

*Using Video Stimulated Reflective Dialogue to
support the development of ICT based pedagogy in
Mathematics and Science*

SONIA JONES, HOWARD TANNER, STEVE KENNEWELL, JOHN
PARKINSON, HELEN DENNY
Swansea Metropolitan University (SMU)

CHERYL ANTHONY, GARY BEAUCHAMP, BETHAN JONES
University of Wales Institute Cardiff (UWIC)

HELEN LEWIS, ANNE LOUGHRAN
Trinity College Carmarthen (TCC)

ABSTRACT

Recent research indicates that the use of ICT to support traditional forms of classroom interaction is ineffective in improving learning and attainment. Instead, teachers are being encouraged to develop more dialogic pedagogies. This paper reports on a project which investigated the efficacy of Video Stimulated Reflective Dialogue (VSRD) as a school-based professional development tool for improving pedagogy in the use of ICT to support dialogic teaching. Parallels are drawn between the nature of the classroom interactions in dialogic teaching and the teacher/researcher interactions during the VSRD process. Distinctions are made between interactions which were dialectic rather than dialogic in character. Developing teachers' pedagogies requires complex changes and it is argued that such changes are best supported by more dialogic forms of VSRD.

Background

In recent years, there has been considerable investment in ICT resources in Welsh schools in the expectation that this would support pedagogical development and lead to improvements in learning. In particular, significant funding was provided for projective technologies such as interactive whiteboards (IWBs) and data-projectors. Although the introduction of this technology might have been thought to support the development of interactive or dialogical teaching approaches, research indicates that the impact of ICT on pedagogy and on learning has been, at best, variable (Becta, 2003; Smith et al., 2005; Smith et al., 2006; Moss et al., 2007).

Mathematics and Science are cognate disciplines that are seen as particularly appropriate for the exploitation of the affordances of ICT. However, ICT-based pedagogies struggle to gain acceptance alongside established classical approaches, which have semi-official status. A research team, funded by WERN, investigated the affordances of ICT for supporting effective pedagogy in mathematics and science classrooms (Tanner et al., this volume). At the heart of our approach was the use of Video Stimulated Reflective Dialogue (VSRD) as a research tool. The team were successful in gaining further funding from Becta to investigate the efficacy of VSRD as a school based professional development tool for improving pedagogy in the use of ICT to support dialogic teaching. This paper reports on the work of that project.

Dialogic Teaching

There is increasing acknowledgement that traditional patterns of classroom discourse are inadequate for improving learning and attainment (e.g. Moyles et al., 2003a). Alexander (2005) suggests that the basic repertoire of classroom talk is unlikely to offer the types of cognitive challenge required to extend students' thinking. In contrast, he characterizes an approach he describes as dialogic teaching which is collective, reciprocal, supportive, cumulative and purposeful. However, these types of talk are less frequently encountered in classrooms (Mroz et al., 2000).

Dialogic pedagogies aim for classroom interactions that involve more than superficial participation. They are exemplified by the teacher's uptake of student ideas, authentic questions and the opportunity for students to change or modify the course of instruction (Nystrand et al., 2003). Teachers

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relinquish some measure of control of the trajectory of the lesson as pupils are offered a degree of collaborative influence over the co-construction of knowledge. Tanner et al. (2005) offer a loose hierarchy of interaction in whole class teaching episodes in terms of the control of the trajectory of the lesson (see Table 1).

The ESRC/TLRP-funded Interactive Teaching and ICT (ITICT) project (Kennewell et al., 2007) explored the effects of using ICT to support interactive teaching. Although it found no significant differences in attainment between pupils taught with and without ICT, there was a pattern of higher attainment for those classes taught by teachers whose approach was more dialogic. Classroom observation, together with teacher and pupil interviews confirmed that expecting learners to play a more active role and display greater autonomy and control over the trajectory of the learning was likely to produce improvements in learning.

There is growing evidence of the value of deeper interactivity and greater learner control in developing concepts and higher-order skills (e.g. Shayer and Adhami, 2007), but also that this is difficult to achieve (Smith et al., 2005). However, the work of Mercer and Wegerif indicates that technology can play an important role in supporting more challenging thinking in schools (e.g. Mercer et al., 2004).

However, dialogic teaching and learning with ICT demands significant changes to traditional patterns of classroom interaction and inevitably involves participants in a subtle process of negotiation over role and identity. This represents a complex change and, in common with most ideas of worth, requires in-depth understanding of the nature and purposes of the change and the development of skill and commitment to make it work (Fullan, 1993).

Gaining insight into how teachers plan and operationalize pupils' participation in richer learning discourses is far from straightforward. VSRD was a

Table 1 Interactivity in whole class teaching (based on Tanner et al., 2005)

<i>Episode</i>	<i>Nature of Interaction</i>	<i>Control of trajectory</i>
Lecture	<i>No interactivity only intra-activity</i>	Low pupil influence
Low level funnelling	<i>Rigid scaffolding/surface interactivity</i>	–
Probing questions	<i>Loose scaffolding deeper interactivity</i>	–
Focusing dialogue	<i>Dynamic scaffolding deep interactivity</i>	–
Collective reflection	<i>Reflective scaffolding / discourse</i>	High pupil influence

key aspect of the methodology of the ITICT project and proved to be an effective tool for researchers wishing to gain insight into both the current state of teachers' explicit pedagogical thinking, and their reflections on directions for future development.

In addition to VSRD's intended use to facilitate analysis of teachers' pedagogical practices, the teachers concerned commented on its potential value as a tool for their own continuing professional development (CPD) (Kennewell et al., 2007). However, exploration of this potential was beyond the scope of that project.

Supervision, mentoring and coaching are terms that are used commonly in the literature to describe the complex processes that are involved in discussions based on the observation of professional practice. They share foundations whose purposes, elements and competencies overlap (Gallacher, 1997). For the purposes of this paper we shall refer to processes involved during the VSRD episodes as coaching.

Many models of coaching exist in the literature to describe a range of staff development practices. These can be considered to vary along several dimensions, such as: the relationship between the observer and observed (manager versus peer), the relative expertise assumed (expert versus novice) the primary objective of the observation (evaluation, research or development), the focus of the observation (e.g. technical coaching – refining a skill, versus cognitive coaching – analysing the teaching and learning process) and the control of the focus of the dialogue (dialogue trajectory controlled by observer or observed) (Garmston, 1987; Joyce and Showers, 1996; Gallacher, 1997; Moyles et al., 2002; Lyle, 2003).

It is often assumed that a coaching relationship is hierarchical and that the observer is the coach. This is not necessarily the case. In fact, when discussing the principles underpinning their model of peer coaching, Joyce and Showers (1996) define the teacher as the coach and the observer as the coached. In VSRD episodes, it is possible for both the teacher and the observer to regard themselves as learners.

VSRD is distinct from video stimulated recall or video stimulated reflection (VSR) through its use of dialogue as a key aspect of the process. The video provides a stimulus for dialogue between the teacher and observer so that they may 'extend and develop their pooled thinking' and where the resulting dialogue is 'scaffolded and supported' by the observer/researcher (Moyles et al., 2003b: 142). Scaffolding is an ill defined term in the literature, however, and often refers to a discourse which leads learners along a pre-determined path towards a commonly accepted position.

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Following Wegerif (2008), we distinguish between discourse moves which are dialectic and those which are dialogic in character. We would regard as dialectic in character, the types of scaffolded discourse moves that lead the teacher towards an established model of good practice – technical coaching. On the other hand, we would regard discourse moves that lead to the co-construction of knowledge and deep understanding about the process of teaching and learning as dialogic – cognitive coaching (Gallacher, 1997).

Although VSRD appears to have potential, its use has not yet been thoroughly investigated as a sustainable tool for practitioner development in the field of ICT and dialogical pedagogy. In particular, the nature of the discourse in the VSRD process may well be different when the aim is CPD rather than research.

Methodology

The Becta-funded project *Improving pedagogy with ICT*, aimed to evaluate the efficacy of VSRD as a school-based professional development tool for improving pedagogy in the use of ICT to support dialogic teaching in mathematics and science classrooms. We intended to explore a model of coaching in which the aim was to stimulate teachers' thinking about the judgements they were making in relation to their use of ICT and the extent to which it supported the process of dialogic teaching.

Teachers who were known to the researchers as being interested in developing their use of ICT to support dialogic teaching were invited to participate in the project. Eight teachers from four schools were involved as shown in Table 2.

The exploratory nature of the research led to the adoption of a mixed-methods action research design. The teachers were considered to be active co-researchers identifying their own focus for research within the context of

Table 2 The distribution of subjects and teachers across phases

<i>Subject</i>	<i>KS2</i>	<i>KS3</i>
Mathematics	2 teachers	2 teachers
Science	2 teachers	2 teachers

the project rather than subjects of the research. To this end we were attempting to develop a peer to peer relationship in which both parties were assumed to have expertise. The purposes of the VSRD episodes were both research and development. We should, more accurately, be referring to the team members as teacher-researchers and university-researchers but for the purposes of clarity we shall continue with the abbreviations teachers and researchers.

The project commenced with an initial one-day workshop for teachers and researchers during which the nature of dialogic teaching and the role of ICT in supporting it was discussed. This discussion served two purposes, firstly to begin to develop a shared understanding across the team and, second, to gather baseline data about the teachers' perceptions of their pedagogical approaches and use of ICT.

Two cycles of action research then followed. At the start of each cycle, teachers identified an aspect of dialogic teaching which they wished to develop and nominated a lesson for observation. To meet the research capacity building aims of the project, these lessons were observed by two researchers (one less and one more experienced) and contemporaneous field notes were taken using the ATLAS framework (Kennewell et al., 2008). Each lesson was digitally video-recorded and the DVD given to the teachers. Our experiences in the ITICT project had highlighted the importance of teachers having an uninterrupted period of time to review and reflect on their DVDs. In this project therefore, supply cover was paid for the teachers to come to the HE institution to watch their DVDs and to select episodes which exemplified dialogic teaching involving ICT before the VSRD took place.

Although the general focus of the observations was ICT and dialogic teaching, the teacher controlled the precise focus of the observations by selecting the initial clips of video to be discussed. The trajectory and pace of the post-observation dialogue was then largely controlled by the teachers.

During the VSRD, the observations and dialogues were facilitated by the less experienced researchers with support from the more experienced colleague when necessary. The main role of the experienced researcher was to observe the VSRD process, and to audio and video-record it for later analysis as part of the project data. The VSRD concluded with the teacher identifying a focus for further exploration or development during the second action research cycle.

At the end of the second cycle, teachers and researchers met as a group to evaluate VSRD as a tool for staff development and to develop a set of activ-

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ities for use with colleagues in their schools which would support the sharing and development of effective practice. Data from lesson observations, discussions during the meetings and the transcripts of VSRD were used to identify and analyse changes in teachers' practice.

One purpose of the VSRD was to probe teachers' explicit pedagogical thinking and their reflections on directions for their future development. In previous projects where VSRD had been used as a research tool (e.g. Kennewell et al., 20007) the researchers had acted as neutral observers whose role had been to elicit as much information as possible from the teachers with minimal interference. The intention had been to support the dialogue in order to ensure that the teachers had opportunity to talk about any required themes without giving any indication of expected answers or preferences.

In the current project, however, the nature of the researchers' role during the dialogue was an issue for debate between the researchers and, subsequently, during meetings with the teachers. The two key issues concerned how dialogic the VSRD conversation was supposed to be and to what extent we were engaged in peer coaching. The initial stance taken was that the process of watching and selecting episodes from their DVDs would lead teachers to reflect on their own practices and that the researcher would act as a neutral, non-judgemental sounding board, intervening only to seek clarification of teachers' comments. The following framework of prompts was constructed as a basis for the VSRD:

- The teacher's reasons for selecting the lesson clips
- Approaches/strategies used in the lesson and their reasons for choosing them
- Approaches considered but not used and the reasons why
- Value of ICT in the lesson or reasons why ICT was not appropriate
- Impact on pupils' learning
- Impact on the teacher's views of the role of dialogic teaching and ICT

However, as the project progressed it became clear that there were subtle differences in the character of the VSRD episodes.

Results

All of the teachers were very positive about the potential of VSRD as a professional development tool; however, they also identified a number of

caveats. These included the fact that most teachers were unused to being videoed and many felt uneasy and apprehensive about the first videoing. These fears were largely dispelled after the first cycle and although some teachers did not look forward to being videoed a second time, they all considered that value of the VSRD was worth the embarrassment. Many of the teachers described how when watching their videos they tended initially to focus on surface characteristics such as mannerisms and that they had to re-watch them in order to focus on teaching and learning issues. They distinguished between the use of VSRD as a collegial tool intended to assist professional development and the dominant mode of observation by senior management for appraisal or top-down assessment purposes. Teachers were clear that if VSRD was to be effective for professional development then it needed to be separate from any judgements of competence. They also stressed that the VSRD partners needed to be 'trusted' and that the DVD should remain the property of the teacher videoed.

A closer examination of the teachers' views of why VSRD would be a useful tool for professional development revealed two groups of purposes. For some teachers, the value of VSRD was mainly seen as a technique for staff development. For others, the focus was mostly on how it could contribute to the development of their own personal pedagogies.

Where VSRD was seen mainly as a staff development technique the teachers tended to use it to provide a commentary on their lesson. They explained the thinking behind their approaches, identified aspects which could have been improved and explained how they would do it differently next time. They often referred to the benefits of being able to show colleagues the teaching activities actually happening in their classrooms rather than having to try to describe them. Whilst they did not consider themselves to have produced 'perfect' lessons they were confident that there were sufficient aspects which modelled good practice to be of interest to colleagues and student teachers.

Teacher A: The children had a big part to play in the lesson, and they got out of it what I wanted them to. I think that was because of careful pre-thought rather than you know, hoping it would turn out OK on the day. I think a lot of students don't consider that and they are frightened if something goes slightly wrong. You know, they may rely purely on children bringing stuff in, you can't – you've got to have stuff of your own prepared. And you have to encourage pupils to talk, discuss, to contribute and not just the same people all the time, try to make sure there's a variety of the class involved.

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Teacher B: VSRD is an excellent way I think of showing them [other staff colleagues] exactly what it is about. You're showing them, not necessarily me as a teacher, but you're just showing them what goes on in that type of lesson, teaching, looking at a specific teaching style. It's an excellent way to let them have a look in and see what's happening.

When VSRD is being used for this staff development purpose, the role of the teacher is to be the coach and that of the observing colleague(s) is to learn. The nature of the dialogue during the VSRD was largely that of commentary by the teacher. The role of the researcher was mainly restricted, as initially planned, to acting to provide a neutral sounding-board to stimulate reflection and self-evaluation, asking questions only to clarify points or the teacher's thinking. There was little contingent discourse and so, in many ways, the process would be better described as VSR rather than VSRD.

When the focus was on the teacher's own personal development, the character of the VSRD was qualitatively different. The teachers sought more feedback from observers and often seemed to invite the researcher to engage in a constructive discussion.

The following extract is taken from a VSRD following a lesson where the pupils had to investigate the most likely total to be obtained when throwing two dice. The investigation was intended to help pupils realise why certain totals (e.g. two or twelve) were less likely than others (e.g. seven). The video episode started with twelve pupils being invited to the front to choose a card from a set numbered one to twelve.

Teacher C: I've possibly missed an opportunity here, looking back. When introducing the game with two dice I should have explained and given them time in pairs here to discuss which total would be best. I just asked them to come out and choose a number without really emphasising the teaching point. Whether it would have made a difference, I don't know. Possibly, looking back, I would have asked them 'Take some time, choose a total here'. I don't know, possibly I might have had a response where some would have said 'Oh yes, I want the total six. I want the total eight. I don't want the total one'.

Researcher: Yes, [pause] but maybe you wouldn't then have had that reaction when H realised that she had chosen the number one?

Teacher: No, no, no that's right. [pause] Yes, and I think at this point H did have [a choice], okay, there weren't many cards left, I think she had three to choose from but, um, you know I just thought 'Brilliant, she's just the person I needed to choose one', you know? And you can see B,

who's got number ten there, and then there were three children in the corner, they grasped it then.

Researcher: Yes, nobody had gone for the middle numbers.

Teacher: No, no and when I was discussing here, it just dawned on them. B's reaction here, he's turned round and said 'H can't win'. His hand is up and then in the corner they started to twig ...

During this episode, although when reflecting on the video the teacher thought that he had possibly missed a teaching opportunity, the query from the researcher and the subsequent discussion led him to re-consider the nature of the interactions that had occurred during the lesson. The cumulative character of this dialogue allowed both teacher and researcher to extend and develop their pooled thinking and to co-construct a deeper understanding of the valuable features of the interactions and their contribution to learning.

During such episodes, some researchers felt able to respond contingently to the teachers' reflective comments with the intention of opening a constructive, exploratory dialogue that was cumulative and reciprocal in character rather than restricting themselves to the passive role of a sounding board. When the focus of the VSRD was on personal rather than staff development, the purpose of the discourse appeared to be to co-construct an in-depth understanding of the situation so that both the observer and the teacher learned from the experience. The discourse could be characterised as dialogic rather than dialectic in character.

Discussion of the nature of dialogue between teacher and observer in VSRD

A direct parallel may be drawn between the hierarchy of interaction in whole class teaching offered earlier, and the forms of discourse that can occur for the purposes of professional development after a video-recorded lesson observation.

Monologic discourse: At the lowest level and equivalent to the lecture is a monologic, oral or written feedback. Such feedback tends to be judgemental and is often in relation to externally imposed criteria e.g. by Ofsted. This is commonly used when a supervisory model of professional development is assumed.

Funnelling: Funnelling questioning may also occur in the supervisory model, when trying to help a colleague to meet external standards, or to follow an

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approved strategy eg: a three-part lesson. The underlying assumption is that the observer knows how the lesson ought to be taught and is guiding a less knowledgeable teacher. This may also apply in a mentoring or technical coaching context.

These first two levels of discourse are dialectic rather than dialogic in character. The observer, not the teacher, is in control of the trajectory of the discourse. The teacher may choose to reflect, but the scaffolding has been rigidly constrained by the observer.

Probing: Probing questioning may occur in most models of professional development. Its purpose is to elicit information from the teacher in order to expose their current thinking. A discourse based on probing questioning might not be fully dialogic, as although the questioning might be contingent, the observer might intend to play a neutral role. An external frame of reference may exist, however, it is not necessary as the observer aims to be non-judgemental and often non-committal. When VSRD is used as a research tool, observers often take this position in order to reduce their impact on the process. In particular, although probing questioning may cause some teachers to pause and reflect, the observer might attempt to avoid scaffolding the development of new knowledge. In this case, the process might be better defined as VSR than VSRD.

Focusing dialogue: The discourse takes on a dialogic character at this next level, when focusing or uptake questioning is common. The teacher takes some control over the trajectory of the dialogue by focusing attention on particular episodes in the video. Observers may take up aspects of the teacher's analysis of the lesson to probe more deeply, contingent on the observer's analysis of the episode. In this context, the observer is attempting to scaffold pedagogical development. This does not, however, imply the existence of pre-existing criteria or models for effective teaching. Any scaffolding is loose and exploratory offering the possibility of the co-construction of knowledge through a form of cognitive coaching.

Creating a dialogic space for reflection: The VSRD equivalent to collective reflection occurs when the teacher and the observer act as co-researchers exploring a pedagogical issue together. Both feel free to focus attention on episodes, ask open questions and propose speculative analyses. The scaffolding is mutual and reflective. The ground rules assume that the pedagogical knowledge sought is not held by either participant, but will be

co-constructed through dialogue and reflection as both participants seek to develop new understandings. The aim is to create a dialogic space for reflection (cf. Wegerif, 2008) in which explicit pedagogical knowledge is generated by both participants, for example, by identifying general principles about the affordances of ICT for dialogic teaching which could be articulated and applied in other contexts. In this model of peer-coaching, either the teacher or the observer could be regarded as the coach.

The intention of the project was to examine the potential of VSRD as a tool for professional development rather than to judge the lessons against a pre-determined model of good practice. The researcher's role was not intended to be supervisory nor that of an external inspector but to support a reflective dialogue between professional colleagues. Initially, the role was envisaged as providing a relatively passive sounding board for the teachers as they tried to articulate or formulate ideas. This level of interaction appeared to be satisfactory where the main purpose of the VSRD process was perceived to be the development of other staff.

However, as the project proceeded it became clear that teachers considered that this non-participative role was not necessarily the best model if the purpose of the VSRD was to support teachers' personal professional development. For this purpose, the VSRD process became more dialogic in character with both teachers and researchers assuming the roles of partners in the dialogue. Although the partner in dialogue does not need to be more expert in the area of focus, dialogue is a contingent process which requires both partners to recognise the ephemeral affordances of the moment to support the development of new knowledge. Thus, for example, each partner had to be able to recognise opportunities to open issues for discussion without appearing to be judgemental. Scaffolding during these dialogues was mutual and reflective and both partners expected to learn from VSRD process.

Conclusion

This analysis has arisen from the results of a small-scale study and so any generalisations must be limited, however, there appears to be an interesting contrast between the types of dialogue that were associated with the two distinct purposes which were identified for the use of VSRD.

Where the purpose was to develop other staff, the process was more akin to a VSR in which the teacher provided an explanation of the key features

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of the lesson in order to make these explicit to other, less experienced colleagues. The VSRD discourse remained at the lower levels on the interaction scale. This could be regarded as a dialectic, scaffolded discourse which encourages teachers to develop pedagogical approaches that fit an external model. The VSRD process could be considered to have similarities with technical coaching.

Research evidence indicates the value of dialogic pedagogies for the development of higher-order thinking and concepts by pupils. Similarly, when teachers were seeking to develop their own understanding of dialogic pedagogy they tended to generate a dialogue with their VSRD partner that was contingent, reciprocal and cumulative. Both parties were involved in the analysis of the lesson, reflection on the selected episodes and the creation of new knowledge – a form of cognitive coaching. The discourse involved the higher levels on the interaction scale and often developed the characteristics of a dialogic space for reflection.

The development of a more dialogic pedagogy using ICT involves generating deeper levels of interaction and greater pupil control. This represents a complex change for many teachers. Complex changes to pedagogy require an in-depth understanding of the processes involved and not just a pattern to follow. The research discussed here suggests that VSRD in its more dialogic form may provide a vehicle for teachers and colleagues to work together to position themselves at the dialogic end of the continuum, aiming to co-construct the explicit pedagogical knowledge and principled understanding necessary for the change towards more dialogic teaching approaches.

References

- Alexander, R. (2005). *Towards Dialogic Teaching: Rethinking Classroom Talk*, York, Diálogos.
- Becta (2003). *What Research Says About Interactive White Boards*, at: http://partners.becta.org.uk/upload-dir/downloads/page_documents/research/wtrs_whiteboards.pdf (accessed 16.10.08).
- Fullan, M. (1993). *Change Forces: Probing the Depths of Educational Reform*, London, Falmer Press.
- Gallacher, K. (1997). 'Supervision, mentoring and coaching', in P. Winton, J. McCollum and C. Catlett, *Reforming Personnel Preparation in Early Intervention: Issues, Models and Practical Strategies*, Baltimore, Brookes, pp. 191–214.
- Garmston, R. J. (1987). 'How administrators support peer coaching', *Educational Leadership*, 44, 18–26.

- Joyce, B. and Showers, B. (1996). 'The evolution of peer coaching', *Educational Leadership*, 53, 6, 12–16.
- Kennewell, S., Beauchamp, G., Jones, S., Meiring, L., Morgan, A., Norman, N., Parkinson, J., Tanner, H. and Thomas, D. G. (2007). *The Use of ICT to Improve Learning and Attainment Through Interactive Teaching: Final Report to ESRC (expanded)*, Swansea, Swansea Metropolitan University, at: <http://www.interactive-teaching.org.uk/ITICT%20Final%20report%20expanded.pdf> (accessed 16.10.08).
- Kennewell, S., Tanner, H., Jones, S. and Beauchamp, G. (2008). 'Analysing the use of interactive technology to implement interactive teaching', *Journal of Computer Assisted Learning*, 24, 1, 61–73.
- Lyle, J. (2003). 'Stimulated recall: a report on its use in naturalistic research', *British Educational Research Journal*, 29, 6, 861–78.
- Mercer, N., Littleton, K. and Wegerif, R. (2004). 'Methods for studying the processes of interaction and collaborative activity in computer-based educational activities', *Technology, Pedagogy and Education*, 13, 2, 195–212.
- Moss, G., Jewitt, C., Levaic, R., Armstrong, V., Cardini, A. and Castle, F. (2007). *The Interactive Whiteboards, Pedagogy and Pupil Performance Evaluation: An Evaluation of the Schools Whiteboard Expansion (SWE) Project, London challenge*, London, Institute of Education.
- Moyles, J., Adams, S. and Musgrove, A. (2002). 'Using reflective dialogues as a tool for engaging with challenges of defining effective pedagogy', *Early Childhood Development and Care*, 172, 463–78.
- Moyles, J., Hargreaves, L., Merry, R. (2003a). 'Digging even deeper into meanings', in J. Moyles, L. Hargreaves, R. Merry, F. Paterson, and V. Esarte-Sarries (eds), *Interactive Teaching in the Primary School: Digging Deeper into Meanings*, Maidenhead, Open University Press, pp. 171–91.
- Moyles, J., Paterson, F. and Kitson, N. (2003b). 'It wasn't as bad as I thought', in J. Moyles, L. Hargreaves, R., Merry, F., Paterson and V. Esarte-Sarries (eds), *Interactive Teaching in the Primary School: Digging Deeper into Meanings*, Maidenhead, Open University Press, pp. 141–54.
- Mroz, M., Smith, F. and Hardman, F. (2000). 'The discourse of the literacy hour', *Cambridge Journal of Education*, 30, 379–390.
- Nystrand, M., Wu, L. L., Gamoran, A., Zeiser, S. and Long, D. A. (2003). 'Questions in time: investigating the structure and dynamics of unfolding classroom discourse', *Discourse Processes*, 35, 2, 135–98.
- Shayer, M. and Adhami, M. (2007). 'Fostering cognitive development through the context of mathematics: results of the CAME project', *Educational Studies in Mathematics*, 64, 265–91.
- Sinclair, J. and Coulter, M. (1975). *Towards an Analysis of Discourse*, Oxford, Oxford University Press.
- Smith, H., Higgins, S., Wall, K. and Miller, J. (2005). 'Interactive whiteboards: boon or bandwagon? A critical review of the literature', *Journal of Computer Assisted Learning*, 21, 91–101.

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- Smith, F., Hardman, F. and Higgins, S. (2006). 'The impact of interactive whiteboards on teacher-student interaction in the national literacy and numeracy strategies', *British Educational Research Journal*, 32, 437–51.
- Tanner, H., Jones, S., Kennewell, S. and Beauchamp, G. (2005). 'Interactive whiteboards and pedagogies of whole class teaching', in *proceedings of MERGA 28, Mathematics Education Research Group of Australasia Conference*, Melbourne, July 2005, at: <http://www.merga.net.au/documents/RP832005.pdf> (accessed: 16.10.08).
- Wegerif, R. (2008). 'Dialogic or dialectic? The significance of ontological assumptions in research on educational dialogue', *British Educational Research Journal*, 34, 3, 347–61.