

Interactive Whole Class Teaching and Interactive White Boards

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In England and Wales, National Strategies promote pedagogies that emphasise interactive whole class teaching, although this is not defined precisely. In recent years major investment has been made in Interactive White Boards (IWB) and, whilst they do not determine pedagogy, as cultural tools they tend to support and encourage whole class teaching. This paper discusses the nature of interactive teaching and suggests that deep rather than surface features of interaction must be addressed if learning is to be improved.

The zeitgeist in Britain and much of the Western world towards the turn of the twentieth century focused on standards of numeracy and literacy in our schools. Concerns over standards and the perceived underperformance of England in comparison with other countries, particularly in basic skills at the primary level, led to the creation of the National Numeracy Project (Straker 1997). Such was the political enthusiasm for the interim results that it formed the basis of the National Numeracy Strategy (NNS) (DfEE 1999). A pilot to extend the work of the NNS into secondary schools began the following year and, without waiting for the results, the DfEE demanded that all schools use the new Strategy for teaching mathematics with eleven to fourteen year old pupils from 2001 (DfEE, 2001).

Although the official status of the Strategies was “guidance”, in England, and to a lesser extent Wales, they were not regarded as optional (Jones & Tanner, 2002). The Strategies contained detailed prescriptive guidance from the level of individual lessons to whole-school planning. Lessons were intended to follow a standard format of three phases incorporating a mental/oral starter, a main teaching activity and a plenary. The emphasis in all three of these phases was to be placed on “direct teaching and questioning of the whole class...” (DfEE 1999, p. 1.11). For primary teachers the insistence on a high proportion of whole-class teaching was “probably the most radical proposal in the Numeracy Strategy” (Brown et al 1998, p. 370). For secondary teachers the proposals appeared less controversial. However, the teaching style being encouraged was not intended to represent a return to traditional approaches. Rather, the approach was intended to be highly interactive.

High-quality direct teaching is oral, interactive and lively. It is not achieved by adopting a simplistic formula of ‘drill and practice’ and lecturing the class, or by expecting pupils to teach themselves from books. It is a two-way process in which pupils are expected to play an active part by answering questions, contributing points to discussions, and explaining and demonstrating their methods to the class. (DfEE 2001, p. 1.26)

Although the tone of this advice indicated far more than a return to traditional approaches, the nature of interactive whole class teaching was not clearly defined. Moreover, tensions and contradictions were inherent in the guidance that many teachers found confusing (Mroz et al 2000, English et al 2002). Obvious tensions exist between:

- the emphasis on maintaining a brisk pace, and allowing pupils time to think through their answers;

- the emphasis on the need to build on pupils' methods, and the need to meet specific teaching objectives;
- the emphasis on rapid recall of facts, and using pupil errors constructively;
- time for personal reflection on what has been learnt, and fast, lively interactive teaching. (summarised from DfEE 1999, p. 1.11-15)

Interpretations of Interactive Whole Class Teaching

Although the introduction of the National Strategies in England was accompanied by significant training, the tensions inherent in the approaches, and the lack of a clear definition of the nature of interactive teaching, left room for wide variations in interpretation and practice. For many teachers, it was the superficial features of the three part lesson that assumed priority, for example, the use of quick fire mental arithmetic tests as lesson starters or the use of mini-white boards, which pupils use to respond to short oral questions as a whole class (Hargreaves et al, 2003, p. 224). The exhortation to emphasise direct teaching and questioning could easily be read as an encouragement to return to traditional styles of didactic teaching. Pronouncements from politicians in the popular press could easily be read as supporting this position.

For many years, systematic observation of traditional classroom discourse has revealed it to be heavily dominated by teacher talk and that the largest proportion of this talk consisted of teachers making statements (Flanders, 1970; Galton et al, 1999). Even when questioning pupils, teachers tended to dominate the discourse.

Traditional classroom discourse follows a triadic structure: *initiation – response – feedback* (Tharp & Gallimore, 1988). Such exchanges are usually based around closed questions with little opportunity for pupils to engage in extended responses or to express and evaluate ideas of their own. Rather pupils are most usually required to recall facts or return the unique response anticipated by the teacher. Such exchanges are often occasions in which pupils are assessed or held accountable rather than given opportunities to speculate or to contribute ideas (Galton et al 1999). Traditional classroom discourse could be described as a one-way communication system in which, for most of the time, teachers talk and pupils listen (Galton et al 1999, p. 34), and where pupils' contributions are restricted in terms of both length and quality.

In contrast, the Strategies were intended to encourage a form of whole class teaching that was highly interactive with the intention of promoting higher quality dialogue, discussion and strategic thinking. This would have required many teachers to modify significantly their traditional triadic style of classroom discourse in response to externally imposed guidance. It is unsurprising that this aim has not been realised (Kyriacou & Goulding, 2004). The more complex a change, the less it can be forced. (Fullan, 1993, p. 22).

In fact there is evidence that interactive teaching has largely been implemented as pupil participation in fast, teacher-led question and answer sessions (Moyle et al, 2003; Hargreaves et al, 2003). An emphasis on "traditional" whole class teaching and demands for pace may be undermining the development of a more reflective and strategic approach to thinking (Kyriacou & Goulding, 2004).

Although the frequency of questioning has increased, it largely continues to follow the traditional triadic recitation script (Galton et al, 1999; Moyle et al, 2003; Hargreaves et al, 2003; Smith et al, 2004). Most pupil responses remain very short, with an average length of five seconds and involving three or fewer words in 70% of cases (Smith et al, 2004, p. 408). Teachers tend to evaluate rather than extend or build on pupils' responses to

questions (Mroz et al, 2000). Sustained interactions with individuals and pupil utterances of more than ten words are extremely rare (Burns & Myhill 2004, p. 44; Hargreaves et al 2003, p. 233).

Similarly, the possibility of using questioning or dialogue to scaffold pupils' learning is underexploited with the majority of questions being of a low cognitive level, designed to funnel responses towards a required answer, with only 25% of questions designed to encourage pupils to think more deeply about their ideas (Smith et al, 2004, p. 408; Burns & Myhill, 2004, p. 46).

The failure of the Strategies to define or explain the nature and purposes of interactive teaching in any depth was always likely to result in superficial change. The training materials associated with the Strategies focused on superficial features such as lesson structure. The majority of the video-extracts associated with the NNS featured questioning that demanded instantaneous or very rapid responses from pupils recalling prescribed number facts, rather than high quality dialogue, discussion and strategic thinking.

The development of high quality interactive teaching is 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. These things cannot be mandated. Rather the danger is that a false clarity may be presented and superficial goals generated if the more difficult aspects of an innovation are avoided (Fullan, 1993, p. 22-23).

Teachers' conceptualisations of the nature of interactive teaching have indeed tended to focus on the more visible "surface features" of the pedagogy, such as the use of mini-white boards, pupil engagement or inviting children out to the board (Hargreaves et al 2003, p. 224). "Deeper features" including formative assessment; the co-construction of meaning through dialogue; and the development of thinking and learning skills tend to be less well developed (Hargreaves et al, 2003; Moyles et al, 2003).

The impact of the Strategies on standards of attainment is contentious. Although there have been gains in national test scores, external evaluations suggest that such gains are a result of "a closer match between what is being taught and what is being tested" or teaching to the test, rather than improved learning and understanding (Brown et al, 2003; Kyriacou & Goulding, 2004). Although improvements in low level skills such as recall of basic arithmetic facts are reported (Ofsted, 2004, p. 23) doubts have been expressed about the depth of pupils' conceptual understanding (Barnes et al, 2003). Indeed there is evidence to suggest that the superficial forms of interaction associated with traditional whole class teaching and the demands for a fast pace to lessons may be encouraging pupils to participate in activities rather than engage with mathematical thinking, undermining the development of a more reflective approach to learning and the ability of pupils to think strategically (Denvir & Askew, 2001; Bibby et al, 2003; Kyriacou & Goulding, 2004).

Superficial or Deep Interactivity?

We take a socio-constructivist approach to interaction, in which pupils construct new knowledge that they validate within the social context of the classroom (Jones & Tanner, 2002). If learning is to occur, then there must be a degree of interaction between the learner and the teaching context. However, for this interaction to be more than superficial, learners must engage with the teaching in some meaningful manner, bringing something of themselves to the exchange and not merely acting as passive recipients of preformed information. We conceive of interactivity as demanding a degree of active participation by learners who contribute to the development of collective understanding.

We conceptualise interactivity in whole class teaching on a continuum according to the degree of teacher / pupil control, the nature of the interaction and the character of the scaffolding provided through the dialogue (see Figure 1).

Nature of the Interaction	Control
Lecture <i>No interactivity or only internal interactivity</i>	High degree of teacher control
Low level / funnelling questioning <i>Rigid scaffolding & surface interactivity</i>	
Probing questioning <i>Looser scaffolding and deeper interactivity</i>	
Focusing or uptake questioning <i>Dynamic scaffolding and deep interactivity</i>	
Collective reflection <i>Reflective scaffolding and full interaction</i>	High degree of pupil control

Figure 1. Interaction in whole class teaching.

The form of whole class teaching with the lowest level of interaction is the *lecture*. In lectures, there may be no interaction between the cognitive processes of the pupil and the teaching. Any interaction is internal and although under the control of the pupil, does not influence the development of the lesson, which remains under the control of the teacher. Scaffolding is restricted to the selective use by the teacher of metaphors, allegories, and diagrams, etc which are intended to contact and support pupils' cognitive processes.

The scaffolding metaphor is often used to describe the intervention of an adult or a more competent peer in the learning process to act "as a vicarious form of consciousness until such time as the learner is able to master his own action through his own consciousness and control" (Bruner, 1985, p. 24-25). However, the construct is ill-defined, with one person's scaffolding being another's Socratic questioning. Indeed, in some respects the metaphor is unfortunate in suggesting a rigid, pre-determined framework within which knowledge must be constructed.

The second level in our hierarchy of interaction incorporates a rigid form of scaffolding based on simple, low-level, *funnelling*, questioning (Bauersfeld, 1988). In funnelling, it is the teacher, who selects the thinking strategies and controls the decision making process to lead the discourse to a predetermined solution. Research suggests that this is the most common form of interaction, with most teachers' questions demanding short, factual responses of a relatively low cognitive level, designed to funnel pupils' responses towards a required answer (Burns & Myhill, 2004; Smith et al, 2004).

The third level in our hierarchy is based on a looser form of scaffolding in which an individual pupil's contribution to the interaction is given greater prominence as the teacher

extends and sustains the dialogue through *probing* questions that deepen the evaluative function within the triadic structure, allowing for formative assessment decisions to be made by both pupils and teachers. Through their more sustained involvement in formative assessment, pupils begin to gain some degree of control over the interaction, albeit within a loose funnelling structure orchestrated by the teacher. Although formative assessment based on such rich questioning is linked to improved performance (Black & Wiliam, 1998) probing questioning is infrequent in English classrooms (11%) (Smith et al, 2004, p. 408).

In contrast to the rigid scaffolding provided by funnelling questions, the next level in our hierarchy is based on a more dynamic form of scaffolding in which pupils and teachers interact more collaboratively in the co-construction of knowledge (Tanner & Jones, 2000a). The aim is to develop a discourse around a problematic in which differences in perspective are welcomed and encouraged. The most significant participant in the discourse is the teacher, who validates conjectures and uses *focusing* questions to control its general direction. Focusing questions draw the attention of the class to aspects of pupils' contributions that are important. For example, attention might be drawn to strategies, explanations, helpful insights or features of the problem that are not yet understood. The class then evaluate strategies and explanations, resolve collectively any perturbations that have been created, or take up new ideas and develop them further (Wood, 1994, p. 160).

Such scaffolding is flexible and unpredictable, demanding a high level of skill and confidence from teachers who must think on their feet in response to conjectures, strategies and explanations suggested by pupils, taking up their ideas and incorporating them into the discourse. Such strategies and explanations may then become the object of the discourse, facilitating the development of mathematical thinking (Tanner & Jones, 2000b).

Although the National Strategies encourage discussion of pupils' own methods, recent research suggests that uptake questioning, in which a pupil's response is incorporated into the ongoing discourse, is uncommon, occurring in less than 5% of exchanges, with nearly half (43%) of teachers never using the strategy (Smith et al, 2004, p. 408).

The highest level in our hierarchy is based on *collective reflection* (Cobb et al, 1997; Tanner, 1997). The focus of this form of interaction is on evaluation and reflection. It usually occurs when teachers deliberately generate a reflective discourse after activities to encourage self-evaluation and reflection on process. Several different activities support our purposes for collective reflection and may be used to generate a reflective discourse, including for example: peer and self-assessment; pupils writing their own revision notes; pupils writing their own examination questions; pupils acting as rapporteurs etc., (see Tanner & Jones, 2003 for a fuller discussion). The significant feature which such activities have in common is that they provide the social conditions to encourage pupils to engage in reflection and self-evaluation. Collective reflection is not the same as reflected abstraction, but during collective reflection teachers may orchestrate opportunities for pupils to reflect on, formalise and objectify their previous actions.

Plenaries were introduced as a significant feature of the Strategies, but the nature and purposes of such sessions was not elaborated, rather a disparate list of possible activities was offered, including setting homework, making links to other work and setting targets, alongside more obviously reflective activities linked to formative assessment or designed to summarise and formalise knowledge. It is perhaps unsurprising that for the last three years the plenary session has been identified by school inspectors as the weakest part of the lesson: it is sometimes omitted, and teachers fail to use it to assess pupils' understanding or to diagnose and resolve their difficulties or misconceptions (Ofsted, 2004).

There is considerable evidence to suggest that a move towards pedagogies involving full interaction, collective reflection and the development of consensual knowledge would lead to improved learning and attainment (Cobb et al, 1997; Tanner, 1997; Black & Wiliam, 1998; Tanner & Jones, 2000a; Tanner & Jones, 2003). However, imposed external guidance is leading teachers to focus on superficial features of interactive teaching such as pace and structure rather than deeper aspects of the pedagogy. Unfortunately, the introduction of new technology may be imposing similar pressures.

Interactive White Boards

Interactivity has long been regarded as a key affordance of ICT that teachers and learners should exploit in support of effective learning. Interactivity was defined as “as the function of ICT which enables rapid and dynamic feedback and response” (DfEE, 1998, p. 11). Many case studies demonstrate that pupils are able to use ICT to sustain two-way communication with learning resources and environments in support of learning (Kennewell et al, 2000). With the development of interactive presentational tools such as interactive white boards (IWBs), it might be expected that such affordances could be exploited to support teachers in their development of interactive whole class teaching approaches.

In recent years there has been large-scale investment in IWB technology in England and Wales. In 2003 the Welsh Assembly invested in one IWB for every primary school and three for each secondary school and the pedagogical practices of many teachers are now being influenced by the introduction of the technology (Kennewell & Beauchamp, 2003).

IWBs do not determine pedagogy by themselves. Clearly the level of interaction generated depends on the use to which they are put and in particular on the teacher’s ability to orchestrate the affordances and constraints of the context. Teachers vary considerably in their confidence and competence with technology and this influences practices, however, as cultural tools IWBs seem to support and encourage whole-class, direct teaching with the teacher at the centre of the action. Certainly, there is evidence to suggest that there is an expectation of “proper use” that influences teachers to shift their pedagogy in the direction of whole class direct teaching (Beauchamp, 2004; Kennewell & Beauchamp, 2003).

Of course, teachers of mathematics in secondary schools have long been familiar with the use of black/whiteboards. The extent to which their use of these tools could be described as interactive depended largely on teachers’ pedagogical practices. For pupils in traditional whole class teaching contexts, interactivity with the knowledge and resources on the board has always been mediated by the teacher and, as we have seen above, for many teachers interaction has been largely limited to low level questioning. The introduction of new technology would not in itself be likely to move teachers towards a more interactive pedagogy. In fact experience suggests that during the early stages, technology is assimilated into existing pedagogy with only superficial changes in practice (Kennewell et al, 2000).

The IWB does 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. Access to the technology is controlled and mediated by the teacher. In the early stages of use, the IWB is treated typically as a black/whiteboard substitute and serves to reinforce traditional pedagogies as teachers pass through a period of de-skilling and technological vulnerability. During this period interaction is often reduced as teachers restrict the use of the board to themselves, sometimes expressing concern that pupils might

put the board into a state that they would not be able to undo due to technical ignorance (Beauchamp, 2004).

The use of presentational software such as PowerPoint is common in the early stages of IWB use and this may also restrict interactivity. There is a significant overhead involved in developing new teaching resources for use with the IWB. One solution is to buy expensive commercially produced resources that are difficult to evaluate in advance or to download from the internet. However, teachers may then find themselves de-professionalised as their role is reduced to a technical one of delivering someone else's PowerPoint presentation. Even when resources are devised collaboratively by teams of teachers with a common goal, their use in the context of presentational software may push some teachers towards low level questioning, rigid scaffolding and surface interactivity as they find themselves locked in to a pre-determined presentation (Kennewell & Beauchamp, 2003; Beauchamp, 2004).

Research to date suggests that teachers and pupils value the surface features of the IWB associated with pace, motivation, engagement, involvement, participation and collaboration (BECTA, 2003). However, it is not clear that attention to such surface features of interaction will result in improvements in learning and attainment.

Reports of increased motivation and attention, following the introduction of ICT, have a long history and tend to be transitory as novelty wears off. Increased momentum in lessons, due to the pre-organisation of teaching materials and swift changing of screens rather than hand writing on a board is likely to be more permanent, and offers the potential for more sustained engagement, during which more substantial interaction might prove possible. However, this is unlikely to occur without a root and branch pedagogical change by teachers from surface to deep interaction in their non-ICT based teaching styles. Although the IWB has affordances to support interactive teaching, offering the opportunity for pupils to be allowed to explore their own ideas and share them with the class in a reflective discourse, such affordances are mediated by teachers. It may be the case that teachers must have made the transition from traditional to more interactive pedagogies in a non-ICT context before being able to recognise the affordances offered by the IWB.

Further research is needed into the relationship between the IWB as a tool and teachers' interpretations of the pedagogy of interactive whole class teaching. The full potential of interactive whole class teaching and the IWB may only be realised when the deeper features of interaction are addressed directly by the profession.

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