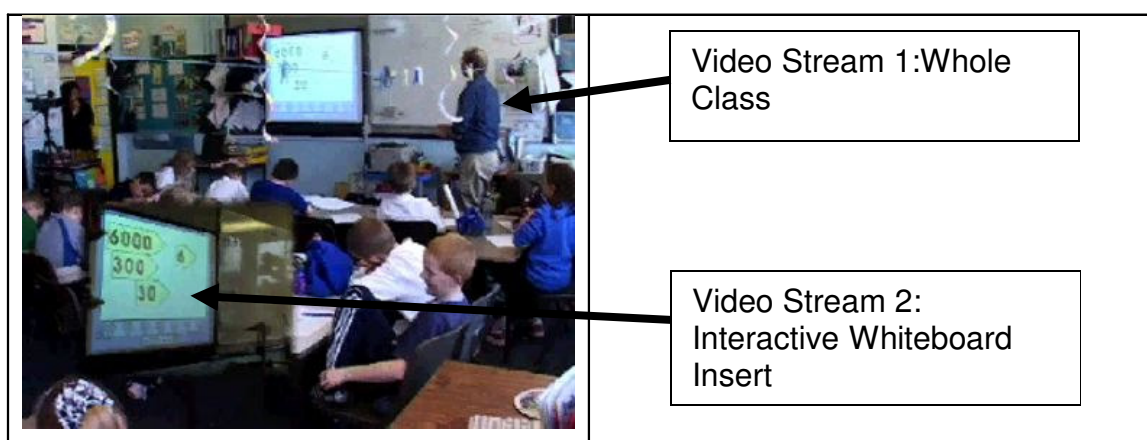
All of these teachers were working full-time as well as working with us on this project. Their interest and motivation about the research was evident in their willingness to come into the university in the evening after teaching all day at school; giving up parts of their holidays to attend research conferences and willingness to code and record the video data in order to address the specific questions they posed. They were engaged in making sense of their classrooms and as part of this process they began to read and theorise about what they thought might be occurring in their classrooms. Initially, they seemed to be self-conscious about watching themselves on the recordings, hearing their own language and seeing their behaviour. However, as committed professionals they became more interested in looking for connections between the things they observed they had done, as teachers, and the impact this may have had on the language and learning of pupils.

The role of digital video

Digital video was used to record spontaneous and naturalistic classroom interactions. The approach is an adaptation of that developed by Clarke (2000; 2002) and used in the Learner Perspective Study (LPS) of mathematics classrooms in nine countries. We used two digital video recorders over a sequence of related lessons, typically, three one-hour sessions. During the whole-class portions of a lesson, one camera was focused on the IWB so that we could capture both the screen displays and any interaction with the IWB by teachers or pupils. The other camera was focussed on the class as they faced the IWB. In this way we were able to track, to some extent, the pupils' focus of attention and their interactions with the teacher and other pupils. When pupils worked at computers, each camera typically focussed on a pair of pupils with the computer screen between them. Ideally, the same pupils were filmed over three lessons. This allowed us to explore their interactions and communication trajectories over the three lessons.

The first stage of processing the recordings involved making a composite time-linked video with a synchronized image from both cameras.

Figure 1: Example of composite video synchronized from two cameras.



The resulting composite video was burned onto CDs, which meant the total class session became available for viewing. Crucially, we did not edit the videos in any

way and so each teacher received the unedited CD of their three classes. In a group session the teachers asked for some guidance about the focus the selected videos might cover. Collectively, we settled for “interactivity” but did not narrow down the focus to any specific type of interaction. The teachers viewed the CDs of their class sessions and selected clips of approximately 10-15 minutes in length that they found particularly interesting. These clips could have been of part of the lesson that they felt had gone particularly well, or where they felt students had not been engaged in learning. Sometimes they selected clips in which a pupil had done something unexpected. We believed that in choosing the video clips, it was more likely that the teachers would invest time in analysing their classroom data. In addition we believed that the teachers were in a better position than the researchers to notice and ask questions and hypothesize about what had taken place in their classrooms. The clips which had been selected for further analysis were edited using FinalCut Pro. The teachers and researchers then worked together to make a transcription of the language used within the video clips.

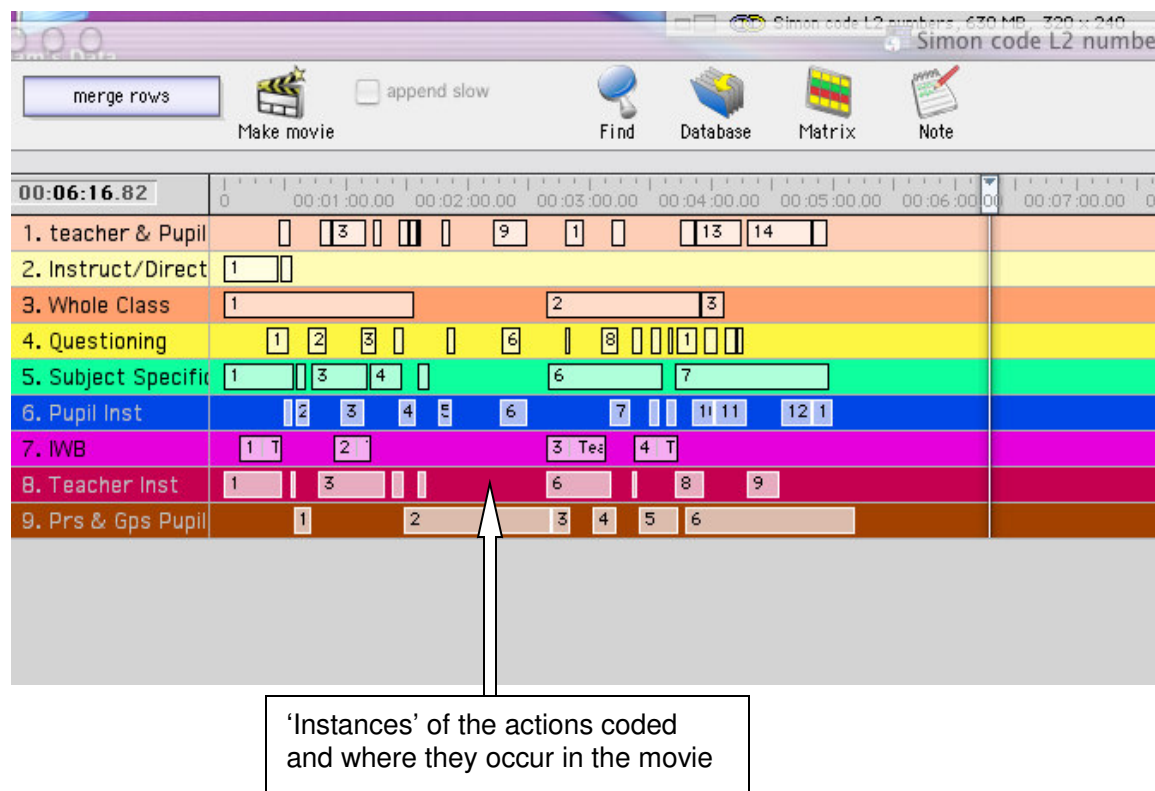
Developing interpretative frameworks

The whole team of researchers and teachers held a day-long research seminar to begin the process of analysing data, by viewing and discussing the video clips. Each teacher presented their clips in half-hour sessions by first providing the situational context: lesson objectives, ways of working, participants, etc. Each clip was then viewed several times, focussing on different aspects of the emerging activity. At times the teacher’s focus might be on the language they used in the classroom; or the way the IWB was being used; or the way the pupils interacted with computers, the software or each other. Discussions of the video clips typically flowed freely around issues of curriculum, time management, the characteristics of the particular group of pupils, resources, etc. Always the goal was to try to make sense of the roles of the IWB, the teacher, learning activity, and so on. Multiple interpretations emerged which were tested against each of our own reflections and perspectives. We were able to develop an overview of classroom interactions on the basis of these viewings and the in-depth discussions surrounding each teacher’s chosen video clip. However, each participant also had different questions they were asking about the video recordings and so these questions, too, were developed and refined over the course of the group discussion. The resulting research questions became the focus of the next stage of the analysis. For instance, Ian Thompson wanted to investigate how use of the IWB may have supported his students in learning to write. Rather than presenting one pupil’s work and then commenting on it, Ian and the pupils developed a narrative on the IWB using suggestions coming from all the pupils in the class. The pupils had a lively debate about what to write in the ‘dual’ narrative and Ian wanted to explore whether these skills extended to the narratives pupils developed when working individually.

During the research workshop a number of potential coding categories were generated which, we thought, would help to explore, more deeply, the teaching and learning interactions which occurred across the different classrooms. The initial focus was on categorizing language. The group developed a simple coding frame which enabled us to begin to analyse different forms of interaction in language (e.g. pupils’ use of questions and subject-specific vocabulary; teacher instructional talk; or talk about use of tools such as the IWB).

Each teacher, together with the researchers, began to code their own video data using the coding frame developed jointly in the research seminar. The coding was carried out using Studiocode:⁶ a bespoke software package developed in Australia through Clarke's Learner Perspective Study. Codes are entered and displayed through a multi-layered timeline beneath the video image.

Figure 2: Coding categories as displayed through Studiocode.



The video can be started and stopped by clicking on a coded section on the timeline. Watching examples of coded language helped increase the reliability of the overall coding. We found that the main advantages of using Studiocode and its multi-layers of code are that:

- The layers have a visual impact on, in our case, the teachers and researchers. This visual image proved crucially important for teachers to begin to make sense of what was occurring in their classrooms.
- It was obvious from the representation, what codes were most used and the period of time a particular code was active.
- The participants found Studiocode easy and intuitive to use.
- Codes and sub-codes could be added at different times providing a flexible environment and the possibility of trying multiple coding systems which addressed different aspects of the teachers' questions.

What became clear was that the language coding frame that had been devised in our joint session did not always cover the specific types of questions which the teachers were interested in exploring within their own classrooms. In this respect,

⁶ Studiocode was originally developed by SportsTec for use in the training of Olympic Athletes. Information about Studiocode is available at: <http://www.studiocodegroup.com/index.html>

the language analysis, alone, was not able to provide sufficient insights into the activity of any particular classroom setting. For example, in Simon's class seeing the non-verbal behaviour of the pupils became critical to his understanding of the language they were using. Each teacher, therefore, needed a coding frame specific to their research questions as well as being suitable for their particular classroom situations and teaching and learning interactions. The following case summaries highlight the way three⁷ of the teachers developed theories and methods of exploring questions about their own teaching practices.

Sarah Curran

Sarah Curran was a Year 6 teacher in an inner city primary school. She was using a web-based resource (Virtualfishtank⁸) in a Science lesson to develop pupils investigative skills. The pupils could adjust certain characteristics of fish (e.g., the size of their eyes) then by logging the selected characteristics they could investigate the survival rates of the fish when they were put into the virtual fishtank. Based on her use of this software in a previous class, Sarah, assumed that the pupils would have time to design and log the outcomes of several fish. Her main purpose, then was for the pupils to design several fish logging the characteristics they chose (the size of their mouths, eyes, and fins). She wanted the pupils to predict about how long a fish would live given the characteristics the pupils chose. The pupils would then record the length of time a fish did live and then design a new fish based on their previous findings. The plan was that the pupils would do this three times and then find the average and see if the choices they made had been consistent over time.

Sarah introduced the lesson and, using the interactive whiteboard, demonstrated how to change the size of the fish's mouths, eyes and fins. She called on different pupils to come up and help design a fish and then the whole class watched to see what happened when the fish was "put in the fishtank". During the demonstrations there was a general discussion about what were desirable characteristics for fish to have to live long "lives". Sarah's impression was that during this period the pupils were engaged in the lesson and impatient to work on designing their own fish. The pupils then worked in groups of twos and threes on computers in the room. Unfortunately, some of the fish the pupils designed lived for unusually long periods of time, up to 25 minutes. During this period the pupils could only act as spectators and some began to 'compete' with other groups to see whose fish would live longest. Sarah was unhappy with the way this lesson had gone and chose to analyse the lesson to understand what went wrong and how to change her teaching practice to ensure the objectives of the lesson would be met in future. One of the main objectives of this lesson then had been for the pupils to systematically record their activities and then be able to reflect on which fish design would live longest and why. However, because the fish didn't die and the pupils had not recorded their actions they couldn't carry out the lesson as planned.

In the project's daylong research seminar questions were asked about how the pupils might have engaged with the software to develop understandings related to primary science. For example, would the science aspects be better understood if pupils had designed a fish to die very quickly; or if the design of long-lasting fish had

⁷ Adam Williams position within his school changed during the course of the Project and he was unable to take part in all our collaborations.

⁸ <http://www.virtualfishtank.com/main.html>

been carried out as a whole group activity? Questions were also asked about why the pupils interpreted the intended 'science simulation' as a game, something that Sarah had not been aware of when she had viewed the video on her own. Through viewing and interpreting the video as a group Sarah became aware that the lesson had shifted from her original science objectives to becoming like a game. We decided that the next step was to explore, in more depth if the gaming element was because the pupils became preoccupied with designing fish that lived as long as possible, or were other things happening?

To explore this aspect Sarah coded the language following the original coding scheme which the group had developed jointly. However, the results did not help Sarah understand what was really going on in this lesson as the coding focused mostly on interaction by, for example, types of questioning and response patterns. She therefore modified the original coding scheme to explore the different types of language that were being used by the pupils and herself. In this new scheme she coded the dialogue and activities in terms of science specific, ICT specific or other kinds of language and realized that there were large tracks of dialogue and activities that she was not able to code with the categories she was using. She then watched these sections more carefully and discovered that rather than science being the focus of their talk what she and the pupils had done in this class was to use language in a way that treated the episode as a game. In a fourth round of coding, she added "gaming" as a new language category and found this became the most frequent type of talk.

These results suggest that the gaming language used by Sarah and the pupils contributed to the lack of emphasis on science in the lesson (see Armstrong and Curran, 2005). From a learning perspective the joint analytic session followed by her more in-depth work with the video and analysis of the language used by herself and the pupils allowed Sarah to reflect, learn and then develop a more effective teaching practice.

Simon Mills

Simon Mills is a very experienced Year 4 teacher in an inner city primary school. He was involved in the InterActive Education Project and became very interested in the connections between language, learning and the use of technology. His interest was such that he began a Master's degree to explore, more deeply, the theories and methods, which underlie his teaching practices. In our second project Simon again participated. This time we recorded sessions when he was teaching a series of lessons on data-handling to Year 4 children⁹. In the first lesson Simon introduced elements of frequency distributions by giving each child a packet of different coloured chocolate sweets. During the lesson, the children worked in pairs at the computer to explore the frequency of different colours from both of their packets of sweets, and entered the results into the spreadsheet Excel. Later in the lesson the results were displayed on an interactive whiteboard to be discussed by the whole class. Over the next three lessons, the pupils continued the investigation and were introduced to concepts such as, fractions, decimals, percentages¹⁰. In the group analytic session Simon introduced a whole class segment when Simon and the pupils were working with the interactive whiteboard. He selected this segment

⁹ This sequence of lessons was a reworking of his Subject Design Initiative for the InterActive Education Project.

¹⁰ For further discussion of this see Mills (2004) and Sutherland (2006).

because he thought it showed how the children were developing very sophisticated language to talk about the results they had produced using Excel. In the course of the open discussion with other teachers and the researchers, Simon became aware that he might have been over interpreting some of the pupils behaviour. At times the language occurring in the classroom did not fit with the behaviour of the children. So that it wasn't always clear what the link was between the terms used and the meaning the pupils attached to them. As such the evidence was not as clear cut as he originally thought. Also, in his work for his Masters' Degree, Simon had been introduced to socio-cultural theories and felt considerable resonance with Neil Mercer's work. So, he developed a coding scheme based on Mercer's language codes which he then applied to portions of his own classroom's videos. What is really interesting here is that when Simon tried to apply Mercer's categories they didn't work very well and he found that he couldn't use them to explain what was happening in his classroom. However, by reading Mercer in greater depth and exploring other theories as well, Simon asked more questions and has since developed a coding scheme which explores the non-verbal behaviour of the children which when analysed in conjunction with the language coding provides a much clearer picture of classroom interactions

As an MSc student at the University of Bristol, and stimulated by a previous ESRC Funded project, the InterActive Education Project (www.interactiveeducation.ac.uk) I had become increasingly interested in the work of Neil Mercer (1995; 2000) particularly his idea that classroom talk, can be viewed as the "social mode of thinking" and the primary vehicle, by which shared understanding is negotiated and developed within learning situations. This 'Thinking Together', or 'Reasoning Together' idea had become a key element in my thinking when 'designing' teaching and learning contexts in the numeracy hour. The interactive whiteboard, as an interface, alongside selected software environments had come to play a central role in facilitating, scaffolding, supporting and recording the outcomes of these classroom based mathematical conversations, developed within my interpretations of the National Numeracy Strategy objectives (DFES 1999).

This model of teaching and learning, lead me to form very specific ideas about what I thought was happening in the teaching and learning spaces I created within my classroom, and to a belief that since my classroom practice had evolved from my understanding of Mercer, then I might be able to identify discursive practices within the data which coincided with the analytical categories devised and presented in the work I had read. However applying these categories, using the analytical tool, Studiocode™ proved problematic The complexity of activity, which emerged during the shared data analysis process [between researcher and teacher] within the whole class context, revealed overlapping discourses between students and students, and students and teacher, due to the socially received and conversational nature of the learning environment (Simon Mills, 2005).

For Simon, his involvement through both projects has led him to begin to theorize more widely about classroom interactions as they relate to the pupils' engagement with the subject through their conversations and use of

technology. By developing his understandings of a range of theoretical perspectives he is developing sophisticated reflective and analytic skills which is evidenced in the quote above.

Ian Thompson

Ian is an experienced English teacher at secondary level. However, unlike Simon, he had not previously embraced the use of technology in his teaching before joining the project. He had previously been involved in the InterActive Education project and wanted to be involved in the follow-on project as a way of investigating, for himself, the potential of different technological tools for teaching English. Ian believed that because the process of writing by hand is so different from the process of using a word processor that the experience results in very different writing outcomes. Over the course of three sessions we recorded Ian teaching a low-attaining group of 12-13 year-old pupils in the computer room (so as to have access to the interactive white board). In the first session, Ian had created a whole-class activity for pupils to start the process of constructing a story using different narrative techniques. The pupils then worked in pairs to write their own stories. Within each session one pair's work would be discussed by the whole class. Ian had been very concerned about how this particular class of pupils would behave when working in pairs and whether there would be classroom management issues which could disrupt the lesson. However, through the analysis the videos and discussions in the university alternative explanations emerged.

In one session, for example, Ian reflected on his intervention in the class of what appeared to be off-task behaviour and how this radically affected the final writing produced by two boys.

“Indeed, frequently pupils begin their talk with a social question such as “Did you go out last night?” that appears to be a necessary precursor to their on task writing. It appears that pupils need the space to explore an idea through shared experience and shared talk and the best writing occurred after pupils had been encouraged to discuss the process before they began writing. Video clips which focussed on the pupils allowed us to see the practical outcome of teacher intervention as well as to glimpse some of the thought processes. What was clear from this short interaction was that, as a teacher, I often discouraged the sort of activity such as socially mediated talk that was in fact critical to the development of the writing process. A simple focus on the written outcome would not have allowed me the opportunity to observe and analyse this process. (Ian Thompson, 2006)

The theoretical explanations which Ian arrived at to make sense of this classroom work developed over time from the joint analytical sessions with members of the English team within the InterActive Education project and from his reading and understanding of Vygotsky. He also drew from theories of discourse and multimodality. He is currently carrying out a PhD investigating the impact of writing with a word processor on different writing genres among secondary school pupils¹¹.

Discussion and concluding remarks

The examples presented in the previous section show how in-depth knowledge of classrooms and an understanding of research methodologies and methods can be

¹¹ The PhD titled The Process of pupils' writing using ICT will be submitted in 2008.

combined to produce more holistic and realistic understandings of classroom interactions. For Sarah, the co-learning of the group enabled her to become aware of how she had unintentionally encouraged the use of the science simulation software as a game. Simon's initial interpretations of his class were based on his own thoughts as a reflective practitioner. When he examined the video evidence together with other members of the group, he discovered that he had not been aware of key interactions between students that contributed to the whole class learning. His use of Mercer's language categories was only able to partially explain the results. However, by expanding his analytical categories to include non-verbal interactions he was able to gain new insights into the way in which the IWB was enhancing learning in his classroom. Ian's insights into the preparatory process his pupils' went through before they engaged in the process of collaboratively constructing a dual narrative grew out of his reading of the research literature and careful analysis of the video data.

From a methodological position collaborative partnerships as discussed in this chapter highlight how the blending of research and teaching cultures can potentially lead to more insightful notions of the inner workings of a classroom. Bringing together teacher and researcher perspectives can illuminate classroom interactions in ways that may not be visible by one group working on their own. Teachers of different subjects, and researchers from different disciplines are able to work through points of disjunction and develop ways of working which could eventually lead to building a community of practice where all participants have a voice in the analysis and interpretation of classroom interactions.

There are two key elements to the work we have presented here. First, the use of multiple research methods which combine in-depth observational techniques with quantitative coding systems. The flexibility of digital video allows researchers to view films, repeating segments and to import them into analytic tools, such as StudioCode. The use of qualitative interpretative techniques coupled with the in-depth systematic analyses of language and behaviour provide a basis for understanding classroom-based teaching and learning.

Second, when teachers and researchers collaborate on research activities they create distributed knowledge research systems (cf. Pea, 1993) which can feed into and support the creation and development of theories of classroom interactions. Elements of a distributed knowledge research system can be seen in the reflective and interpretative activities of the teachers and researchers reported here. We suggest that the skills and practices which Edwards, et al (2002) argue are needed for teachers to teach with technology are the same skills which teachers and researchers need to adopt to be able to engage with the inevitable points of disjunction in carrying out and interpreting research outcomes (Sutherland, et al. 2003).

One area where this research is leading is in addressing the known difficulty for research theories and findings to have an impact on teachers and classroom practices. Sutherland (2006) highlighted, that teachers do not typically read the research literature about teaching and learning. Nor do researchers typically read applied education journals which might have a bearing on their research interpretations. Rather these two different cultures continue to look at teaching and learning from quite different points of view. The collaborative and co-learning work reported here may contribute to the development of new representational

techniques which support the dissemination of research results to different communities. For example, videopapers which are hyperlinked documents with three screen areas for text, video clips, scanned images. As such they can provide multiple texts to accompany a video clip. A videopaper could incorporate video of the classroom, together with text which relates to the teacher's perspective, the researcher's perspective and also the students' perspectives. This type of dissemination practice is being used with initial teacher trainees to develop dissemination practices which build on collaborative reflective practices (Beardsley, et al., 2007; Olivero, et al 2004).

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