Interactive Whiteboards and Collaborative Pupil Learning in Primary Science
Cambridge University Faculty of Education

Project aims and key drivers

The main aim of the project is to explore how IWBs can usefully contribute to the joint activity and communication known to be effective in developing children's learning. The context is collaborative group activities in primary science.

Initially, the school's interest was motivated by the school development plan's focus on science. This tied in well with the recent introduction of IWBs in every classroom, including playgroup. As science coordinator, this opportunity provided scope to take our AT1 science teaching forward, whilst utilising one of the school's largest financial investments. Miss T was ICT coordinator when the decision was made to invest in IWBs and was interested in how to use them to their greatest potential as a learning tool.

Group meetings brought to light the following strands of interest;

1. The children's use of the IWB
2. The quality of their talk and other forms of interaction
3. The nature and success of their collaboration
4. Their learning of science

As an introduction to this project the class carried out various activities from the 'Thinking Together' resource book (Mercer et al.) to encourage them to develop their levels of exploratory talk within the classroom environment. The results of the 2003 'Language, Thinking and ICT in the Primary Curriculum project' (EDU/00169/G) indicate a link between children's engagement in collective thinking activities and gains in understanding, learning and problem solving. It was hoped that the skills acquired through these tasks would then be transferred to collaborative activities at the IWB.

Tim Rudd cites Burden (2002) in his Futurelab article, 'Interactive Whiteboards in the classroom' and highlights 'transformation' as a stage in IWB use, whereby the technology is used to 'add value' to learning processes through an enquiry based approach. In this way the learners themselves become centrally involved in the use of the IWB and the interaction leads to an ever increasing knowledge.

It is this style of learning that we are striving to achieve within our classroom and hope that through this project we will be able to reflect on our current teaching practices, seeing to what extent we are achieving this.

Class 7 – Class and Lesson Overview

Class 7 is a year 5 class of 28 pupils. The talking trio that were used for the 1st and 2nd filming sessions are a social group of mixed ability although they all fall into the national expectations for their age group. ~

The IWB has been a feature in this particular room for 2 years. As class teacher I have worked with the IWB for 3 years as I was fortunate to be one of the teachers who received an IWB in the first phase of use.

The children are comfortable with the IWB in the classroom however there is plenty of scope to increase their independent use of the technology. The main use of the IWB is during whole class teaching and sometimes with small groups during mathematics activities. This project provided us with an opportunity to develop our use of the IWB and use it more productively to support the main learning.

My IWB dominates the front of the classroom and is the main board used for all teaching and learning. There is another white board next to the IWB which tends to be used for the daily timetable and any notices. The pupils often use the IWB for introductory activities and interactive games. At present it is rarely used for the main literacy task and is occasionally used for group work during numeracy. All the children are comfortable around the IWB as it has been used as a teaching tool in our ICT suite for a number of years. However their skills are still developing as they become more comfortable with the developing software and functionality of the boards.

The three lessons that were developed for this research project were all based around our SC1 focus of reading and interpreting data presented in graphs and charts. Our School Development Plan focus is to develop the teaching of science. Within this focus, SC1 investigative skills were core and as science-co-ordinator, I felt this was the perfect opportunity to combine science and ICT in a productive fashion.

The pilot lesson was based around line graphs that showed the amount of time sugar had taken to dissolve. The children were asked to match the graph to the appropriate experiment. The 1st lesson (appendix 1) was based around food groups, where the children were asked to match the menu to the appropriate pie chart. The 2nd lesson was based around electrical circuits where the children were asked to identify which circuit matched the appropriate bar graph. (appendix 2)

Each lesson focused on the children being detectives to help out Class 6 who had forgotten to name their work and needed help. The activities were designed to encourage the children to work as a team and discuss the different graphs, working out how to sort them. On all the activities there were 2 graphs or charts where, with a little thought, the match would be reasonably obvious whilst 2 of them would require some deeper thinking and discussion. We tried to make it clear to the children that the reasoning behind their decision was just as important as the decision itself.

Selected Clips

I have selected two clips from lesson 1 and a further clip from lesson 2.

Reasoning behind clip selections in relation to the 4 key strands of intersect

Strand 1 - The children's use of the IWB

It is interesting to note throughout the clips selected how the children group themselves around the IWB or the desktop screen.

The children utilise the board functions to aid their understanding, check ideas and review what they have previously done.

This links to the findings of Kate Wall, Steve Higgins and Heather Smith from their article entitled 'The visual helps me understand the complicated things': pupil views of teaching and learning with interactive whiteboards, published in the British Journal of Educational Technology Vol.36 No.5 2005 851-867.

' the IWB was seen as helping memory and the thinking around ideas'. Three comments linked this retention directly to the structure of the software (in this case Smart Notebook), with one pupil stating that she could:

Flick back pages in your mind (girl, age 10).'

In clip b) there are clear links between what the group are doing and the findings of J.P. Cuthell, (2005), 'Seeing the meaning. The impact of interactive whiteboards on teaching and learning,' where it is shown that, 'The ability to move backwards and forwards in a sequence, or laterally to another topic, provides further learner support.'

My pupils are seen to demonstrate this as they visualize the large pie chart but utilize the page sorter to move from chart to chart.

Strand 2 - The quality of their talk and other forms of interaction

There are examples of 'exploratory talk' as discussed in the book, 'Thinking Together,' by Lyn Dawes, Neil Mercer and Rupert Wegerif. Exploratory Talk is described as happening 'when people engage critically but constructively with each other's ideas.'

There are several examples of the 'because' being used and in clip b) there is a nice example when a child says, 'hold on' and the discussion continues to reach a consensus.

During the final section of clip c) there is an interesting group dynamic when two of the group move away from the board to allow the other group member to carry on. Their physical interaction demonstrates a teacher and learner stance between the pupils before they return to the collaborative group that they have been in for the rest of the activity.

This interlude adds to the work of Gary Beauchamp and John Parkinson, School Science Review, March 2005, 86(316), 'Beyond the 'wow' factor: developing interactivity with the interactive whiteboard,' when they say, 'teachers should not be seeking to interact with the

technology, but rather to use the technology as another medium (besides themselves) to interact with the class, as well as allowing the class to interact with each other, in mutually developing new teaching and learning strategies.'

Strand 3 - The nature and success of their collaboration

Throughout all of the clips there is evidence of deeper learning as the children use exploratory talk, are active around the IWB and are taking responsibility for their own learning. This links well with Tim Rudd, Senior Researcher, Futurelab who wrote, 'but there is much research to suggest that the best and 'deepest' learning occurs when learners are active, have more control of the content development and interaction in lessons, and where there is greater dialogue around learning episodes, in his article, 'Interactive Whiteboards in the Classroom' 2007.

Strand 4 - Their learning of science

During lesson 1 the children are developing their skill at interpreting data presented in pie charts. This is linked to their understanding of food groups. This learning and increased understanding is demonstrated in clip a) when S2 notices that they have read the key incorrectly and points out that one section of the pie chart is a lighter colour to the other, similar section. This learning leads the group to make some key progress in the task.

During clip c) there is clear evidence that their knowledge and understanding of electrical circuits is growing as they discuss the need for a complete circuit, parallel circuit, battery and switch.

Rupert Wegerif's article from Computers Education Vol.26 No.1-3, p51-60 1996, 'Using Computers to help coach exploratory talk across the curriculum' not only highlights the advantages of exploratory talk but notes that, 'children can be seen to engage in uninhibited debate amongst themselves between the prompts and responses of a computer in a way that would not be possible with a directive teacher.'

During clip c) I believe this point is completely exemplified because, despite teacher intervention to get the pupils on track it is only as they engage with the task on the IWB that they begin to see for themselves and truly understand the connection between circuit and graph. Although the pupils required a few pointers from the teacher they were able to access the internet programme for themselves making the learning pupil centered and meaningful. The pupils who were using the concrete material and building their own circuits were unable to access this deeper understanding as the practicalities of building circuits in series and parallel was a barrier to their ability to see the whole picture. This is where the feedback that the IWB group were able to do for the class benefitted the teaching and learning outcomes for the whole class.

My observation is reflected in the work of J.P. Cuthell, (2005), 'Seeing the meaning. The impact of interactive whiteboards on teaching and learning,' when he discusses visualization and writes, '…identify where errors may have occurred. This can then be shared by the whole group, reinforcing communally constructed learning.'

Analysis of selected clips and key areas of interest

The clips that are cited in page 3 of this document are small sections that I have used to refine my thoughts and findings during the whole research project. In this section I will select sections from the clips to highlight the 4 strands as per pages 4 and 5 and look more closely at the conversations and actions of the pupils.

Page & Timing	Words spoken	Analysis of words and actions
a) p7 10.20	**S2:** Prawn salad has fruit, has loads of fruit in it.	Pupils are having a discussion around the small computer screen linked to the IWB
	S3: Right I think um, I think red group's actually prawn salad because that's like all the fruit, and that's the fat and sugars.	S3 is looking at the larger screen while S2 is pointing at the page sorter on the smaller screen. This is all happening while the group remains together around the keyboard. The opportunity to see the larger screen gives S3 a clearer view and you can see her thinking develop. It appears that she clarifies the thoughts in her own mind before re-joining the group and contributing to the discussion.
	S1: Yeah I think same here.	S1 is kneeling on the floor ready to type
	S2: Yeah because that one's lighter.	S2 points to the graph on the small screen using the visual to demonstrate his point. There is recognition that there has been an error in reading the pie chart.
p8	**S1:** Exactly.	Confirmation of the error and acknowledgement, ready to take the thinking forward. S1 flicks to the menu and the other two pupils can be seen using the page sorter as an 'aide memoire'.
	S3: So you can delete that and put the prawn salad.	
	S1: What group, what group is that?	
	S3: Red group and prawn salad.	
	S2: Oh that's fish and chips, so you could have just left that. Delete it. Why are you putting that (inaudible)? Why are you putting that in that?	During this next section the findings of Kate Wall, Steve Higgins and Heather Smith from their article entitled 'The visual helps me understand the complicated things': pupil views of teaching and learning with interactive whiteboards, published in the British Journal of Educational Technology Vol.36 No.5 2005 851-867 are demonstrated. This quote plus my pupils kneeling position and need to type, show how;
	S1: Because its prawn salad.	
	S2: Yeah but you don't need that in prawn salad.	

		'Many children talked about the need for recalibration in the middle of the lesson and the impact that this had on teaching and learning: The bad things about Smartboards are when you can't read the writing and you have to orientate the board and it wobbles some times (girl, age 11)'
	S1: We do lots of fat and sugars.	
	S2: I don't think there's lots of fat.	My pupils found it very difficult to write in the top left corner of the board.
	S1: I know how to do this right yeah? Uh prawn cocktail.	This was due to orientation issues and the layout of the task.
	S3: Succulent (inaudible).	The position of the area for writing reasons
	S1: We think this is red, red, red group because it's totally radical.	was too high up and we could have used voice recording to alleviate the typing issues. *Implications for the teacher and future planning.*
	S2: Because, because there's lots of fruit.	
	S3: Yeah.	
	S1: Because there's lots of fruit and veggies in it.	Clarification to ensure understanding that fruit refers to the section of fruit and vegetables.
11.45	**S2:** Lots of fruit and veg.	This clarification is taken on board and mirrored.

Page & Timing	**Words spoken**	**Analysis of words and actions**
b) p21 30.49	**S3:** The best balanced meal is roast dinner. Because it's more balanced out on the pie charts.	S3 appears to make a unilateral decision.
	S1: I don't think, hold on.	It is nice to see a challenge and further examples of exploratory talk.
	S3: Yeah roast dinner is yellow group, so yellow group. It's more balanced out	
	S1: That bit, and that bit, because they're bigger than the rest of them.	S1 utilises the functionality of the board to demonstrate thinking in a visual way.
	S2: Hold on.	Another request to stop and think.
	S3: That's not balanced out, that.	
	S1: Could you just um. No it isn't, could you just go back? Because um, that's what (inaudible)	
	S3: That's not.	Again S3 takes a certain amount of control and flicks through the different pie charts to

		re-enforce the point to the other pupils.
	S2: Its yellow group.	Confirms understanding and agreement
	S3: And that's not	
	S2: its yellow group.	Re-confirms his position
	S1: I think that definitely isn't because of.	More exploratory talk with the use of 'because'.
	S3: The rest aren't balanced out.	Another attempt to explain the views.
	S1: That and that and that, and that. That's why I don't thing they're balanced out.	Student is pointing to the pie chart on the Smart Board.
	S2: What?	
	S1: They're not balanced out because, because there's more of that, those 3 than there is of them 2.	S1 re-considers the view and offers an explanation. The pens are used with the IWB to clarify and the pupils are able to quickly move through the screens.
	S2: Yeah but. No that one's bigger than that one. I think. No, no, no, no. Rub it out.	An important feature of the IWB is that the annotations are not lost and can be revisited.
	S1: No and that one isn't bigger because of that bit. That one's definitely the biggest. That's definitely not balanced out.	During this next section the pupils re-visit their thinking and explore all the pie charts to compare the balance of the sections. This demonstrates exploratory talk and deeper thinking as they confirm their ideas and look for agreement from the rest of the team.
	S3: That one's definitely not.	
	S1: Because of that bit.	
	S3: And that one's definitely not.	
	S1: Because of that bit.	
	S2: See the most balanced is the (inaudible).	
	S3: Roastie, roastie.	
	S2: Ah ok.	S2 returns to the keyboard to type
	S1: What have we put is the most balanced?	S2 is followed by S3 and S1 briefly but S1 then returns to the main board to have another look.
	S2: Go onto roast (inaudible).	
	S3: Go onto the.	S1 returns to the rest of the group as they begin to type up the reasons for their choices.
	S2: That one. Yeah, yeah that one.	
32.35	**S3:** Balance is (inaudible). We think the roast dinner is the best balanced.	As previously mentioned, the need to type is something for the teacher to consider when setting up the next activity.

Page & Timing	Words spoken	Analysis of words and actions
c) p21 29.00	**T:** This is the light that we want to be using, yeah. Ok now, if you want to go back, to look at the graphs you just click onto that and it'll take you back onto the, and then you just click back on that to get back to the circuit. So if you click on complete circuit. Ok now how many other bulbs do you want into that?	The teacher intervention is purely method and helping the pupils to understand the internet programme that they have accessed. The teacher is vicariously present through the set up of the IWB and the links that have been placed between pages. This encourages the pupils thinking to travel in the direction the teacher intended.
	S1: One.	
	S3: Two.	
	S2: Two.	S3 & S2 agree and the task moves forward.
	T: Was there a circuit, yeah. So click the light.	Again, teacher intervention is designed to focus the pupils and help them decide how to take things forward.
	S1: Click on there Danielle. And again.	S1 takes the lead and appears to have a clear understanding of how to interact with the programme. *Q – Gender issues?*
	T: Now what are you going to do?	
	S1: Parallel.	
	T: Ok, no.	
	S1: Oh there's the switch.	
	T: Now what's happened?	
	S2: They're red.	
	S1: They're (inaudible) power.	
	T: Right go back and have a look at the graph and see if you've built any of the circuits, and see if it matches any of the graphs.	Teacher offers one directive statement and then withdraws from the activity.
	S2: No.	The pupils return to the graphs and then use the page sorter to look at the circuits.
	S1: Yes.	
	S2: Circuits if we built any of them. We haven't built any of them.	
	S1: No, no.	
	S2: Is there a three in a row? There is this one.	They flick through the pages to find the circuit that they have built.
	S3: Yeah this one.	
	S2: So that means that. Three of them are flashing, they weren't, they were all exactly.	The pupils are using the page sorter and their new understanding to select the correct graph.
	S3: It's not that one, it's not that one.	
	S2: Because all three of them were exactly the same.	

	S3: That one.	There is a new level of excitement.
	S2: Yeah. Which one was it again? That one.	
	S1: There it is.	
	S3: This one too. No.	All three students are trying to drag and drop the correct graph on to the correct circuit.
	S1: Oh I'll use the mouse to do it.	It is interesting how the science learning is postponed and replaced with ICT learning.
30.31	**S2:** Archie we're not supposed to use the mouse Miss (inaudible) said.	There is a section where the pupils attempt to drag the correct graph into the correct circuit. At this time the learning has happened and the pupils are absorbed in the technical issues around the IWB.
Resumed at 31.12	**S2:** Now let's go back to this weird electronic circuit thing. New circuit. Archie what no hold on, stop, stop Archie, Archie stop.	There is a certain amount of over exuberance and the pupils are not listening to each other as they all want to make progress quickly.
	S1: Click.	This is where the nature of the IWB is forcing them to attempt patience.
	S2: No we can't do one with three again.	
	S1: New circuit. Go back to (inaudible) graph thing. That one.	The pupils have slowed down and are listening to each other again.
	S2: We've already done that. We've got one, two, three.	S1 appears to be taking control over the IWB while S2 & S3 are thinking.
	S3: They're all on; they're all on (inaudible).	
	S2: No they're not, they're on the switch.	
	S1: They are all on.	
	S3: They are all on.	This is a nice example of agreement.
	S2: Yeah so light uh Archie.	
	T: Eyes to the ceiling, eyes to the floor, eyes to me. Those of you that are working on the smart board, you're fine, you can carry on. When I'm talking (inaudible).	
	S1: New circuit because they weren't like that	The teacher is talking to the rest of the class; the three students continue working on the smart board.
	S2: That's the wrong circuit. New circuit, that's the one. Oh no didn't want that, new circuit, new circuit because (inaudible). No press two.	S2 takes a back seat as S1 & S3 are attempting to use the programme.
	S2: Ok so two. Two.	
	S1: Yeah parallel circuit.	
	S2: Anna get your head out the	

	way.	
	S3: We need a complete circuit.	
	S2: Simple first.	
	S3: Complete, just do a battery and a switch.	
	S2: We need another light, one light.	
	S1: There and one there.	The pupils complete the circuit but then click complete circuit rather than closing the switch. At this point they hand over responsibility to use the programme to S2. The pupils are recognising their strengths and working in a team to get the task done.
	S2: Ok complete circuit. You do it Archie, Archie do it he's really good on that.	One student builds a circuit on the smart board while the other two become the audience in a teacher pupil type arrangement.
	S2: No, no because two of them aren't working properly so that means.	
	S1: They are working properly.	
	S2: No not the biggest one. That's the most powerful one, so.	
	S1: So do, that one.	
	S3: That one.	All pupils are pointing at the correct graph. They are keen to drag the graph to the correct circuit and move on. This is where the key learning appears to be taking place and there is a genuine comprehension of how the circuits and graphs link together. Science learning is clearly taking place in a child centred and collaborative way.

Conclusion

During this research and subsequent analysis I have learned;

More about creating collaborative opportunities for my pupils
How the IWB can assist with this and help my pupils learn in science
Developed my skills in creating valuable learning opportunities with the IWB

The key learning for me has been using the functionality of the IWB to maximise the teaching and learning that is happening in my classroom. By taking the time out to observe the pupils working and analyse the quality and educational value of the materials presented to them, plus their interactions with the hardware and software, I have become more aware of the opportunities for learning, afforded to me through appropriate use of the IWB.

Rupert Wegerif's article from Computers Education Vol.26 No.1-3, p51-60 1996, entitled Using Computers to help coach exploratory talk across the curriculum confirms my thinking when it says, 'However, computer-based collaborative activities can offer an alternative educational focus and framework for talk and research suggests that computers have significant potential for helping teachers support children's exploratory talk.'

Tim Rudd, Senior Researcher for Futurelab further confirms my views in his 2007 article,' Interactive Whiteboards in the Classroom' when he cites Higgins et al (2007) as they, 'further note that it is the skills and professional knowledge of the teacher mediating interactions with pupils that is the crucial factor in determining how much 'value' is gained from IWB's.'

Investing the time and effort into this project has allowed me to appreciate that the hardware in my classroom has forced me to consider how I teach and amend that teaching to match the new opportunities afforded me through the IWB. There are implications from a management perspective following on from our aims and key drivers where we must consider the balance between financial investment and impact on pupil learning.

Gary Beauchamp and John Parkinson's article in the School Science Review, March 2005, 86(316), entitled, 'Beyond the 'wow' factor: developing interactivity with the interactive whiteboard', state that, 'teachers should not be seeking to interact with the technology, but rather to use the technology as another medium (besides themselves) to interact with the class, as well as allowing the class to interact with each other, in mutually developing new teaching and learning strategies.'

This will inevitably take time and there is a requirement on the senior leadership team to train and empower staff to use the IWB to its best advantage. As time moves forward it will be important for research to track any changes to pedagogy and gains to pupil's attainment.

This research is nicely concluded by a quote from, Learning, Media and Technology, Vol. 32, No. 3, September 2007, pp. 213–225, by Steve Higgins, Gary Beauchamp and Dave Miller, University of Durham, Swansea Institute of Higher Education, Keele University, titled, 'Reviewing the literature on interactive whiteboards' which says, 'the introduction of IWBs into the classroom involves much more than the installation of the board and software. The researchers argue that teachers are critical agents in mediating the software and in ensuring the integration of the software into the subject aims of the lesson and the appropriate use of the technology to promote quality interactions and interactivity.

References

Beauchamp, G., Parkinson, J. (2005). Beyond the 'wow' factor: developing interactivity with the interactive whiteboard. School Science Review, March 2005, 86(316)

Burden (2002) (as cited in) Rudd, T., (2007). Futurelab. Interactive Whiteboards in the Classroom.

Cuthell, J. P. (2005) Seeing the meaning. The impact of interactive whiteboards on teaching and learning Proceedings of WCCE 05 Stellenbosch South Africa

Dawes, L., Mercer, N., Wegerif, R., (2004). Thinking Together. Birmingham, Imaginative Minds Ltd.

Higgins, S., Beauchamp, G., Miller, D. (2007) Reviewing the literature on interactive whiteboards. Learning, Media and Technology, Vol. 32, No. 3, September 2007, pp. 213–225

Rudd, T., (2007). Futurelab. Interactive Whiteboards in the Classroom.

Wall, K., Higgins, S., Smith, H. (2005) 'The visual helps me understand the complicated things': pupil views of teaching and learning with interactive whiteboards. British Journal of Educational Technology Vol.36 No.5 2005 851-867

Wegerif, R. (1996). Using Computers to help coach exploratory talk across the curriculum. Computers Education Vol.26 No.1-3, p51-60 1996

Wegerif, R., Mercer, N., Littleton, K., Monaghan, F., Houssart, J., Sams, C., Cajee, P., Manners, N., Quigley, M. (2003). Thinking Together around ICT in the Primary Mathematics Language, Thinking and ICT in the Primary Curriculum project' (EDU/00169/G)

Appendix 1

Date:	27.2.08	**Activity length:**	60 mins	**Time:**		**Year Group/ Set:**	5	**Number of children:**	29	**NC Subject:**	Science
Learning Objectives:	To interpret data from charts and graphs To use logic, scientific knowledge and discussion with peers to match data to the appropriate chart.										
OMS/ Introduction (10 mins)	Recap what we did in previous graph interpretation lesson, by matching graphs to descriptions of science experiments. Introduce the idea of a balanced plate of food and show the pie chart that shows what a balanced diet consists of and the 5 food groups that the pie charts might show.										
Teaching Activity and Group work (25 mins)	Look at task on the smartboard. Read out instructions to the chn. Explain that chn have got a copy of the sheet, menus and pie charts or may be asked to work on a computer. (1 group to work on Smart board, one group on class computer and one on teacher's laptop) The aim is to match the menu to the appropriate pie chart by considering which of the food groups are represented within the menu and to which level. NS and TA to float around classroom offering support where needed. If chn finish this activity then they can create their own menu and try and assemble a pie chart to match it.										
Plenary: (10 mins)	Look at the work completed by the group on the Smart board and discuss their answers.										
Key Vocabulary:	Pie chart, fats, carbohydrates, sugar, dairy,										
Success Criteria	I can interpret the pie chart. I can give reasons for why I think something. I can write share and discuss the conclusion that my group comes to.										
Assessment:	Assess chn's contributions to their group discussions during activity. Children to look at their own work to assess if they have achieved L.O. and be able to discuss why or why not they the same or different answers to another group.										
Resources:	Pie charts, menu and balance of good health plate for each trio. Smart notebook file for 3 groups.										

Appendix 2

Date:	05.03.08	**Activity length:**	60 mins	**Time:**		**Year Group/ Set:**	5	**Number of children:**	28	**NC Subject:**	Science
Learning Objectives:	To interpret data from a circuit diagram and match it to a bar chart. To use logic, scientific knowledge and discussion with peers to match data to the appropriate diagram.										
OMS/ Introduction (10 mins)	Recap what we did in previous graph interpretation lesson, by matching graphs to descriptions of science experiments. Introduce the electrical circuits and discuss the meaning of parallel and series circuits. Look at a bar chart and elicit the meaning of the axes.										
Teaching Activity and Group work (25 mins)	Look at task on the smartboard. Read out instructions to the chn. Explain that chn have got a copy of the circuit diagrams and bar charts or may be asked to work on a computer. (1 group to work on Smart board, one group on class computer and one on teacher's laptop) The aim is to match the circuit diagram to the appropriate bar chart by considering which of the bulbs will be lit and how brightly they will shine. The children working on the computers will use an on line circuit to test their ideas while the other children will make the circuit using the bulbs and batteries we have at school. NS and TA to float around classroom offering support where needed. If chn finish this activity then they can create their own circuit diagram and appropriate graph.										
Plenary: (10 mins)	Look at the work completed by the group on the Smart board and discuss their answers.										
Key Vocabulary:	Bar charts, circuit diagram, wire, bulb, battery, series, parallel, switch,										
Success Criteria	I can interpret the bar chart. I can give reasons for why I think something. I can write, share and discuss the conclusion that my group comes to.										
Assessment:	Assess chn's contributions to their group discussions during activity. Children to look at their own work to assess if they have achieved L.O. and be able to discuss why or why not they came to the same or different conclusions to another group.										
Resources:	Bar charts, circuit diagrams, batteries, bulbs, switches, wires and connectors. Smart notebook file for 3 groups.										