Research for Teachers

Interactive teaching and interactive whiteboards

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What is good interactive whole class teaching and how can interactive whiteboards help?
Interactive whole class teaching has been identified by the British Government's National Strategies as a key way to help to raise standards in literacy and numeracy. At the same time, interactive whiteboards (IWBs) have been made widely available and are generally viewed as teaching tools which can promote interactive whole class teaching. They are often seen as a means of increasing pupil motivation to learn and of improving interactivity in teaching. How can teachers create an interactive learning environment in practice and do IWBs, as their name suggest, really help to make teaching and learning more interactive?
This month, the Research for Teachers team has summarised a study* that explored both these questions. The project involved the detailed observation of 184 lessons conducted by 30 Year 5 and 6 teachers from 12 schools, over two years. All interactions in every lesson were recorded electronically, many of the lessons were video recorded and feedback was gained from pupils and teachers on their perceptions of interactive teaching and IWBs.
The researchers found that whole class teaching was typically characterised by traditional question and answer sequences directed by the teacher, with 64% of talk time being taken by teachers and with boys involved more than girls. IWBs seemed if anything to exacerbate this imbalance unless teachers took active counter-measures. True interactive teaching which was more helpful to learning was characterised by a more equal distribution of dialogue between the teacher and pupils. In addition:

- the type and quality of responses teachers gave to pupils' answers were found to be central to promoting interactive teaching and learning, even more important than questioning techniques
- a key feature of good interactive lessons was that teachers consciously intended lessons to be conversational.

Pupils were generally very positive about their experience of IWBs, especially in providing a new mode for learning which chimed with pupils' increasing experience of new technologies. But the introduction of IWBs did not, by itself, automatically change the way teachers taught or interacted with pupils. Some aspects of IWBs were identified as having potential to enhance whole class interactive teaching. In particular, IWB use over time led to more open questions, more whole class teaching, faster paced lessons and more, though shorter pupil answers. The researchers went on to suggest that for IWBs to be used to their full potential, they are best saved

for when they can add most to a lesson.
We think that teachers who wish to enhance their use of whole class teaching will find this RoM helpful, both for picking up techniques for improving interactive teaching and for identifying the specific potential of IWBs in the classroom.
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Overview

Why is the issue important?
Interactive whole class teaching has been identified by the National Strategies as a way of helping to raise standards in literacy and numeracy. The question is how interactive teaching is actually achieved and how IWBs can be used such that they help make teaching truly interactive.

What did the research show?
The researchers found that whole class teaching was typically characterised by traditional question and answer sequences directed by the teacher, with 64% of talk time being taken by teachers and with boys involved more than girls. True interactive teaching, which was more helpful to learning, was characterised by a more equal distribution of dialogue between the teacher and pupils. Pupils were generally very positive about their experience of IWBs, especially in providing a new mode for learning which chimed with pupils' increasing exposure to new technology. But the introduction of IWBs did not, by itself, automatically change the way teachers taught or interacted with pupils.

How was this achieved?
Those teachers who avoided the traditional question and answer sequence used the following techniques:

- encouraging peer to peer feedback
- allowing longer responses to questions
- engaging genuinely with pupils' ideas and comments
- maintaining flexibility in lessons, and allowing pupils to shape and direct lessons
- using open questions.

But it was the purpose of questions and responses to pupils' that made a difference - closed questions could be just as helpful as open ones if the teacher was intent on opening the classroom for learning conversation.

Aspects of IWBs were identified as having potential to enhance whole class interactive teaching. In particular, IWB use over time led to more open questions, more whole class teaching, faster paced lessons and more, though shorter pupil answers. The researchers suggested that for IWBs to be used to their full potential, they are best saved for when they can add most to a lesson.

How was the research designed to be trustworthy?
The project involved the detailed observation of 184 lessons conducted by 30 Year 5 and 6 teachers from twelve schools, over two years. All interactions in every lesson were recorded electronically. Many of the lessons were video recorded and feedback was gained from pupils and teachers on their perceptions of interactive teaching and IWBs.

What are the implications?
The study showed the importance of teachers:

- planning lessons to include questions aimed at higher order thinking, and using IWBs to motivate pupils to get engaged with the task
- focusing intently on opening up dialogue
- providing good quality responses to pupils
- finding ways of using IWBs more imaginatively and interactively
- giving pupils greater opportunity to use IWB technology themselves
- questioning why types of attention differ so much between boys and girls.

What do the case studies illustrate?

The case studies show, for example, how:

- a group of secondary school teachers working together on whole class interactive teaching skills came up with five pointers for improving practice in this area, including the development of questioning and feedback techniques
- a pupil benefited when her teacher slowed the lesson down and reduced the number of closed, whole class questions
- an IWB can be used to good effect, with teacher preparation and a willingness to make alterations during the lesson
- IWBs can be used to initiate learning through stimulating conceptual thinking and kinaesthetic learning.

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Study

What were the best strategies used in whole class interactive sessions?
The researchers concluded that for whole class interactive teaching to make the most of learning opportunities for pupils it needed to include a high degree of conversational talk. (This was also shown in our earlier RfTs about effective talk in the classroom and group work. This kind of interaction has also been labelled as 'dialogic' teaching - where there is genuine dialogue between teacher and pupils and between pupils themselves. This type of teaching and learning encourages a more even distribution of dialogue between teachers and pupils.

Lessons in which interactive and dialogic teaching is not taking place often follow a traditional pattern, the I-R-F sequence, in which:

- Initiation - the teacher asks a question
- Response - a pupil attempts to answer
- Follow-up - the teacher provides some kind of response (usually an evaluation of the answer)

The researchers' review of other research revealed that this three-part exchange is common in more directive forms of teaching. It often consists of closed teacher questions and brief pupil answers followed by superficial praise. Emphasis is often on pupils recalling information rather than exploring a topic and teacher questions typically have predetermined right and wrong answers.

Those teachers who avoided this traditional sequence and who the researchers found encouraged conversation and fostered interactive learning, used the following techniques:

- encouraging peer to peer responses

- allowing longer responses to questions
- engaging genuinely with pupils' ideas and comments
- maintaining flexibility in lessons, to allow pupil input to shape and direct lessons
- using open questions
- opening up closed questions to discussion
- really intending to open up the classroom for learning conversation.

We look at these strategies in more detail on the next two pages and give some examples from the lessons recorded by the researchers. First we look at the techniques which relate to teachers' responses to pupil comments and then we look at the techniques which relate to questioning.

Why was the kind of response teachers gave important?
Although the kinds of questions teachers asked was important, the researchers suggested that it was the response teachers gave to pupils which was really the key to good interactive whole class teaching. The researchers concluded that in the I-R-F sequence, the 'F' or 'follow-up' should be used to extend the pupil's answer. The lessons which contained the most in-depth pupil talk were those in which the teachers' response encouraged the following:

- peer-peer responses
- reciprocal engagement
- following pupils' ideas.

Peer-peer responses
In this example, from a numeracy lesson, pupils were explicitly asked to review one another's contributions. The teacher's strategy involved paraphrasing pupil ideas, thus confirming their importance - pupils felt that their comments were as valid as the teacher's. The teacher managed to provoke peer-peer responses with a casual uptake question.

Teacher: OK ready three, two, one, show me brilliant, [pupil 1] read it out for me please
Pupil 1: Four hundred and twenty thousand
Teacher: [Pupil1] thinks she's got four hundred and twenty thousand, anybody want to disagree?
[Pupil 2 questions pupil 1's board]
Teacher: Sorry, what have you got written down [Pupil 1] show me. What have you actually written down there?
Pupil 1: Forty two thousand
Teacher: Forty two thousand, good girl, OK
The teacher continues by exploring her own mistake.

The teacher's request for peer responses resulted in a mistake which he had made but failed to notice being highlighted. The mistake here became a starting point for shared understanding. Peer-peer responses generally were seen to result in mistakes being seen as less embarrassing and to be avoided.

The researchers also concluded that a further benefit of peer-peer critical responses was that it enhanced self-evaluation. When pupil responses were opened up to the whole class then pupils began to evaluate all responses in relation to their own understanding, and therefore to question their own understanding more closely.
Reciprocal engagement

In this strategy, rather than simply prompting pupils to continue (eg. 'come on carry on you're doing well'), teachers reacted in a more conversational, less institutionalised manner. This included signalling genuine interest during pupil responses or reacting with exclamation such as 'ooh' or 'ah' at the end. Another strategy was for the teacher to react with a relevant example from his/her own experience or opinion. This personalised the teacher's observations.

Pupil: Ehm, it's a guitar with laser strings...it's for teenagers that actually know how to play the guitar.
Teacher: Ah, now I have to say I think that's going to appeal to people who play guitar... my sister plays the guitar, drives her mad every time the strings break.

Following pupils' ideas
Using this strategy meant feedback was in the form of another question, with the teacher asking something genuinely unknown to him/her. This strategy ratified the pupil response and created an opportunity for the pupil to expand. On other occasions the teachers showed genuine interest in pupils' ideas, suggesting the class followed an idea in the future. Another strand to this strategy involved pursuing unpredicted ideas and incorporating them into the immediate discussion. For example, from a lesson looking at properties of geometric shapes:

Pupil 1: You could rotate it and then it would fit
Teacher: Ooh rotate it then
Pupil 1: ok, ehm (laughs)... [long pause as pupil tries to draw the rotated shape]
Teacher: It is a bit tricky isn't it? Can you on the whiteboards in front of you try and rotate the shape? [teacher opens task to the whole class]

In this way the pupils got ownership not only of the solution (as they were all asked to try to solve the problem), but also of the flow of the lesson with the teacher becoming a co-participant (as the suggestion came directly from one of the pupils).

These strategies are all about the teachers' responses to a pupil response. The researchers pointed out that just as questioning does not change simply by suggesting teachers use open questioning, so feedback responses do not change easily. They concluded that teachers need to understand the reasons for offering different responses in terms of the pupil behaviour they are trying to encourage. These strategies required a conscious and determined effort by teachers to embed them into their practice.

In the lessons from which the above examples were taken the researches noted that the teachers had actually used the IWBs for less time than the average of all the lessons observed. The researches speculated that the teachers with good interactive practice had yet to discover the best ways in which an IWB could enhance their practice. A second possible explanation was that IWBs are best used sparingly, when they can add most to a lesson.

You may like to read a case study which summarises the work of a group of teachers who spent time looking at the potential of whole class interactive teaching. They discovered that when good quality questioning skills and responses are incorporated into a teacher's interactive teaching repertoire, then there can be many benefits for pupil learning.

What factors were crucial in making questions work in whole-class interactive teaching?
The researchers noted from their review of other research that the most common technique for initiating dialogue in the classroom is through teacher questioning. They noted the surface features of three key forms of questioning - but in particular the crucial issue of the purpose and authenticity of questions as key issues. The types of questions they explored were:

- open questions
- closed questions
- probe and uptake questions.

Intent and authenticity in questioning
By observing so many lessons over an extended period of time the researchers discovered that the type of question asked by the teacher did not on its own predict the type of response from pupils. Open questions did not necessarily lead to better discussion and closed questions did not necessarily lead to short answers. The researchers concluded that another vital factor is the intention of the teacher and the authenticity of the question asked.

The researchers noted that pupils could spot a 'veneer of openness' (ie. pretending to be open) if a teacher kept bringing the interaction back in line with their original plan for the lesson. Conversely, the researchers concluded that where pupils had become used to being encouraged to contribute more than a short or closed answer, then the type of question is less important. They gave the following example to demonstrate that an apparently closed question will not necessarily close down conversation:

Teacher: 'What colour do you get when you mix red and blue paint?'
Pupil 1: 'Is it purple?'
Pupil 2: 'Miss, I think you sometimes get lilac'.

On the surface this was a factual closed question and in some classrooms 'purple' might have been expected as the one-word 'right answer'. But the second answer was equally valid and indeed opened up the chance for the teacher to go on to discuss shades of colours with the class. The researchers concluded that this kind of answer to an ostensibly closed question came from a child who had become used to being encouraged to speculate. If a pupil knows that his/her teacher genuinely intends pupils to speculate, discuss and debate topics, then the type of question that the teacher initially asks becomes less important.

Effective use of open questions
Effective open questions allow a range of possible responses from pupils, with no pre-defined. Teachers using these well signal this and make it clear that the multiple answers are themselves open to discussion and negotiation. The example below comes from the end of a literacy lesson on writing instructions:

'Ok what things are important in instructions? If we were going to write a checklist for when I do this with my class next year, what things would you say to them that would have to be in your instructions?'

Effective use of closed questions
Closed questions which have a single, correct answer are generally not seen as conducive to encouraging interaction. But the researchers found examples of where closed questions could themselves be transformed into opportunities for interaction. For example, when a pupil gave a single answer to a closed question, some teachers then opened this up to the whole class to corroborate, challenge and/or discuss the answer or suggest alternatives. As we saw on the previous page of this RoM, the researchers suggested that it is how teachers facilitate talk, react to and respond to pupils' answers that is key to interactive classrooms.

Probe and uptake questions
The researchers found examples of other types of questions which were used to take the learning conversation forward and as such were seen as useful strategies for interactive teaching. Probe questions encouraged an individual pupil to say more or to expand on his/her original comment, for example:
'Can you tell me why you think that?'
'Please explain how you worked that out?'

Uptake questions opened up the discussion to the wider group, using and therefore validating what a pupil had said, for example;
'What does anybody else think about what X has said?'
'Who can explain why X is right?'

If you want to find out more about questioning techniques you may wish to look at our earlier RfT about effective talk in the primary classroom.

What did the researchers discover about whole class interactions generally?
The researchers' analysis of whole class teaching showed:

- teacher talk took up 64% of all lesson time with pupil talk taking 36%
- teacher explanations took up 28% of all class time
- pupil presentation and answering were the next most common categories, both taking up an average 17% of total classroom time

- the only other interactions which took more than 5% of total classroom time were teacher directions (9%) and teacher evaluations (7%).

When they analysed teacher questioning closely, the researchers found that closed questions were three times more frequent than open questions and took up nearly three times as much of total classroom time. Uptake questions (which encourage a pupil to expand on his/her own answer) and probe questions (which encourage others to expand on a pupil's answer), both took up less than 2% of classroom time.

Overall, the researchers found that the vast majority of lessons, whether explicitly interactive or not and whether they used IWBs or not, followed the traditional Initiation-Response-Follow-up sequence. This sequence typically has a teacher question followed by a brief pupil answer and superficial teacher response. Having identified the minority of lessons which demonstrated different patterns of interactions, and in particular those lessons in which classroom 'talk for learning' was more open and varied, the researchers also looked at how the use of interactive whiteboards contributed to these interactions.

The importance of sometimes slowing down fast paced and quick fire whole class questioning is shown in a case study. In the study a pupil appeared to be participating in and learning from whole class teaching but was in fact putting on 'a performance'. She needed the pace of questioning to be slowed down and encouraged to admit that she needed help.

How did IWBs influence classroom discussion?
The researchers found that IWBs did not bring about any fundamental change in teachers' underlying practice - the traditional patterns of whole class teaching largely persisted. (This was after two years of IWB use in the classroom). They concluded that the introduction of an IWB will not by itself bring about an automatic change in the traditional pattern of whole class teaching. But their detailed analysis of all the lessons did show up some subtle differences in lessons using IWBs.

When the researchers compared all lessons using IWBs with all those without IWBs they found some changes which happened gradually over two years of IWB practice:

- lessons using interactive whiteboards contained five minutes more whole class teaching and five minutes less group work than those without
- in lessons with IWBs there were significantly more open questions, repeat questions and probing questions from teachers, but less time taken on uptake questions and explanations
- there were significantly more answers from pupils and more general talk in IWB lessons, but pupil answers were briefer on average
- IWB lessons were noticeably faster paced and choppy than those without IWBs.

The researchers were encouraged that more open questions occurred in IWB lessons but briefer pupil answers diminished this positive effect somewhat. So IWBs were found to engage pupils more and produce a faster pace, but sometimes at the expense of longer and more detailed pupil answers.

The researchers also found that some of the changes in IWB lessons took a while to become embedded in practice. It was only after two years that some of the changes were significant. For example the increase in probing questions was only apparent after two years of use.

By contrast, other effects were short lived. For example, time spent on pupil presentation increased after one year's IWB use but by year two this effect had tailed off. The researchers stressed that the full effects of IWB use may be more visible only over the long term, especially as teachers develop their knowledge and skills in using IWBs.

Practitioners may like to read a case study which shows how IWBs can be used to bring structure and pace to whole class teaching, encouraging a range of pupil answers. In the case study preparation of good material for the IWB brought whole class teaching to life, while retaining the flexibility to make changes in response to pupil talk.

How did IWBs impact on gender imbalances in the classroom?
In line with other studies noted by the researchers, they found that boys dominated classroom interaction. During whole class sessions boys made more contributions, called out answers more, asked more questions and were evaluated and reprimanded more. But the researchers did point out that gender imbalance is a highly complex issue - not least because it can be argued that girls can be said to be exercising their own power by choosing to say less in class.

The researchers found a number of gender issues.

In non IWB lessons:

- the majority of teacher questions were directed at the whole class. Boys were asked more questions than girls and substantially more uptake questions than girls (nearly double)
- significantly more closed questions were asked of boys than girls, taking into account the numbers of boys and girls in each class
- boys were also praised much more than girls
- all other moves were directed more at boys than girls, except when teachers asked a girl a repeat question, in which case the teacher spent longer doing so.

In IWB lessons there was an increase in teacher talk aimed towards boys and this became even more embedded after two years of IWB use. In the second year teachers directed 69% more open questions to boys than girls when using an IWB.

Overall then, the research showed that there was significant gender imbalance in classroom interaction and that IWBs seemed if anything to exacerbate this imbalance. Where more directive teaching was taking place (using the I-R-F sequence) it was found that more of this was aimed at boys than girls (with more refocusing of boys too).

Boys answered more in IWB lessons, though their motivation for doing so was not established. But there was no evidence of boys getting more involved than girls in interaction which stimulated higher order thinking (eg. boys did not increase their response to probes, uptake questions or curriculum-related spontaneous contributions).

The researchers also found that these effects were even stronger in classes with significantly more boys than girls. As the percentage of boys in a class increased, so did the pace and the amount of directive teaching.

Further, the data showed that girls seemed more inhibited than boys when they were outnumbered in class, the participation of girls dropped much quicker when their numbers dropped than did the participation of boys when their numbers dropped.

You may like to read an earlier case study which investigated how one teacher found that the praise and feedback she gave to girls and boys in the primary classroom differed. Both boys and girls in this study were positive about the changes which the teacher subsequently introduced.

What did pupils have to say about how IWBs help them to learn?
The researchers used small group discussions with pupils to find out their views of interactive whiteboards in the classroom. These small groups used a template which enabled the pupils to consider how they acted in a lesson with an IWB and also what they were thinking during that lesson (ie. pupils reported on their metacognition about their learning).

Pupils were very positive about IWBs (883 positive statements about IWBs were made, 494 neutral and 191 negative). They were particularly positive about the introduction of new hardware, software and multi-media capability to the classroom.

In terms of learning, the most common positive comments made about IWBs by pupils were that they:

- facilitated learning
- initiated learning
- worked well in taking different learning styles into account
- helped particular subjects or pupils.

IWBs facilitated learning
Pupils here felt that an IWB helped their understanding (eg. by use of different software to see different methods for the same calculation) and made good use of games ('makes learning fun'). Many pupils talked about IWBs affecting their thinking eg.:

'I like the way you can see things moving rather than imagining they are' (boy, 10).

Others comments around thinking processes included:

'It assists remembering....you can flick back pages in your mind' (girl, 10).

Another frequent comment was that concentration was improved. Pupils also felt that learning was improved through direct use of IWBs:

'The IWB improves people's behaviour because they want to go up and write on it' (boy, 10).

IWBs initiated learning
Themes here identified by pupils were that IWBs were motivational, attention grabbing, interesting, confidence boosting, making pupils prepared to learn. Another common perception from pupils was that IWBs instigated learning in a fun way.

IWBs helped to support differentiation and a wide range of approaches
The two styles of learning which pupils felt were best achieved by IWBs were:

- visual - eg. 'The pictures help you to understand what the teacher is talking about.' (girl, 10)
- verbal-social - eg. 'You must get a smartboard because it helps you mix your ideas and work together' (girl, 10).

Two common themes from pupils were that IWBs helped them see greater value in sharing thoughts and increased their motivation to contribute ideas. Seventeen pupils said IWBs made them want to volunteer more information in class.
IWBs helped particular subjects or pupil groups

The most common subject comments from pupils were about numeracy, especially that IWBs helped learning about shape, space and measure and increased accuracy.
'I like the IWB because it changed my mind about hating maths' (boy 11).

The second most common subject mentioned was ICT
'...it's like having an ICT lesson all the time' (boy 10).

Regarding benefits for other pupils, pupils saw the greatest benefits for others with SEN and behavioural problems.

Negative comments from pupils centred mainly on the occasional technical unreliability of the board, some on the waiting time for the technology and others on its fragility. Another negative perception was that many pupils said they wanted to have a go but that there was not enough opportunity for this. Some negative effects on the teacher were identified - 'sometimes teacher moves on too quickly' (boy 11) or forgets how to use it. A small minority of pupils also raised health fears from IWB, including headaches and sore eyes.

You may like to read a case study which demonstrates some of the advantages of IWBs which were identified by pupils themselves. The study describes how a teacher used an IWB in a series of geometry lessons to

initiate and facilitate conceptual learning and to allow kinaesthetic learning to take place.

What did the researchers conclude about how we can make our teaching more interactive?
The results of the study clearly demonstrated that the introduction of IWBs into the classroom will not, on its own, lead to an automatic change in teaching practice, nor necessarily make teaching more interactive. What the study did identify were some of the strategies which were most useful in delivering interactive whole class teaching (as highlighted in the earlier pages of this RoM). The study also pinpointed some of the ways in which IWBs could be used to enhance the impact of these strategies.

An IWB was identified as a tool which could enhance both communication and teaching. Communication benefits were simpler to pinpoint, with the technology allowing for good whole class visibility of a range of images, presentations, video etc on a dynamic, colourful and flexible platform to which pupils generally responded well.

The ability of IWBs to enhance teaching was identified as being more dependent on other strategies, such as good questioning and more particularly high quality responses to pupils. The researchers concluded that teachers would best refine their use of a technology which is still relatively new, through in-school strategies such as peer mentoring, coaching and observation of practice.

The study was also useful in alerting teachers to potential pitfalls in IWB use. The researchers believed that raising awareness of these potential pitfalls was a first step towards teachers avoiding them. These potential pitfalls include:

over-reliance on IWB, leading to too much directive teaching from the front of the class, at the expense of other teaching styles and approaches. This could be avoided by ensuring lessons were pre-planned to use a mix of styles and teaching tools
skewing of pupil interaction even more heavily toward boys' participation when IWBs are used. This could be avoided by ensuring participation of girls at particular times, for example by inviting them to present and by the careful targeting of uptake questions to girls, and
IWBs increasing the pace of the lesson at the expense of sufficient time for pupil pauses, extended talk and opportunities for pupils to report misunderstandings. This could be avoided by regularly and deliberately pausing the use of the IWB, to allow for reflection.

How was the evidence collected and analysed?
The study looked at the impact of the recent large-scale introduction of interactive whiteboards (IWBs) into primary school classrooms, in particular looking at the impact of IWBs on teacher-pupil interactions. Other aspects of interactive whole class teaching, outside of IWBs, were also considered in the analysis of the data.

Six local authority areas were involved in the study. The authority areas were chosen by the Primary National Strategy team. Two schools from each of these authorities were randomly selected to take part.

The researchers observed a total of 184 Year 5 and 6 lessons over a two-year period, a very large sample for a study of this type. Trained researchers observed and recorded lessons on a palmtop computer, using a schedule known as the Classroom Interaction System which had been well tested previously. All interactions in each lesson were coded. For each exchange in the classroom, the following was logged:

- actor and receiver (whether teacher, whole class, boy, girl, teaching assistant or even the IWB)
- type of discourse move (eg. teacher question types such as open and closed, teacher evaluation, teacher explanation, teacher direction and pupil answer)

For spontaneous pupil contributions, whether it was procedural or curricular in nature was also logged. In all cases the duration of an interaction was measured.

Thirty Year 5 teachers (18 male 12 female) were each observed four times (with and without an IWB in both numeracy and literacy lessons). Fifteen of these teachers were observed for a second time the following year.

This allowed changes in the use of IWB over time by the same teachers to be considered. Twenty of the same classes were observed in Year 5 and Year 6. This allowed changes in pupil responses to IWBs over time to be considered. The researchers video recorded a further 29 lessons (15 numeracy and 14 literacy).

The researchers also gathered information on pupils' own perspective on the usefulness of IWB on teaching and learning and on their metacognition. A template was designed to stimulate pupil talk about learning. The template was an image of a classroom with an IWB. There were blank 'thought bubbles' above the pupils' heads on the template which encouraged pupils to consider the learning process (this encouraged pupils to say 'what is going on inside your head'). Eighty Year 6 pupils, in groups of 4-6, from three education authorities completed templates.

Implications

Teachers may like to consider the following in making use of the findings of the study.

- Pupils in the study reported that they enjoyed using the IWB technology and saw this having a beneficial effect on some other pupils' behaviour, but that they found it frustrating how little time they were allowed to use the technology themselves. Could you give pupils greater opportunity to use the IWB technology themselves?
- Researchers in the study observed a large number of lessons and were able to pick those which clearly demonstrated good examples of whole class talk for learning. In lessons which you have taught that have produced good learning conversation and dialogue between pupils and teacher, what was your key role in facilitating that talk? How did you plan for it and are you able to replicate it in other lessons?
- Use of IWBs in the study lessons did not consistently engage either boys or girls in higher order thinking. Could you plan lessons to include questions aimed at doing this and then to use IWBs to motivate the pupils to get more deeply engaged with the task? Such questions might include "Why did you think that...?" "What do you think might happen next?"

School leaders might consider the following implications from the study.

- The study showed that interactive whole class teaching relied heavily on good quality responses to pupils. Could you set up structures in your school whereby peer lesson observations are focussed more in this area, to establish a culture in which staff are happy to have their responses to pupils constructively commented upon on a regular basis?
- Some teachers in the study were using IWBs in a similar way to blackboard and chalk, overly relying on teacher explanation at the front of the class. Could you and your CPD coordinator arrange additional sessions to encourage thought about how IWBs can be more imaginatively and interactively incorporated into whole class teaching? CPD for IWBs needs to include more than the basic introduction to the technology.
- The research showed that IWB use can exaggerate gender imbalances in the classroom. It also concluded that the goal for teachers should not be simply to distribute their attention evenly between the sexes. The researchers suggested that teachers should be questioning why types of attention differ so much between boys and girls. Do you have a whole school strategy with a gender specific focus? If so, could the implications of this research be incorporated into your action plan, to stimulate thinking about how boys and girls are treated differently and react differently to teaching?

Gaps in the research

Gaps that are uncovered in a piece of research have a useful role in making sure that future research builds cumulatively on what is known. But research also needs to inform practice, so practitioners' interpretation of the gaps and follow-up questions are crucial. We think three kinds of studies would usefully supplement the findings of the interactive teaching and IWB project:

- Studies that move on from quantifying the gender imbalance in the classroom and towards understanding why it exists, which processes are behind it and what impact this has on learning. Video observation methods focussing on the verbal and non-verbal actions of teachers are needed to achieve this.
- More research is needed into interactions in the same classrooms over an extended period of time, to establish the socio-historical perspective. The degree to which a group of pupils has become used to being expected and encouraged to speculate and discuss (or not) may be one of the crucial factors in explaining the degree to which whole class teaching is truly interactive.
- Case studies of lessons which use IWBs to their full potential, especially outside of mathematics. This research helped

to identify some examples of good practice with IWBs but mathematics lessons do predominate in this sample.

What is your experience?
Do you have any evidence regarding whole class interactive teaching or use of IWBs in your school? Do you have action research or enquiry based development programmes running that explore, for example, use of IWBs to stimulate higher order thinking, or any striking case study material? We would be interested to hear about examples of effective CPD, which we could perhaps feature in our case study section.

Your feedback
Have you found this study to be useful? Have you used any aspect of this research in your own classroom teaching practice? We would like to hear your feedback on this study. To share your views with us email: research@gtce.org.uk

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Case studies

We have chosen four case studies to illustrate aspects of the findings reported in this RfT summary. Case study 1 involves a group of secondary school teachers who worked together over a period of time on whole class interactive teaching skills and came up with five pointers for improving practice in this area, including the development of questioning and feedback techniques. Case study 2 focuses on a single pupil and shows how she benefited when her teacher slowed the lesson down and reduced the number of closed, whole class questions. Case study 3 gives examples from a literacy and a science lesson of how an IWB can be used to good effect, with teacher preparation and a willingness to make alterations during the lesson. Finally in case study 4, a researcher taught a series of five lessons which showed how IWBs can be used to initiate learning through stimulating conceptual thinking and kinaesthetic learning, in this case in Year 5 geometry.

Five characteristics of good whole class interactive teaching

We have chosen this case study as it summarises the work of a group of teachers who spent time looking at the potential of whole class interactive teaching. They discovered that when good quality responses and questioning skills are incorporated into a teacher's interactive teaching repertoire, then there can be many benefits for pupil learning. These teachers made five key findings about what works and what is useful in this area.

A group of key stage 3 teachers from the Manchester area became interested in the high levels of mathematical attainment, whole class teaching, levels of classroom discussion and pupils' willingness to discuss their mistakes or difficulties in classrooms in Hungary.
How did the teachers test and refine different strategies?

Some teacher exchange visits to Hungary took place to exchange ideas. Following this a group of interested teachers from five schools met every half term at the Manchester Metropolitan University to explore whole class interactive teaching.

The group used video to record lessons. These recordings were analysed and theories were refined before returning to the classroom. Other research and development strategies used were reading, classroom observation and peer discussion. Effectiveness was judged on the basis of pupil achievement and on their ability to justify conjectures articulately.
What were found to be the most effective strategies?

The teachers came to five key conclusions about the practice and potential of interactive whole class teaching.

1. Whole class interactive teaching encouraged a culture of working publicly with pupils' beliefs and difficulties.

The schools involved adopted the idea of encouraging pupils to regularly come to the front and demonstrate their mathematics to the rest of the class, especially at the beginning of lessons. Pupils' sensitivities to this exposure became an issue for the group. An important and helpful distinction was therefore made between the pupils as individuals and their mathematics. This proved liberating for the pupils. This way of working encouraged a culture of co-operation and mutual support - pupils became increasingly willing to expose and explain their ideas and difficulties.

2. Whole class interactive teaching necessitated an in-depth focus on a small number of significant problems.

The teachers found that pupils needed to have sustained engagement with a small number of problems where in-depth discussion was essential, in order for whole class teaching to be effective. Pupils' partial understandings, beliefs, feelings, instincts and misconceptions needed to be explored. Tasks for pupils needed to be seen as problematic and worthwhile and the mathematics needed to be not obviously embedded in the task. Teachers found greatest success when they focussed on concepts and issues and not simply on techniques for solving problems. Pupils needed to be allowed to fall into traps. False generalisations were found to be useful to help pupils to come to recognise the correct generalisation.

3. Whole class interactive teaching focussed on key ideas and misconceptions.

Early on the teachers agreed that their stances towards mathematics, pupils' beliefs and conceptions needed to change, especially by replacing exercises as a means to develop pupil understanding. Examples of strategies which worked included; gaining greater awareness of pupils' beliefs and misconceptions; a raised awareness of the teachers' own tendency to jump in to correct pupils and explain away difficulties; designing problems which allowed pupils access to key mathematical ideas.

4. Whole class interactive teaching promoted high levels of articulation in pupils of all abilities.

The teachers found to their surprise that pupils in lower ability groups could be encouraged to discuss their mathematics openly. Successful strategies included:

- valuing pupil contributions without judgement
- recognising when to facilitate discussion and when to intervene
- developing high level questioning and prompting skills
- insisting on the use of correct mathematical language where appropriate.

5. Whole class interactive teaching required a significant shift in the teacher's role

It became apparent to the group that lesson preparation had to change. Teachers needed to:

- be able to respond to what they had heard, not with a predetermined script
- recognise that pupils' misconceptions needed to be challenged
- develop a repertoire of additional questioning skills
- increase their repertoire of activities for each and every topic.

These five findings distilled the learning of this group of teachers over a long term project. They can be used provide the scaffolding for other teachers who wish to enhance their interactive whole class teaching.

Reference

Harrington, A (1999) Whole class interactive teaching in mathematics Teacher Research Grant Scheme 1998/99.

A pupil's 'performance' during whole class teaching

We have chosen this case study because it demonstrates the importance of sometimes slowing down fast paced and quick fire whole class questioning. In the study a pupil appeared to be participating in and learning from whole class teaching but was in fact putting on 'a performance'. She needed the pace of questioning to be slowed down and encouraged to admit that she needed help.

The case study comes from the Leverhulme Numeracy Research Programme, a longitudinal study of the teaching and learning of numeracy. This particular case study focused on one pupil, Meg, who had been observed by the researchers for four years.

Episode 1

As part of a whole class session, the teacher was working on halving numbers. Each child had an individual white board and marker pen with which to display answers.

Teacher: Half of 36?

Meg started to lift her board up to show the teacher. She had written '15', but before she showed it she noticed that others around her had '18'. She quickly changed it; the teacher did not notice and said, 'Well done, Meg.'

Teacher: Half of 72?

Meg put on an act. She took the top off her pen, pushed it back again and looked puzzled. She appeared to be counting - her lips were moving but it was not clear what she was saying. She turned round and saw what George had written then turned back again and wrinkled her face (as if to say, 'I'm concentrating hard'). Then she looked around at several boards and saw what answer others had got. Next she closed her eyes and screwed up her face. After a time her face lit up as if she'd just made a big discovery and she wrote down '36'.

Episode 2

The teacher was using a counting stick to count from zero in 10s, 5s and 2s. The children each had a number fan to show their answers. Meg appeared to rely a lot with the higher multiples on counting from zero. She was often still searching for the two digits on her fan to show her answer when the teacher had moved on to the next question. After two counting on in 10s questions

(where Meg was not quick enough to show her answer) the teacher changed to counting in 2s. She pointed to the 8th division and asked for its value.

Meg, repeating her nodding and looking at the divisions from zero, noticed that the boy sitting next to her had set his fan to show 16. She stopped counting on and put out 16. The teacher then pointed to the 9th division. Meg nodded and counted from zero, put out 18 on her fan. The teacher asked her how she got the answer.

Meg: You count in ones to nine and then go backwards and then it's like double again.

Teacher: Meg is using what we did last week, like doubling and halving.

While it is possible that Meg was multiplying by 2, her actions suggested otherwise. She arrived at the answer by counting on in twos. There was little suggestion that she was counting along to nine and doubling it.

Why was Meg putting on her performance?

The researchers stated that they frequently heard Meg offer explanations with great conviction which did not match what she did and were sometimes mathematically incorrect. They suggested that Meg was less concerned with explaining her method than with taking part in the 'game' of providing an explanation.
The researchers concluded that one possible result of interactive whole class teaching was a strong 'performative' element of being able to produce correct answers to closed questions. Some children can develop characteristic behaviours in order to be seen to participate in such sessions.

What motivated Meg when she was relating to the teacher, here and in other examples, was her status. Throughout the four years of observing Meg, her teacher said that she was able, hardworking and reliable and Meg was concerned to confirm this to the teacher and to her peers.

How was Meg helped to move on from her 'performance'?

On those occasions where Meg was encouraged to slow down and think about the mathematics, rather than investing her energy to convince others that she knew it all, her delight at succeeding was palpable. She often resisted admitting that she might need help. In another incident she protested that questions from the researcher were making her terribly confused, rather than saying that she wasn't sure about the work. But when asked if she would welcome some help she looked both pleased and interested, listened carefully and seemed to take on board intelligently the suggestions offered.

The researchers distinguished between 'participation in the lesson' and 'engagement with the thinking'. In this case slowing the pace of the lesson and finding a way to enable Meg to admit that she would welcome some help were effective strategies.

Reference

Denvir, H. & Askew, M. (2001) Pupils' participation in the classroom examined in relation to interactive whole class teaching, In Rowland, T. (Ed.) *Proceedings of the British Society for Research into Learning Mathematics* 21(1) March 2001.

Using IWBs to strike a balance

We chose this case study because it shows how IWBs can be used to bring structure and pace to whole class teaching, encouraging a range of pupil answers. In the case study, preparation of good material for the IWB brought whole class teaching to life, while retaining the flexibility to make changes in response to pupil talk.

Researchers observed and interviewed four teachers working in urban primary schools in the South of England. The classes observed were in key stage 2. Sixteen lessons were video recorded and the four teachers were interviewed about their perceptions of the potential of IWBs. This case study draws on data from two lessons in one of the schools. The first extracts are from a Year 3 English lesson, taken by a teacher who had been the enthusiastic first user of an IWB in his school. The second extracts are from a Year 5 science lesson, taught by a teacher who was also the IWB adviser for her LA.

How was the IWB used in the literacy lesson?

The first lesson was a literacy lesson in which the pupils were to write a recipe for pancakes, having made the batter the previous day. The teacher had taken digital photos of the ingredients and processes and displayed them on the IWB. Pupils were asked to come up and label the pictures with instructions. There was then a whole class discussion in preparation for writing the recipe. The teacher had prepared instructions which were blocked then revealed as the discussion progressed. The pupils then went into small groups to write up the recipe while the IWB displayed a recipe template showing headings and some pictures of ingredients.

What were the strengths of the IWB in this literacy setting?

The lesson demonstrated some imaginative and positive use of IWB:

- the use of digital photographs taken from a previous lesson on the topic
- the use of the 'block-reveal' facility gave structure and pace to whole class discussion
- the IWB technology was used flexibly to make changes during the lesson.

The use of photographs supported the continuation of learning from one day's activity to the next and the use of photographs from the classroom made the activity personal and more authentic.

Block-reveal was a useful way of keeping the lesson moving. When one pupil noted that the recipe template did not have space for the amount of ingredients, the teacher acknowledged the importance of this and added it to the template, allowing pupils a sense of real engagement with the learning process.

This use of IWB showed a good balance between planned lesson structure and spontaneous reactions to contributions and events as they unfolded. In this case the IWB afforded the opportunity for interactive and dialogic teaching to be demonstrated - pupils engaged with the teaching and the teacher authentically responded to pupil talk.

How was the IWB used in the science lesson?

In the science lesson the teacher opened a video file of herself in her kitchen at home. The extract showed her putting water in a hot frying pan to demonstrate water evaporating. The video was presented in the form of a 'magic trick'. Later in the lesson individual pupils were asked to categorise objects as either solid, liquid or gas, as part of a whole class discussion. Children were called to the IWB to select a picture to categorise. One child was mildly ridiculed by others for making a mistake. The teacher rescued this by helping her to explain to the class why she had chosen what she had.

What were the strengths of IWB in this science setting?

The lesson demonstrated some imaginative and positive use of IWB:

- demonstration of an experiment not possible in the classroom

- use of a 'magic trick' presentation to hold the children's attention
- allowing increased interactivity by inviting pupils to use the IWB
- allowing a pupil's public mistake to be seen as positive.

The inclusion of the teacher in her own kitchen and the magic trick made the clip more interesting and engaging. The invitation for pupils to use the IWB in this case study was effective though the researchers acknowledged that a limited number of pupils could participate. A significant benefit of allowing such use is that it gave the teacher the opportunity to establish individual pupils' understanding about the topic. The teacher paid considerable attention to recasting the perceived error by a pupil as a legitimate possibility.

The two examples in this case study demonstrated the potential for IWBs as communication and teaching tool. They both showed the balance being struck between pre-planning an interactive lesson while retaining the capacity for spontaneous adaptation as the lesson progressed.

Reference

Gillen, J. et al (2006) A 'Learning revolution'? Investigating pedagogic practices around interactive whiteboards in British primary classrooms. Presented at AERA conference, 2006 San Francisco, USA.

Using IWBs to promote conceptual learning

We chose this case study because it demonstrates some of the advantages of IWBs which pupils themselves identified. The study describes how a teacher used an IWB in a series of geometry lessons - to initiate and facilitate conceptual learning, and to allow kinaesthetic learning to take place.

The study looked at the use of dynamic geometry software (DGS) on an IWB, focussing on both the technical advantages of the IWB and the opportunities which this gives to change the teaching process and teacher/class interactions.

What was the issue?

Children typically allow the visual component to have overriding control over the conceptual component when learning about geometry. So for example a pupil who knows the definition of a parallelogram may nevertheless find it difficult to recognise various shapes which correspond to that definition. The researcher looked at whether IWB could help in this area.

How was the research carried out?

A series of five main lessons were taught to Year 5 pupils by the researcher. The lessons were specifically focused on the inclusive nature of quadrilateral definitions;

Lesson 1 - familiarity with Cabri (software) commands
Lesson 2 - consolidate lesson 1 ideas, plus investigate triangles
Lesson 3 - construction of quadrilaterals
Lesson 4 - dragging quadrilaterals into other quadrilaterals
Lesson 5 - deciding on the 'best' rectangle and using this to construct a definition.

Pairs of pupils were interviewed before and after all the lessons and their work in the classroom was recorded.

What were the findings from the lessons?

A shape which had been constructed as a 'true rectangle' could be dragged into a square shape but not into another quadrilateral shape. By the final lesson some pupils were still struggling to choose this 'true rectangle.' The teacher was able to address this issue clearly with the IWB, demonstrating to the pupils which

of the shapes had in fact been constructed as a rectangle.

Understanding was tested during a subsequent interview with two of the girls (Vanessa and Nina). They were presented with a shape which had been constructed as a rhombus but which appeared to be a square. The task was designed to create surprise, which it certainly did in this case. The girls dragged the shape from different corners, turning from a square to a rhombus. They were surprised but then worked through the problem they had identified using the 'drag mode', to see how the shape could be changed.

Vanessa: If it was a rhombus, it would be able to construct into a square because just has the same properties.... I don't know
Nina: A constructed square cannot change into a rhombus because it's constructed as a square.
Teacher: So what is it that means it can't be a rhombus?
Vanessa: 'Cos a square has 4 angles all 90 degrees. A rhombus doesn't have special angles so it could become a square and still be a rhombus.

The researcher then checked the stability of the girls' understanding with a similar problem - by showing them a rectangle and dragging it into a parallelogram and asking how it was constructed:

Nina: I don't know
Vanessa: Parallelogram, because that's not a rectangle [pointing to the shape] but these are still like parallel [she drags the parallelogram into a rectangle]
Nina: I agree...a rectangle, just like the square, has 4 corners of 90 degrees ,and that's a property of a rectangle and so a parallelogram does not have any really special angles, so I think it's constructed as a parallelogram.

Vanessa used the kinaesthetic approach, the technology assisting her thinking by allowing her to physically move the shapes as the teacher had done on the IWB. Nina quickly grasped the idea while Vanessa was talking and demonstrating. After five lessons and the interview these two Year 5 girls showed impressive understanding.
How did pupil understanding come about?

The case study showed that several factors were required to aid these pupils in the development of their understanding.

The pupils had several opportunities to see that some quadrilaterals are examples of others - this was aided by dragging the quadrilaterals on their PC and on the IWB.
One of the lessons gave the pupils opportunities to become 'definers' (ie. to create shapes themselves) and then to have their definitions challenged by the teacher.
The girls constructed meaning during their final interview, aided by the opportunity to drag the shapes and to discuss between themselves.

What does this case study tell us about the potential of IWBs in the classroom?

The researcher judged the success of the lessons to be because they were tightly focussed on definitions of quadrilaterals and because pupils had more relevant experiences on their PC and with the IWB. Also the opportunity for pupils to be 'definers' on the IWB led to wider discussion in the classroom.

The study showed how IWBs can allow teachers to prepare material in advance which can demonstrate complex concepts to a whole class. The use of IWB helped to show up where nearly all pupils had a gap in their understanding. The shapes prepared by the teacher were quickly used to explain this lack of understanding and prompt an effective forum for discussion.

The kinaesthetic nature of the IWB also allowed the two girls highlighted in this case study to develop their understanding - one pupil moved the shapes while the other watched and talked and learning happened for both of them.

Reference

Davison, I. (2003) Using an interactive whiteboard to facilitate pupil understanding of quadrilateral definitions. *Proceedings of the British Society for Research into Learning Mathematics* 23(1) pp. 13-18

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Further reading

1. Where might teachers find related research?

Interactive whole class teaching in the National Literacy and Numeracy Strategies
Smith, F et al, (2004)
British Educational Research Journal 30 (3) pp403-419

Running with technology: the pedagogic impact of the large scale introduction of interactive whiteboards in one secondary school
Glover, D & Miller, D, (2001)
Journal of Information Technology for Teacher Education 10(3) pp257-276

2. Research summaries
Digest: *Talk, talk, talk: Teaching and learning in whole class discourse*
This study, funded by the ESRC, was designed to investigate exactly how teachers use talk during the whole class teaching element of literacy and numeracy lessons to support pupils' learning and develop their understanding.
www.standards.dfes.gov.uk/research/themes/speakandlisten/talktalk/

3. Resources
Guidance materials for supporting pupil learning through talk
www.people.ex.ac.uk/damyhill/talk.htm

Introductory guides to IWB use
For whole school use and for particular curriculum areas
www.teachernet.gov.uk/wholeschool/ictis/infrastructure/iwb/

National Whiteboard Network
This website contains IWB teaching resources submitted by teachers in a number of curriculum areas.
www.nwnet.org.uk

The DCSF (Department for Children, Schools and Families) website
This website hosts resources for primary teachers for use in interactive classrooms
www.standards.dfes.gov.uk/primary/teachingresources/

I can
This website provides information about supporting communication and talk in children, especially those with a communication disability
www.ican.org.uk/

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Appraisal

Smith, F. et al (2007) Gender inequality in the primary classroom: will interactive whiteboards help? *Gender and Education 19* (4) pp.455-469

Smith, F. et al (2006) The impact of interactive whiteboards on teacher-pupil interaction in the National Literacy and Numeracy Strategies, *British Educational Research Journal 32* (3) pp.443-457

Smith, H. & Higgins, S. (2006) Opening classroom interaction: the importance of feedback, *Cambridge Journal of Education, 36* (4) pp.485-502

Wall, K. et al. (2005) 'The visual helps me understand the complicated things': pupil views of teaching and learning with interactive whiteboards, *British Journal of Educational Technology 36* (5) pp.851-867

Robustness
The researchers set out to explore the characteristics of interactive teaching both with and without the use of IWBs. They gathered both quantitative and qualitative data. They carried out observations using a computerised observation in 184 Year 5 literacy and numeracy lessons over two years (taught by 30 teachers, most of whom were observed four times). They also video recorded 29 lessons. They gathered data on teacher questions (eg. open, closed, repeat, probe), whether questions were answered, and by whom, and what reaction the teachers gave in response. As well as observing the classes, the researchers also gathered pupils' perceptions of IWBs using a template which enabled the pupils to consider how they acted in a lesson with an IWB and also what they were thinking during that lesson

The researchers found:

- the typical pattern of classroom interaction was Initiation-Response-Feedback (IRF) - the teacher asked a question, a pupil gave a factual answer and the teacher responded with an evaluative comment
- the most frequent teacher interactions were explaining, followed by making closed questions, making evaluative comments and directing
- boys were more involved in lessons than girls, but they were not more involved than girls in the kind of interaction that stimulates higher order thinking (achieved through asking probe and uptake questions) because teachers were highly directive
- using IWBs made little difference to the pattern of interaction that took place in whole class teaching and increased the amount of directive teaching aimed towards boys.

The researchers then looked for lessons with a more symmetrical distribution of talk and where pupils' talk was more in-depth. What distinguished these lessons was the quality of teachers' responses. The teachers explicitly asked pupils to review one another's contributions, showed authentic interest in what the pupils were saying and followed up pupils' ideas.

Pupils were generally positive about IWBs. They described how different elements of the software and hardware motivated them and kept their attention. But pupils were also frustrated by their desire to use the board themselves and (like teachers) by technical difficulties.

Relevance
Both the National Literacy Strategy and Numeracy Strategy focus on interactive whole class teaching. It is seen as a means of raising standards of literacy and numeracy in schools. Emphasis is usually placed on teacher talk, particularly teachers' use of questioning. They are expected to ask questions that probe pupils' understanding and cause them to reflect on and refine their work, and extend their ideas. The Primary National Strategy recommends encouraging active responses through the use of wait time and using varied and open questions (defined as questions that invite a range of acceptable answers). It is commonly assumed that IWBs will make teaching more interactive.

Applicability
A number of studies have shown that despite the push for more interactive whole class teaching, the structure

of whole class discourse tends to follow the traditional question and answer pattern, with teachers asking closed questions and/or missing opportunities for expanding on pupils' ideas and creating shared, co-constructed meanings. This study suggests that the critical factor is inappropriate responses by the teacher. It thus points to a shift in emphasis from the questions that teachers ask, to the manner with which teachers react to pupils' responses to the questions.

The findings suggest a number of implications for practice, for example:

- teachers working with a colleague to observe each other's lessons to find out how often they stimulate higher order thinking through the responses they give as well as the questions they ask
- teachers taking care to not only distribute the amount of attention they give to pupils more evenly across boys and girls, but increase the amount of higher order thinking they promote
- teachers exploiting the potential of IWBs to teach interactively and probe pupils' understanding
- leaders making teachers' subconscious biases visible to teachers through raising awareness, providing information and encouraging reflection.

Writing

The researchers' study resulted in a number of separate outputs. All the papers are clearly written and signposted and the researchers helpfully provide many useful illustrative example dialogues.

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