Primary teachers’ understanding of the interactive whiteboard as a tool for children’s collaborative learning and knowledge-building

Paul Warwick and Ruth Kershner
University of Cambridge Faculty of Education

Summary

This paper reports on the second phase of a joint teacher/researcher project that explored teachers’ understandings of the potential of the Interactive Whiteboard (IWB) as a tool for primary school children’s collaborative group work. Using teachers’ written analyses and discussions of work carried out in their own classrooms, links are made between the teachers views of learning and their perspectives on the place of the IWB in such work. The analysis focuses the interrelationships between such features as the collaborative learning process itself, the children’s technical skills and confidence, the mediating role of the teacher, the physical placement of IWB, the IWB affordances for knowledge building, motivational aspects of the learning process, the place of the IWB in the evolving classroom tool systems, and teachers’ knowledge, attitudes and professional development. Conclusions focus on the considerations that might inform a more effective use of the IWB for collaborative group work.
Primary teachers’ understanding of the interactive whiteboard as a tool for children’s collaborative learning and knowledge-building

Introduction

In recent years UK schools have seen the extensive introduction of interactive whiteboards (IWBs) into classrooms, encouraged by policy initiatives and substantial financial resource (Moss, Jewitt, Levačić, Armstrong, Cardini, and Castle, 2007; Higgins, Falzon, Hall, Moseley, Smith, Smith & Wall, 2005). The considerable financial, and psychological, investment in IWBs means that they are unlikely to be removed in the near future. In many primary and secondary schools they have already replaced other classroom equipment such as ‘ordinary’ whiteboards and they are in daily use by teachers and pupils. The research presented in this paper focuses on primary teachers’ beliefs about how best to use IWBs to support pupils’ learning, particularly through collaborative group activities.

The research evidence on educational gains from IWB use is mixed. It seems clear that many teachers have found IWBs to be an important and highly motivating teaching resource (Smith, 2000; Smith, 2001; Becta, 2004; Rudd, 2007). IWBs are seen to have certain distinctive features, such as the facilitation of opportunities to employ the multimodal dimensions of language, image, sound and gesture known to be important for communication and learning (Kress, Jewitt, Ogborn & Tsatsarelis, 2001; Scott & Jewitt, 2003). Certain studies have indicated some positive developments in whole-class teacher-led sessions, including teachers’ engagement with surface features of interactive teaching (Higgins et al., 2005; Smith, Hardman and Higgins, 2006; Esarte-Sarries and Paterson, 2003). The recent Evaluation of the Primary Schools Whiteboard Expansion Project for the Department for Education and Skills goes so far as to state that, where teachers have embedded the use of the IWB in their pedagogy, it is a ‘major factor that leads to attainment gains’ in literacy and numeracy (Somekh, Haldane, Jones, Lewin, Steadman, Scrimshaw, Sing, Bird, Cummings, Downing, Harber Stuart, Jarvis, Mavers & Woodrow, 2007, p.6).

However, research has also indicated less positive effects on the quality of both pupil engagement and pupil response. Smith et al. (2006) have suggested that IWBs may reinforce established styles of whole-class teaching unproductively, rather than promoting new, innovative teaching approaches. As has been the experience with other uses of technology in classrooms, IWBs are often made to fit pre-existing instructional practices (Nordkvelle & Olsen, 2005) and, importantly, the children may also feel this. For instance, one finding from Higgins, Wall and Smith (2005) suggests that although pupils see the IWB as motivating they do not feel that they have sufficient opportunity to use it themselves.

The history of technology-led initiatives in education has demonstrated that the use of new technologies has often not been accompanied by an adequate understanding of what their take-up might imply for pedagogy (Dawes, 2000; Granger & Morbey, 2002; Hennessy, 2006; Wellington, 2005). This is a continuing concern with respect to current
developments in IWB use. IWBs were not initially developed as ‘a response to a pedagogical imperative’ (Laurillard, 2004, p.27). This may help to explain the response of many teachers to the introduction of IWBs as primarily a tool to enhance the familiar types of teacher-pupil interaction already in use. Up to this point the focus of both professional development and research on IWB use has been mainly on teacher-led exposition and interactive whole-class teaching (Condie, Munro, Seagraves and Kenessson, 2007). Yet whilst such teacher-centred approaches are commonly used in primary schools, many primary teachers also wish to foster alternative types of ‘…active, self-regulated and collaborative learning’ (Hennessy, 2006, p.7). As Mortimer and Scott (2003, p.3) remark, pupil-pupil interactions and talk are ‘…central to the meaning making process and thus central to learning’. It has been demonstrated that computer-based guided collaboration enhances pupils’ learning of science and mathematics (Mercer, Dawes, Wegerif & Sams, 2004; Mercer & Sams, 2006). There is also a clear policy commitment in the UK (DfES, 2004) to the development of collaborative classroom learning environments.

Children’s collaborative use of the IWB for learning does not imply that the teacher is absent from this process. Much previous research on computer use in the classroom has pointed to the link between the teacher’s role in supporting children’s learning, the interactive ways in which knowledge is developed and represented, and the children’s involvement in collaborative classroom practices which emphasize shared cognition and a re-working of pupils’ own ideas (Wegerif, Mercer & Dawes, 1998; Wegerif and Dawes, 2004; Hennessy, Deaney, Ruthven, Winterbottom, 2007). As Rudd (2007, p.6) argues, ‘… central issue appears to be how ‘teachers become critical agents in mediating the technology to provide a more dynamic, interactive and appropriate learning experience’. Teachers’ own thinking about learning is of fundamental importance in their mediation of pupils’ collaborative learning experiences involving the IWB.

We explored theoretical and practical perspectives on learning with the teachers involved in the research reported here. As a project team we considered social constructivism in terms of the role of social interaction and communication during joint, purposeful activity in which knowledge is both used and created (Wertsch and Tulviste, 1998). This involved discussion of the ways in which children’s classroom learning is mediated by their interaction with more expert peers or adults, employing material tools such as computers and symbolic tools such as language (Mercer and Wegerif, 1999; Säljö, 1999; Wertsch, 2007). In the classroom, just how the teacher mediates tool use for learning depends on many factors (Cogill, 2003; Hennessy 2006), not the least being the perceived ‘affordances’ of the tool for the activity in question; in other words, what it is seen to offer to the people involved (teachers and pupils) in relation to their immediate and longer-term intentions, desires and beliefs. The apparent affordances of a new tool only work as such if they are perceived in this way by those using, and it will be clear that the affordances perceived relate directly to pedagogic understandings and intentions (John & Sutherland, 2005). This is important in seeing how effective mediation might encourage ‘deep’ interactivity and learning in the classroom (Moss et al., 2007), rather than potentially less productive types of teacher-pupil engagement.
The research project: an approach to professional learning

This project was instituted as part of a continuing joint research initiative between the University of Cambridge Faculty of Education and Cambridgeshire Local Authority (LA) ICT Support and Advisory Service. Seven primary teachers in four schools participated in a ‘guided research group’. In effect this comprised the initial reconnaissance and reflection stages of an action research cycle, with its associated implications for knowledge-building and educational change (Selwood and Twining, 2005; Noffke and Somekh, 2005). The project, which was carried out in two phases over 18 months, was designed to involve the teachers, the LA representatives and the Faculty researchers in layers of reflective interaction and analysis (Pollard, 2005; Warwick, 2007). To support this process, the teachers enrolled in a Faculty of Education course of study allowing accreditation at certificate level for their research involvement.

We report below on Phase 2 of the project. Phase 1, involving the same teachers, had focused on children’s learning in teacher-led whole class sessions (Kershner and Warwick, 2006). During Phase 1 ideas relating to different psychological and social constructivist models of how children learn had been explored with the research group. Consideration had also been given to the intrinsic problems of evaluating IWB use in terms of children’s learning outcomes, given the view that primary classroom learning is too complex to allow the simple measurement of learning outcomes as the only evidence of impact (Black, Wiliam, Harrison, Lee, & Marshall, 2002). To avoid making unsupported claims about direct learning gains from IWB use, both phases of the project focused on gathering evidence about the apparent relationship of IWB use to processes that are known to be strongly associated with children’s learning and knowledge building, such as certain types of talk and collaboration taking place over time (Mercer & Littleton, 2007; Wegerif & Dawes, 2004).

The theoretical discussions with the teachers extended during Phase 2 to include consideration of collaborative group work structures (cf. Dunne and Bennett, 1990), the analysis of classroom talk and its association with knowledge building over time (cf. Mercer, 2000; Dawes, 2004), and an examination of social and cognitive aspects of collaborative learning (Wegerif and Dawes, 2004; Kutnick and Manson, 2000). We also reflected on work related to the analysis of interactions and learning episodes to provide evidence of collaborative knowledge building over time. The process of working together is represented diagrammatically in Appendix 3.

In Phase 2 the teachers developed group tasks, as relevant to their particular class and curriculum planning (see Appendix 1). The research questions intended to guide the teachers’ individual projects, were agreed as:

How do pupils use the IWB when working in collaborative groups?
Is there anything distinctive about the ways in which the children talk to and interact with each other?
How does the IWB appear to support learning – specifically knowledge building – in collaborative group contexts?

A bank of data collection activities was developed with the teacher group, from which they selected approaches most relevant to their own projects. These included observations (recorded with diary notes, task flow diagrams based on examples presented in Appendix 2, video and still photographs) and assessment of the pupils’ work and learning outcomes. The teachers also completed a short reflective overview at the end of the project.

Our interest in the teachers’ understandings of the IWB as a tool to help children build knowledge through collaborative learning brought us to the following research questions, which are the focus of this paper:

a) In their analyses of children’s IWB-related interactions whilst working in collaborative groups, what do teachers seem to be saying that they understand and value about learning in the primary classroom?

b) How do these beliefs about learning connect with the teachers’ developing understanding of the distinctive uses of IWB for primary children’s collaborative learning and knowledge-building (in combination with other classroom tools)?

Our main sources of evidence are the teachers’ final individual written reflective overviews. Perhaps these writings are best viewed as part of an 18 month dialogue within and beyond the group involved, anchored in the teachers’ professional interest and concern about effective IWB use. These overviews were written after the final group meeting, in which the teachers shared initial findings and interpretations from their own projects. The teachers’ writing was coded and analysed for emerging themes (managed using NVivo, see Appendix 4). These themes were then further analysed to deepen understanding of the teachers’ embedded assumptions and propositions about how collaborative IWB use might support children’s learning in the primary classroom context. The teachers’ views about key factors in this process were extracted, together with their understanding of the interaction of these factors in practice.

Research findings: Primary teachers’ understanding of the IWB as a tool for children’s collaborative learning

What teachers say they understand and value about learning in the primary classroom.

Two examples of teachers’ extended writing about classroom learning are given below. Wendy focuses here on pupil/pupil relationships in groups and Gordon concentrates on the quality of the children’s talk:

The IWB used by a group of pupils to engage in tasks offers the opportunity to share ideas although the balance of talk varies according to group dynamics, numbers and gender. I have seen instances of segregation where one member is
left out or a passive child may be overlooked or a whole group dominated by one individual. Sometimes current friendships come into play and can impact on the effectiveness of the collaborative nature of the task. Group dominance is common and this may be done by taking control of the board physically, by ensuring no one else can use the tools; or by talking over other group members, or even deliberately trying to dissuade members from working together for whatever reason. It appears to me that although a group of children are using the IWB together it may not be in a collaborative way. (Wendy, Year 6 teacher)

Any learning that occurs depends heavily on the way that the children talk together…During the activity the children showed evidence of cumulative talk … and exploratory talk … This means that they were sharing their knowledge and skills while completing the task set (cumulative) as well as engaging critically and constructively on each others ideas (exploratory). Do these patterns of talk show that the children have been learning? In sharing their ideas the children are sharing their knowledge. When solving numeracy problems the children need to apply their mathematical knowledge to solve the problem. If the children are sharing their knowledge between them then, as well as solving the problem, they may be attaining more mathematical knowledge from their peers. So, the children have demonstrated that they can collaboratively work together to solve a problem and share their knowledge to allow others in the group to develop their understanding. (Gordon, Year 5 teacher)

After coding the seven teachers’ writing and drawing the evidence together, there emerges a collective view of learning as a social, dynamic process. The teachers emphasise:

- The importance of active participation, focus and concentration on the task by the learner. Within groups this is influenced by:
  - social structures, dynamics and skills (both social and technical) within groups;
  - experience and training in how to work as a group.
- The role of sharing and applying knowledge. In groups, communication is particularly illustrated through:
  - direct interaction;
  - talk;
  - non-verbal communication.
- The necessity of information processing and metacognition. For both individuals and groups the following elements are seen to be particularly important:
  - Reflection;
  - making connections;
  - evaluation, rethinking and reconsideration.
- The importance of mediation, particularly by the teacher. This includes the importance of:
  - direct scaffolding of learning;
  - providing reference points – technological and human.
• Linked particularly to the first factor, the role of motivation. This is seen as incorporating:
  – curiosity and enjoyment;
  – a sense of self-efficacy with respect to a subject area or task;
  – a degree of autonomy in the experience of learning.

Additionally, all of the teachers made some reference to the effect on these processes of the particular classroom and class context. The context is seen as multifaceted, incorporating such features as the precise nature of the task; individual learning difference amongst pupils; the dynamics of specific class interactions; technical resources, especially the availability of software and hardware; and teacher skills and attitudes.

The importance of establishing these ideas about learning becomes apparent, when we turn to the teachers’ views on factors affecting IWB use in collaborative groups.

*Teachers’ understanding of the IWB as a tool for children’s collaborative group work, learning and knowledge building: key factors relating to general classroom processes and specific IWB use*

As can be seen in the coding summary (Appendix 4), evidence emerged about the teachers’ views on the importance of factors relating to the collaborative learning process, the children’s technical skills and confidence, the mediating role of the teacher, the importance of the physical accessibility of the IWB, the distinctive IWB affordances, the motivational aspects of IWB use, the IWB as part of the whole classroom ‘tool system’, and the teachers’ own knowledge and attitudes.

Each of the above main factors has a number of subcategories in the coding. For instance, the perceived IWB affordances can be seen in terms of its ‘provisionality’, the opportunities for demonstrating the ‘justification’ of particular arguments, and the development in knowledge-building over time, as shown in the following example from Wendy:

> Another feature of the IWB is that it enables children to try out a strategy and then amend it. The opportunity to be able to ‘change their minds’ enables them to rethink and reconsider through talk or the use of the board to physically re-arrange digits/words/phrases/graphics whatever. (Wendy)

Some of these factors are very specifically attuned to the IWB as a classroom tool. Others, particularly those related to aspects of collaboration in groups, might be seen as more general, defining ‘precursor considerations’ that would affect collaborative group work with any classroom tool. The teachers’ writing demonstrates that this is a subtle mix between knowledge that relates generally to class teaching and specifically to IWB use, often shifting between the two.
The following two examples of teachers’ thinking about the general processes of collaborative learning relate to ‘group size’ and ‘processes and skills’. The question of ‘group size’ is mentioned in various ways by five of the teachers, leading to, amongst others, the following observations. Firstly it was noted that children may speak more in the small group situation compared to the whole class, leading in one case to the teacher’s better understanding of a particular child’s knowledge:

Niall was far more knowledgeable about the software than I had realised during whole class sessions and he was much more vocal in this group situation. In class he waits to be invited to speak. (Julie, Year 5/6)

However, this apparent confidence within the group may be related to assertions about the optimal group size for children in general and for the children in question. Mercer (2007) argues that groups of three provide the optimum number for children to develop ‘exploratory’ talk, although this optimisation of group size was not always possible for our project teachers or necessarily their main concern. Another factor for the teachers related to physical access to the IWB, bearing in mind equal opportunities to participate:

It is therefore important to ensure the group is not too large to prevent all pupils getting an equal chance to physically reach the IWB. (Kathleen, Year 3/4 teacher)

Group size is also linked to other important factors and variables such as relationships, social skills and role taking:

The size and dynamics of the group are extremely important. For this activity there were only 3 children at the IWB, which enabled them all to access it easily whilst not allowing any of them to take a ‘back seat’ while the others did the work. The 3 children co-operated extremely well, with two of them quite willing to listen to the ideas and instructions of the third who had taken on the role of leader, but still contributing effectively to the task. (Wendy)

These few examples of group size highlight the teachers’ thinking about the combination of factors and issues that may influence their decision making. Another example relating to collaboration - ‘processes and skills’ - extends this point. Specific references to pupils’ collaborative processes and skills were made by five of the teachers (not including references to the children’s technical skills and confidence at the IWB which are the focus of another theme).

It was clearly important to the teachers that collaborative group work gave the children the opportunity to support each other in group tasks, taking collective responsibility for completing the task in hand but often taking on different roles in relation to the activity. Collaborative learning implies participation and sharing of relevant knowledge and skills; the degree of sharing affects subsequent talk (and hence learning) and is likely to be affected by the children’s levels of understanding and confidence. The teachers suggested that collaborative learning (as with any learning process) draws on different types of skilful thinking, which may be supported in different ways by the IWB:
The Interactive Whiteboard supports learning by helping the children to:
- understand the problem or task
- gather and organise relevant information
- construct and manage a plan of action or strategy
- reason and test hypotheses (Lindsay, Year 5 teacher)

The analysis also revealed that children may have knowledge and own skills which can surprise the teacher:

In a lesson related to art … one child was chosen to draw a flower because she was known to be good at art and another to check the spelling because she was a good speller. This was quickly organised with no input from myself and was only brought to my knowledge during the final presentation to the class when another pupil asked who drew the flowers. (Wendy)

Yet in considering children’s activities at the IWB it is clear that problems may emerge in spite of previous experience, when certain aspects of familiar working practices are changed:

What really happens(!) children are sidetracked by the physical aspects of using the IWB. There is a lot of discussion about who uses the pens, and a lot of ‘exploring the tools’ (i.e. finding out how to erase peoples’ work, and what happens when 2 people touch board at once!)….NB These children have used IWB for at least 3 years they are not new to the hardware, and are extremely competent at ICT. However, they are new to the idea of working independently and collaboratively at the board with minimal teacher intervention. (Kathleen)

As a consequence, it seems that children’s collaborative learning may need explicit teacher intervention and guidance at particular stages of the activity.

Perhaps unsurprisingly, the nature of the collaborative task, including the expected outcomes, is seen to have a direct connection to how the children use resources and work together. The flexibility available to the teacher through the manipulation of the functional options available via the IWB may mean that the teacher is able to change certain aspects of the task to achieve the desired ends, bearing in mind what is also known about the relevant collaborative factors and processes. The discussion above illustrates just how dependent any success is on the consideration of factors linked to effective collaborative work per se. However, consideration of another theme from the teachers’ writing (‘affordance’) brings out the distinctive relevance of the IWB tool in the learning process.

In considering the perceived affordances of the IWB as a tool for learning (from the perspective of both the teacher and the pupils), issues of provisionality, justification, interaction, memory and multimodality were considered by the teachers. Most of the
teachers mentioned the importance of easy access by the group to the task to be undertaken. Kathleen’s comments are representative:

I saw clearly how efficient the IWB is for collaborative work, reducing the time it took for all pupils involved to gain the information they needed to start the task only a matter of minutes or even seconds elapses when pupils are extracting the information, allowing a much larger proportion of time to be spent on collaborative discussion. (Kathleen)

The idea of the IWB as supportive of the collective memory of the group was linked by this teacher to the perceived multimodality of the IWB. Although she is talking about IWB ‘memory’ in the context of a single lesson, it is interesting to note that her comments might equally well relate to the temporal development in knowledge building over lesson episodes:

Tasks where children need to handle a large amount of information or data, preferably with the ability to return to it as and when necessary, are ideal for the IWB (one of the key features of the IWB being that children can revisit previous screens/access other media, e.g. internet, and navigate between them with ease). This type of activity should really enable pupils to take ‘ownership’ of their work, navigating information with confidence to find what they need and revisiting/improving where necessary. (Kathleen)

However, the overwhelmingly visual nature of the stimulus from the board was a source of disquiet for another teacher:

…its visual impact isn’t necessarily the way to imparting the knowledge in the task. (Julie)

The issue of provisionality is an important one here. The idea that ideas can be ‘held’ provisionally by the board and then adapted later might be seen as giving a freedom that may not be available to groups working on another medium:

The IWB enabled the children to work effectively as a group in the knowledge building process because they could all clearly see what they were working on, they could capture their ideas easily and they could easily make changes. (Lucy)

Finally, the idea of justifying reasoning using the IWB as a reference point might be seen as linking to the notion of the board ‘holding’ the vicarious presence of the teacher:

…the IWB remains the focus to which the pupils must return if they are to uphold a point of view, rather than the teacher always being the sole source of guidance and information. (Kathleen)

This selective discussion of the teachers’ thinking about certain factors that affect the nature of IWB use by collaborative groups has so far highlighted one distinction between those which relate specifically to the IWB as a classroom tool and those which related to
more general classroom processes or conditions. This analysis can be extended to show how the factors might be grouped more comprehensively in terms of their:

- Specificity (to IWB or to ‘good’ classroom practice in general)
- Causality (with factors defined as necessary, sufficient or contributing to successful practice)
- Control (within teacher’s control or more distributed in school)
- Complexity (single issue or multidimensional in relation to other things/people)
- Location (relating to the child/group/whole class/activity/IWB/classroom environment/beyond the classroom)

Some factors such as the placement of board for maximum visibility are simple, necessary but not entirely within the teacher’s control; other factors such as group size are simple, contribute significantly to the success of the task and are more clearly within the teacher’s control. There could be some advantage in considering factor characteristics in this way, especially if it helps to identify any specific obstacles or potential sources of support for incorporating IWBs into primary classrooms. However an insight into separate factors is not sufficient to understand how they interact in practice in particular classroom contexts, or how teachers’ perspectives on IWB use be informed by their underlying beliefs about learning. The next section includes a case example of one teacher’s thinking and practice in an attempt to understanding these connections better.

**Case Study – Kathleen**

In Kathleen’s Year 3/4 class (ages 7-9 years) the children were working in a group of 5 (4 girls and 1 boy). The lesson was a Personal Social and Health Education (PSHE) session about ‘good’ and ‘bad’ secrets, in which the children were asked to read a series of scenarios on the IWB. They then had to decide how the characters in each scenario should respond, write their joint decisions on the IWB and be prepared to feed back these decisions to the rest of the class at the end of the session. It will be clear that this activity was not one that uses the full multi-modal affordances of the IWB, but the links made between factors in such a scenario throw light on the value of using the IWB in ‘conventional’ classroom activities.

In our analysis of Kathleen’s reflective writing, the first significant link across analytical categories (see Appendix 4 for a full list) indicates her view of how elements of ‘team competence’ combine with the children’s technical competence with the IWB in determining, to a greater or lesser extent, the level of participation of each child in the task (Figure 1).

*Insert Figure 1: Linking technical competence at the IWB and ‘team competence’*
In defining ‘team competence’ in the specific context of work carried out at the IWB it is unsurprising that a combination of elements within the analytical category of collaboration are drawn upon – in these passages, group size, composition and dynamics, together with the processes and skills of collaboration, are particularly important:

…it was clear that the cohort of pupils chosen is also key – in this case, the girls dominated a younger, smaller boy. It is therefore important to ensure … (that) … the teacher’s own discretion should be used to judge the confidence levels of the pupils involved so that one particular child does not dominate, either because of social/academic confidence or advantage.

Pupils are – in effect – involved in a process of self-assessment all the while they are completing such a IWB task, and this is only magnified by a group context, where the pupils’ ideas and answers are instantly opened to a wider audience (possibly the whole class, which can see the IWB) – thus increasing the opportunity for that child to receive instant feedback about their contributions.

Linking these elements with the children’s technical competence, Kathleen suggests that neither the embeddedness of the IWB in teacher-led lesson contexts nor children’s previous experience of collaborative work in ‘normal’ classroom activities may be entirely sufficient preparation - at least at the outset - for the demands of collaborative group work at the IWB:

I was amazed at how much time was spent during the task on managing the ‘tools’ of the IWB, despite these pupils having used IWBs confidently for 3 years previously. What was new, I realised, was being given freedom to make their own choices about the tools … and also being given independence to experiment with the tools – perhaps they do not normally receive this freedom in everyday teacher-led class use of the IWB...

The careful selection of tasks is clearly central to the development of appropriate experience in this context, and it is the fundamental means by which the teacher maintains a vicarious presence through an activity. Here, Kathleen’s comments again mirrors those of the other research teachers:

Tasks where children need to handle a large amount of information or data, preferably with the ability to return to it as and when necessary, are ideal for the IWB (one of the key features of the IWB being that children can revisit previous screens/access other media, e.g. internet, and navigate between them with ease). This type of activity should really enable pupils to take ‘ownership’ of their work, navigating information with confidence to find what they need and revisiting/improving where necessary.

To synthesise these comments, the question of active pupil participation, fundamental to the learning process, seems to lie at the heart of Kathleen’s considerations. It seems that the degree to which children feel self-efficacy (Bandura, 1997) with respect to a
particular collaborative task at the IWB – and therefore the degree to which they are likely to participate enthusiastically in the task - will depend not only on their understanding of their knowledge context of the task, but also on their understanding of, and confidence with, the nature of the collaborative ‘setting’ for work at the IWB. This is further linked to their willingness to make choices based on their understanding of the affordances of the IWB.

Drawing conclusions: enhancing collaborative group work at the IWB

In reviewing the data to address our two central research questions, we have identified numerous factors that affect the nature of IWB use by collaborative groups and have illustrated some of their interactions and connections with teachers’ beliefs about learning. With respect to factors influencing learning, the teachers stressed:

- the importance of active participation, focus and concentration on the task by the learner;
- the role of sharing and applying knowledge;
- the necessity of information processing and metacognition;
- the importance of mediation, particularly by the teacher;
- the role of motivation.

Here, we develop a tentative framework for developing a deeper understanding of these factors and their interaction. Our analysis of the teachers’ perspectives leads to a conceptualisation of some emerging principles for enhancing collaborative group work at the IWB (Figure 2).

![Insert Figure 2: Key emerging principles for enhancing collaborative group work at the IWB]

There are five main principles, which appear in Figure 2 at points that reflect how they relate to the particular characteristics and interactions of the teacher, the children or the learning environment. All of these are, inevitably, dynamically connected and mutually influential and link strongly to the teachers’ views of factors influencing learning outlined above.

The first of these linked principles relates to the pupils’ active participation in knowledge building. As we have seen, the conditions that lead to such participation are complex. However, in the context of this study, the teachers’ writing defines ‘active participation’ with respect to five key components: pupils’ sensitive and informed support for each other, their joint awareness of task expectations, their acceptance of collective responsibility for completing an activity with some independence of the teacher, their perception of the importance of a division of labour that recognises individual strengths and the contribution of pupils’ different skills to the collective thinking, talking and learning process. However, these elements may not all come together in the ways we expect:
...at the end of the discourse, Emma has allowed the other pupils to override her own decision. She allows them to move on to the next scenario with no more mention of the position she held so strongly at the beginning of the discourse (has the fact that she no longer holds the pen diminished her confidence? Has she quietly acquiesced with the group because the majority have spoken against her? Or has she come over to their way of thinking because of the arguments that they have put to her?) (Kathleen)

We have already made clear the importance of social structures and skills in promoting the group dynamics that lead to positive collaborative action.

It appears to me that although a group of children are using the IWB together it may not be in a collaborative way. Throughout my research I have felt that the more children are exposed to using the IWB in a group situation the more chance there is of them using it to solve a problem or present a conclusion successfully. (Wendy)

For the teachers, there was one agreed imperative:

...it must also be recommended that the children are trained to work in an exploratory way if the interactions are going to be effective. (Gordon)

In the context of work at the IWB – as opposed to collaborative group work in general – the success that pupils have in developing and using the specific affordances of the tool and the ways in which the teacher constructs and guides the work at the IWB, both directly and vicariously, illustrate how the manipulation of the learning environment is crucial. This may relate to situations where complementary work requires the children to use resources other than the IWB, but it is essentially the way in which the teacher understands how the IWB might be used to promote collaborative interaction and learning that is important. Such an understanding is clearly illustrated by Lindsay:

The IWB supports knowledge building as it:
- teaches a ‘thinking’ vocabulary and gives children an explicit explanation of what is to be learnt
- facilitates formative assessment by giving instant feedback on a public workspace
- scaffolds the early stages of learning a task and then a gradual move towards self-regulation and autonomy
- provides the opportunity to articulate thinking strategies and discuss these with other learners
- bridges thinking strategies acquired in one area into problems in another area. (Lindsay)

With respect to the facilitation of learning over time, the effect of the provisional nature of work at the IWB has already been given some consideration, as has the facility for
recall and review provided by the IWB. Kate’s (Year 1/2 teacher) review provides an interesting analysis of flow in the interactions around the IWB during a single lesson (Appendix 5) that links the affordances and visibility of the IWB with the class and group interactions that contribute to learning.

The final element of the emerging principles highlighted in Figure 3 relates to the reflective nature of the teachers engaged in an analysis of their own classroom environment. The value of a focus on learning process was evident in the writing of all the teachers, as was their questioning – indeed, sceptical at times – attitude with respect to the ‘value added’ in using the IWB for collaborative group work:

The opportunity to analyse children’s learning within my classroom has been an interesting one as I have become more aware of the types of evidence for learning taking place e.g. an eager hand in the air, glances, nods of the head, a quite ‘Oh yes’ or an ‘Oh no’. (Julie)

However, does the IWB give a better media to impact the children’s collaborative group work and knowledge building? This depends on the activity being undertaken... The IWB does allow the ease of accessibility and interaction with the software and therefore the activity. This surely must increase the quality of the talk throughout the task. (Gordon)

In the research reported here, the process by which knowledge developed in the group was dynamic and drew on individuals’ experiences in different contexts. There are clear traces in the teachers’ writing of ideas introduced and developed during the whole research and course experience, as well as those brought from schools and elsewhere. Our analysis of the teachers’ writing was carried out with this understanding in mind, assuming and indeed hoping that the teachers’ thinking was likely to have been influenced in some way by their previous research in Phase 1 and by ideas about learning discussed during group meetings. The whole research process – the original planning of the research network and sessions with teachers, the experience of the university based group sessions, the teachers’ activity of classroom research, the initial reading of the data, the final group meeting, the individual teachers’ further thinking and writing that provides a final synthesis and representation of their ideas, and the researchers’ analysis of this written data - can be construed as a social constructivist process of knowledge building by all the people involved. It takes the form of reciprocal interaction as people move between different activities and contexts, bringing knowledge gained elsewhere, participating in knowledge building activities and, in turn, taking the transformed thinking forward to new activities (Salomon, 1993).

Our conclusion is that teachers’ professional development in the use of information and communications technology should necessarily be integrated with discussion of learning and teaching rather than focusing on technical skills alone. Here, we can only concur with Smith, Hardman and Higgins (2006) that if work of this kind is to be developed in classrooms then ‘...teachers need extended opportunities to think through new ideas and to try out new practices, ideally in a context where they get feedback from a more expert practitioner and continue to refine their practice in collaboration with colleagues.'
Acknowledgements

We are grateful to the Cambridgeshire LA ICT service for having the foresight to sponsor teachers on the learning journey that we have outlined here. However, we are particularly indebted to the teachers involved – Gordon, Kathleen, Wendy, Lindsay, Kate, Julie and Lindsay – who gave themselves wholeheartedly to the enterprise of research enquiry in their classrooms.

References


Becta (British Educational Communications and Technology Agency) (2004) Getting the most from your interactive whiteboard: A guide for primary schools. (Coventry, Becta).


Interactive Teaching in the Primary School: digger deeper into meanings (Maidenhead, Open University Press).


