Interactive Whiteboards and Collaborative Pupil Learning in Primary Science

The school got involved with this project as we were fairly new to using interactive whiteboards and thought this project might give us an insight into how we could effectively integrate them into our everyday practice but ensuring they were used as an appropriate tool and not just a substitute for an overhead projector.
My own personal interest was to study the way I was teaching science and how the children could become more involved in their own learning and collaborative group work.
The key focus of the project follows the question: **How do children use the IWB when working together on science related activities?**

<u>Use of the Whiteboard in Year 4 Class</u>

Generally the IWB has been a major benefit to the way lessons have been carried out since it was first installed. The main use has been for the teacher to plan and deliver lessons where the children are invited to the board to model answers, correct mistakes, add labels or fill in missing information. In order to prepare the children for using the IWB for group work they were allowed to experiment with the board during some lessons and break times. This led to them being confident at using the pens and being able to navigate between pages on notebook.

The first task of the project was splitting the class into groups of 3 for discussions. This showed that some of the children are very set in who they wish to work with and I deliberately made them work with new partners. They were then introduced to talk tasks using Thinking Together by Lyn Dawes, Neil Mercer and Rupert Wegerif. The first chapter using talk words was a very good prompt and the children were actively engaged in the activity but were better at talking than listening to the other members of their group. This did, however, lead nicely into the next activity of deciding what rules were needed to make group collaborative learning successful. The children selected rules appropriate to the activity but it then remained to be seen if they would follow their own rules. The children really enjoyed sorting the owners for the dogs (Chapter 5 Reasoning with Ground Rules) but were too ready to agree with each other to complete the task rather than challenging each other as to the suitability of their choices. I was pleased to see how nearly all of them were actively engaged in this activity and were trying to put their talk rules into operation.

First Filming

In planning the first activity I wanted to create a science lesson with the opportunity for the children to discuss ideas but with enough challenge that they would need to challenge their ideas and thinking. I chose to base the activity on the classification of substances as solids or liquids and decided to include air to see which groups realise it is in neither group. The children were supposed to give reasons for their classifications at the end of the session and this is the important part to see how their reasoning has developed. The whole class were involved in the same activity but the children using the IW**B** had the pictures of the substances available and could move them into the classification circles that were labelled solids and liquids. Also the actual items were available close by for the children to look at, touch and smell as necessary. The lesson was started with some revision of talk rules and an introduction

to the task. The children working on the IWB were allowed to get on with the task after showing them what to do and I was available to help them if it was necessary.

Significant episode 1

Active and productive collaboration by the group
This is a 5 minute section of the lesson where the children had read the task and already discovered how to move the named pictures into the classification circles. They were very clearly working well together and taking turns to select the items from the top of the notebook page and move them into the places they thought correct. They did have a few problems moving the pictures to start with but soon realised that sustained pressure helped the items to move smoothly. The two boys in the group spent most of their time directly in front of the board whereas the girl in the group tended to move between the IWB and the laptop controlling it. The whole group were not afraid to move the items out of the circles if they changed their minds about the classification. This proved to be one of the strengths of using the IWB in this way as the other children in the class who were using pencil and paper to write their classifications in the circles were far more reluctant to change an item once placed. The group did not mind leaving the IWB to pick up and look at the real objects when they felt any uncertainty. The items that they all agreed on, sometimes very quickly, were never moved on the table. The children did not spend all their time looking at the IWB but were often looking at each other as they discussed where they thought each item went. This led to much non-verbal interaction like smiles and nods.

Evidence of learning in science

Looking at the talk summary, many significant statements show that the children are trying to move their knowledge of the substances from the experience they have had of them in home life to the generalities of what a solid or liquid is.
I especially thought the discussions about the jelly were showing how home experience was being used. The girl in the group knew that jellies are made by heating the gelatine and dissolving it in water before allowing it to cool. This led her to the idea that a jelly could be either solid or liquid. The other members of the group may not have had this experience but thought about how the firmness of the jelly when bitten meant it was a solid. This seemed to satisfy the group and they then placed the object. Much of the discussion was based around the impenetrable nature of solids and the mobile nature of liquids. Retention of shape was very seldom mentioned.
The discussion about air was also very significant as the children actually asked the important 'how do you know' questions. They were sure it did not belong properly in either group but did not realise the significance of placing it between groups, implying it had characteristics of solids and liquids. It was at this point I happened to come back to the group and tried to move their thinking on by getting them to think about the possibility of a third group. Eventually they decided that air did indeed belong to a different group altogether.
When the groups were all finished the IWB group showed the rest of the class their classification. This again is an important function of the IWB as it left a record of their work that was easy to share. The group were then very clear in explaining their work and choices and some of the reasons behind them. It lead to a good discussion of what a general property of any solid or liquid is and how some substances although being solids have the flow of liquids, powders.

Use of functionality of the IWB

The children in the IWB group made use of the easy way objects could be placed in different parts of the board. The recording tool also allowed me to follow the path they took to reaching a final classification showing that objects were moved in and out of circles more frequently than any group tried using pencil and paper.

Summary

For this particular lesson the IWB was not only useful to the group involved using it but to the whole class during the plenary session. The task chosen was important in that it had limited tasks for the children to perform so they could concentrate on the science. The children eventually found that it was easy to move the pictures into the relevant classification circles but that being in a defined space and able to step back and discuss was also beneficial in completing the task and maintaining dialogue. It was also important to have the 'real' objects close by so that they could handle them with minimal disruption to the task at the IWB. The other members of the class were not influenced by what the children at the IWB were doing and carried out their classifications without referring to the IWB.

Second Filming

In planning for the second activity I wanted it to have an activity where the children could discuss some results and try to interpret them. I chose some graphs that showed the variation of temperature in a classroom during a day. The initial discussions were about where in the class they could place thermometers and would they get different temperature readings in these places. The IWB was used to show a plan of the classroom and the children also had a copy of this plan. Then they looked at some graphs showing temperature being recorded over a period of time in different situations. The final task was to interpret a graph showing the change in temperature in a classroom during a day (with some suggestions as to what happened given later for them to sort out).

Active and productive collaboration by the group

The group started well and looked at the plan of the classroom with interest. They started discussing which parts of the plan were which parts of the classroom and generally helped each other to get the orientation right. This group had slightly less time to work on their ideas due to the microphones being fitted etc. They had quite clearly discussed where they thought the thermometers should go before they arrived at the IWB and spent little time giving reasons for placing the thermometers and more time about which parts of the plan were the places they had decided for the thermometers. It is a pity this part of their work was not recorded. They had decided that near the air conditioning unit was a must, "air conditioning" "Yeah air conditioning" " that's at the back" " yeah there on the plan" was the sort of conversation. They also decided on the windowsill, the teacher's desk, by the sink, on the cupboard and in the middle of the classroom. The ~ talk was all about where and very little about why these were the places for the thermometers. At this stage P2 was beginning to get more excited about the way things could be moved and erased on the whiteboard than engaging in the discussions. P3 often offers ideas but is ignored by

the other two more dominant members of the group. When they left the IWB P3 stayed at his place working on transferring the information to his own copy of the plan but the other two moved back and forward between the IWB and their plans to ensure they placed the thermometers in the same places.

During the second part of the activity between ~ P1 and P3 were very actively engaged in discussing the graphs and the titles and reasoning which title belonged to which graph. P2, however, spent significant amounts of time after the opening minute moving from the laptop to her seat in the classroom and back and only coming to the IWB when P1 and P3 called her back to the task. She also spent time moving the pictures on the screen which annoyed P1 and P3 although some of this was trying to get the picture back to where it should have been. They eventually decided which title belonged to each graph but used their experience of the previous use of the IWB to try and drag the titles into position. This caused everything to move about and caused frustration and confusion. They decided to ask if this was what they were meant to do. When I told them they had to write the titles they then spent some time experimenting with how much fun it was to write with fingers rather than the pens. Under pressure at the end of this activity when the class were drawn back together they completed the task rapidly drawing the final line in very quickly.

The next part of the activity, where they were looking at a graph of how the temperature in a room changed during the day, showed the group really having problems collaborating. P2 was not often interested in the task and found that moving the pictures around the screen or making shadow pictures was much more fun. P1 and P3 tried to make sense of the graphs but were easily distracted by P2. The discussions were not constructive talk and any decisions made were made by one pupil and often altered by another without any reason given or discussion. All the good talking about the previous graphs seemed to have no significance with the new situation.

Evidence of Learning in Science

~ The initial discussions were very useful (see appendix 2) showing that the children were relating the lines to the falling temperature and the significance of the beginning temperature and final temperature. They all soon realised that the graphs started at 80C and this must be the initial temperature of the water. The final temperatures were discussed more and P1 had trouble reading the graphs and was often helped out by P3. They soon realised that the colder places would give the lowest final temperature and thus sorted out the headings for each graph. When the whole class were questioned about the graphs P3 was able to tell everyone that the water in the freezer would go from 80C to –20C and quickly as it was much colder.

~ They read the instructions and repeated the times and temperatures but there were no significant questions asked about what they thought was happening. They thought the suggested reasons for the changes in temperature were funny but could not link them to the graphs. The other groups in the class, who were using paper graphs, were having more useful discussions and questioning why the temperature might be rising or falling.

Use of the functionality of the board

For this lesson the first activity used the drawing function of the board where they were supposed to write on the plans. This was meant to be repeated in the second activity but the children wanted to drag titles etc. The third activity was to link the suggestions to the graph.

Summary

The IWB was useful for the children in looking at the plan of the classroom and they could easily mark where they wanted to put things. However, in this and the subsequent activities it became clear that the pictures etc. need to be locked in place so that the children do not spend large amounts of time moving them around the screen and getting frustrated.
It is becoming clear that how the activity is set up on the IWB is vitally important in allowing the children to spend time discussing rather than moving things around the screen.
It was also significant that the more times they went back to the board the less inclined the group became to discussing the work and the more they wanted to play with the board.
Does this mean that the group at the board needs to be changed frequently to encourage good collaborative work and constructive dialogue?
I am also beginning to worry about the composition of the group. The one female member of the group, who is in the top 10% of the ability range in the class, is the child who is least engaged and most inclined to "play" with the board. The two boys are trying to co-operate but the child who is academically weakest is often giving the best ideas but is ignored. The talk rules established earlier are not being applied. Perhaps they need to be displayed close to the IWB as a reminder.
The next point I thought about was the need to make the instructions clearer. I tended to keep away from this group during the filming but this was also a mistake as they needed as much encouragement as the other groups and were probably under greater pressure.

Third Filming

When planning for the third activity I wanted to try out the use of the IWB with a simulation. The class had been doing experiments with thermal insulators and had used thermometers to record the temperature drop of hot water in a beaker with various materials used as a lagging. They had difficulty measuring and recording the temperatures and I found a website that simulated this sort of experiment. I chose the Bitesize Science – Keeping Warm activity. I tried this out myself and thought the children would be able to carry this through successfully. The idea behind the simulation was to test the various materials and discover which was the best insulator.

Active and productive collaboration by the group

The group worked together very well on this activity although there were a few times when P3 mentioned that it was boring. The pupils P1 and P3 spent most of their time in front of the IWB and P2 was delighted when it became apparent that a person was needed to use the laptop. P2 took charge of recording results and P1 and P3 were active in starting and stopping the timing and relating the results to P3. The experiment did not lead to much discussion but the children did talk about the

temperature falling and tried some predicting before they became aware of the fact it would not go lower than room temperature.

Evidence of Learning in Science

~ The children all realised that the temperature could not fall below room temperature ~. They showed this too by not continuing with the simulation and completing the table with room temperature recordings.
When the children gave their feedback to the class they could tell the class which materials were the best and worst insulators but this was never really discussed at the IWB. They also appreciated that the results obtained were easier to get than using scientific apparatus. There was, however, little discussion as to why some materials may be better than others as they spent significantly more time than the rest of the class working on the experiment.

Use of the functionality of the board

For this activity the board created a wide space for the children to interact in. Due to the nature of the simulation it did not recognise written numbers and these had to be typed in on the laptop. This did not stop the children from co-operating far better than in the previous filming. They could talk across the gap and each child seemed to have a different function within the group. Another problem occurred either with the nature of the simulation or the functionality of the IWB but the children managed to "lock up" the program for 3 minutes before realising it was not going to work any more and needed to be restarted. This could have led to frustration but they kept on trying and were eventually helped out by adult intervention. Although the instructions seemed straight forward the children needed more explanation and this again restricted the time for talk.

Summary

This activity could have been done using laptops and working in groups. Three children working around a laptop would have proved difficult and the IWB gave the children a clear view of what was happening. Again the task needs to be supervised and the children instructed on what to do if the program fails to respond. The children did not really discuss what they were meant to do or how they expected the experiment to work. They tended to talk less about what was happening than the other children in the class who were looking at graphs of similar experiments. I would use this activity again but would ensure the group working on the simulation were doing this instead of using thermometers so that they had more time to think about why the materials were behaving differently.

Conclusions

The key focus of the project follows the question: **How do children use the IWB when working together on science related activities?**

As Rudd pointed out ~ the interactivity lies not only within the technology itself but when there is a willingness on the behalf of the teacher to create an interactive environment at classroom level.

It is also important that the software and affordance offered by the IWB are compatible with the work undertaken.

A number of different factors have come out during this work.
1) the nature of the group
2) the nature of the task set
3) the way that the task is set up
4) the amount of intervention given

1) the group of children I chose were of mixed ability and mixed gender. They worked very well during the first filming and fairly well in the third but did not cooperate with each other in the second filming. This could have been due to the nature of the task or that the group had been together as a talk group for too long. In future I think I would alter the composition of talk groups more frequently. This would have the advantage of the children listening to a wider variety of children's views and any character clashes being more short term. It would also be interesting to see if children of more similar abilities talked more together.

2) The first task created the most productive talk and was a sorting activity with clear instructions and simple drag and drop functions required. The actual objects being there as well led to good discussions. The second task was across too many activities and it would have been better to have just concentrated on the children labelling the graphs correctly. The third task was a simulation and although in the end the children did enjoy it and cooperated very well it would have been better linked to a different lesson where other children were doing the experiment with "real apparatus" to compare the value of the simulation with experiment.

3) Setting up the task was the most important factor. Clearly in the first task the children had good pictures, plenty of real examples and only needed to drag pictures into circles. This meant very little could go wrong functionally and the children had lots to say about why they were placing the objects in the groups. With the second task I could have eliminated a lot of their problems if I had locked the graphs in place and written extra instructions telling them to write the titles or overwriting the titles so they would drag to the appropriate graphs. These simple operations would have saved the children from spending time moving the whole graph around and one of the group finding this more fun than interpreting the graphs. The third task couldn't really be set up differently as the program was downloaded but a reminder of the talk needed might have been appropriate.

4) The children in this group often needed more intervention. Listening to their dialogue they were reluctant to come and ask for help even though they knew they needed it. I too was reluctant to interfere as I knew they were being filmed and wanted them to try and discuss their way out of problems. This was a mistake. They clearly would have benefited from earlier intervention and this is something that a teacher would need to be aware of if using a group at the IWB.

References

Lyn Dawes, Neil Mercer and Rupert Wegerif   Thinking Together

Tim Rudd   Interactive Whiteboards in the Classroom.