

# The use of ict in science lessons



Critically evaluate the use of ICT in sciencePupils are now required to have ICT lessons where they can build their knowledge of ICT and its uses; there is also a statutory requirement for pupils to use ICT in every subject at school. My placement has been at Deyes High School.

The school has, this year, introduced a btec course in science. Through spending time in the science btec lessons I have noticed that a big proportion of the lessons are spent with the pupils using laptops to research and produce work. The use of pupils using laptops is also common across the years for all science lessons.

The teachers also use ICT in their lessons for a wide number of uses, such as power point, and videos. ICT is used in many different ways to support learning and particularly in science it seems to have many benefits. For this reason I have chosen to critically evaluate the use ICT in teaching science. According to the national curriculum, there are two ways in which using ICT can help enhance the learning of science, this is through simulation software and improving presentation. The first one, using simulation software, enables pupils to conduct investigations that they can control in various conditions and this allows them to predict outcomes . Through this simulation pupils able to be more creative in there thinking and test their theories. Simulation software is also particularly beneficial for teachers trying to illustrate an idea that is hard or impossible to demonstrate in the classroom setting.

Several studies have explored effects of the use of simulations and modelling. Hogarth (2006) conducted a review which identified studies relating to teaching science to 11-16 year-olds using ICT in science for

simulations. In this small sample, ICT simulations improved students understanding of science ideas and scientific approach. However when comparing this study to Bloom's (1956) work, it is found that the use of ICT only had positive effects on the lower levels of learning and there was no significant impact on higher level learning, for example designing an experiment. This is a disadvantage to the software as it should be used to help improve learning. It could mean the use of ICT could be more beneficial to different levels of learner, so it would be up to the teacher to decide whether the use of technology is necessary and beneficial to the lesson.

O'Shea et al., (1993) focused on aspects of pupils' misunderstanding of science concepts, whilst using the simulation software, the evidence they found did not lead to a definite conclusion with misunderstandings being high with and without the software. This could suggest ICT has no benefit to improving learning and also that there are some other factors other than the ICT that needs to be changed to reduce misconceptions, such as teacher testing understanding regular. The second benefit, the national curriculum (2010) says, of using ICT in science is that it improves pupils presentation of information, allowing them to demonstrate their understanding of science. This could be, for example, using graphs, pictures, creating a science poster, giving a presentation or creating a mind maps. The way in which ICT is used in science education can be divided into areas: data handling, communication and exploration showing ICT can have positive effects for the teaching and learning of science. Current research however shows that even where technology is available, it is often underused and that there are too many obstacles in the way.

Currently, the effective use of ICT in science seems to be conducted by a minority of teachers who are willing and enthusiastic to use what is available (Osborne & Hennessy, 2003). A teacher can use tool applications in several different ways, for example preparing assignments, tests and other resources that are used for teaching and supporting learning. Pupils can use these applications for things such as presentations, homework, ideas and also they can use spreadsheets for analysing data and presenting data in different forms. ICT helps pupils learn in science by giving access to information and ways to measure and analyze variables. ICT can provide quicker and more accurate data collection, saving lesson time and giving better quality results (Osborne and Hennessy, 2003), Methods of investigation are increased and the collation of data is made easier when conducting experiments. For example in a physics experiment looking at acceleration of a trolley down a ramp Data loggers can be used. These record and store measurements electronically, collect data more quickly and accurately, improving the quality and quantity of results as the reduction in error is removed (Newton, 2000). They can also help produce a table of results and a graph.

The production of a graph straight away allows for pupils to relate the data to the experiment straight away, without the delay of having to produce the graph through traditional methods, to allow for a greater understanding of the data (Barton, 1997). The production of a real time graph also allows for discussion over the data straight away, which the teacher can prompt and get involved with whilst the pupils still have the experiment fresh in their minds. The use of data loggers enables pupils to complete the experiment

faster and more accurately which leaves more time in the lesson for the pupils to interpret and discuss the results and come to a conclusion.

This shifts some of the focus from the doing of practical work to the analysis and understating of what is being observed (McFarlane and Sakellariou, 2002). This can therefore increase scientific understanding of the science being observed in experiments showing that it is a valuable tool to use in the classroom (Trindade et al., 2002). However when using equipment, such as data loggers, some time is needed to show pupils how to use them and with all ICT problems with equipment can occur.

The teachers should also ensure the appropriate ICT. For example, when taking single temperature measurements it may be better to use a regular thermometer and if looking at varying temperature changes, these could be recorded more effectively with a data logger and temperature sensor. Data loggers are of particular useful when two or more measurements are made simultaneously which is hard for pupils to carry out accurately so leads to more accurate data.

This use of ICT whilst it is quicker to carry out practical??™s and can lead to more learning, it does move away from the set of skills they are usually important in science for example; accurate measuring technique and repeatability. It does as, previously stated enhance the use of graphs, but the teacher needs to make sure that the appropriate practical skills are being learnt and used. When conducting experiments using a large screen display, for example a digital projector, is a way to enable the pupils to observe clearly what changes are happening when the teacher is carrying

out an experiment, for example I demonstrated reactive metals in water, this experiment is carried out behind a safety screen which meant that when the pupils were crowding round it was hard for them to see clearly and I those pupils at the back were not paying attention. Showing experiments on a large screen would allow for a greater number of pupils to clearly see and allowing for a whole class discussion on what is being observed. One problem in science is the lack of interest pupils have, with few students carrying science on past GCSE there must be something wrong in the way science is taught that makes pupils loose interest. Research has suggested that the use of ICT may help overcome this by it allowing pupils to have some control over their own learning and for them to be able to look at content which they think is relevant to them (Osborne and Collins, 2000). Research from Mistler-Jackson & Songer (2000) looked at one class of pupils participating in the Kids Global Scientists (KGS) Program, which is a project where pupils study atmospheric science through authentic images and online communication. They examined the motivational effect of the programme and findings indicate that students not only showed a high level of motivation but also gained a higher knowledge of weather.

This study shows that not only does the use of ICT increase motivation, but also allows for a greater understanding of the subject knowledge, showing that it is an effective learning tool. Another way of motivating pupils may be to allow them to produce work in different ways, like presentations, which allows for them to present their work in a more creative way, that they like and it also allows for them to work in groups. Allowing pupils to present work also improves pupil??™s communication skills and can improve self

confidence (Murphy, 2003). Teachers can also promote learning by referring pupils to websites that they can use as a starting point for research they need to carry out. The pupils can then use their own research skills to find any relevant information they need allowing for independent, self-directed learning (La Velle et al., 2003) However research shows that teachers should try to encourage discussion and interaction between pupils (Newton, 2000) this is so pupils can discuss what information they have found and share and swap ideas with other pupils, this can also allow for them to develop ideas through discussion. There is also research by Johnson et al. (1995) that shows that pupils working in groups on the computer rather than individually perform better in the task they are given, this is beneficial considering science practical work is mostly carried out in with group work.

Through the use of ICT pupils can work collaboratively and produce pieces of work such as a presentation, video or poster which allows for a more creative way of producing work. For btec lessons pupils were asked to research and present their work in a poster/mind map/chart. When they did, pupils used ICT imaginatively and made use of images and colours and were able to include relevant information they had researched on the Internet, they were more enthusiastic about doing the project on the computer as it allowed for them to be imaginative and so the class were focused for the lesson. I have found ICT helps the lessons flow more smoothly and allows getting through the material quickly. This is when presenting pupils with information you do not have to write on the board as the information is all ready on the board from a prepared presentation which helps flow. This also means as there are little gaps in-between getting the next section of the

lesson ready the pupils have less time to chat and stay focused. However it is important that the lesson is not entirely presentation based, I have found that the pupils will get distracted easily and that there is a need to allow for hands on learning.

Also whilst the use of a presentation may make the lesson flow faster there has to be time taken to prepare it in the first place so it is important to know if it will improve the lesson or the learning otherwise you would be wasting time preparing them. The uses of video clips are also very useful when trying to explain a difficult concept to pupils and also allows for them to see a phenomena they would not have otherwise been able to witness (Trindade et al., 2002), For example, an animated simulation of the digestive system should be used because it is the most effective means of illustrating the functions of the organs.

This is also a more stimulating way of showing the pupils the functions rather than feeding them information. I myself recently showed a video of caesium reacting with water, something that is far too dangerous to demonstrate in the classroom yet I think it benefited the lesson as it was a hook that pupils responded to. This is also true of using images and animations, pupils all have a different learning strategy and by mixing in images and videos you are able to accommodate for the visual and audio learners making the use of technology here useful. It is, however, important that teachers do not move away from doing practical??™s, with it being so fast and easy to show a video clip demonstrating something, the pupils are not gaining the same discovery experience by watching it being demonstrated or carrying it out themselves. To make science more credible to the average secondary school



pupil, the work can be put into a context that pupils will recognise as important in their lives and ICT is particularly helpful where a concept cannot be demonstrated or not something the pupils may have seen before, like an earthquake or volcano eruption. Research suggests the key to making effective use of ICT is giving pupils more opportunities for independent learning, giving pupils a chance to control their own learning (Newton, 2000).

From my own experience pupils can be left on their, to find the answers to question by using the laptops. Whilst some pupils like that they can research from themselves many pupils are not motivated to do any work and then you spend a large proportion of the lesson trying to motivate pupils to work rather than focusing on what the pupils are learning and what they understand. Nakhleh & Krajcik (1993) conducted a study looking at two groups of pupils, one using ICT (pH meters, computers) and the other not, when studying about pH, acids and bases. They found that those students who used the ICT to complete their work had a greater understanding and that their thought concepts were greater than those pupils who did not use ICT.

They speculated the reason for this could be that the pupils using ICT had to input data onto the computer and had access to a wider amount of information on the topic, allowing for greater thought processing. However the group using ICT also had the higher number of students who had a wrong understanding of students. This suggests that although ICT is useful in producing a more accurate understanding it can also lead to misconceptions, showing that the role of the teacher is still important in checking the understanding of the pupils whilst they are using ICT, and steering them

away from any unacceptable understanding. Teachers should therefore act as facilitators, guiding pupils through their investigational research and encouraging group discussion to assess learning. ICT also allows for contextualization.

This is when the pupils are researching, for example using Google, they are able to look at a number of different sources and see the concept they are researching in a number of different contexts, which should deepen their meaning of the concept. When allowing pupils to use search engines to research facts it is important that the teacher goes through their findings to make sure the information they have found has come from a reliable source. It is also important to note that when pupils are often researching and using information they have found they often use the copy and paste option into a word document. Whilst the pupils have found the information they need this can mean the pupils are not processing and understanding the information that they are copying. What may be more useful is getting pupils when they have found information to put it into a mind map or some other structure piece so that they are processing the information and allowing for deeper learning (Bentley & Watts, 1989) This is also why teachers should encourage discussion between pupils so they are able to process the information they are learning (Newton, 2000).

ICT has mainly been used by teachers to plan and prepare for teaching lessons. In my placement teachers use it in recording pupils assessment data and producing reports and setting attainment targets. They also electronically take the register so that all teachers can see if a pupil has been absent for any days or lessons.

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The school also has a shared drive that teachers can access that contains any lesson plans, worksheets or activities that can be used by other teachers to shave time and effort producing new ones. In my placement the science department makes use of the availability of laptops. Especially the btec lessons where they are available for every lesson. This shift from using laptops from going to the ICT rooms allows for the focus to stay on the science.

I think the use of laptops allows for discussion between pupils and teacher. The pupils are able to discuss their findings and ideas, I think it is easier for them to discuss as they can easily change what work they have done so far very easily and they are able to easily insert anything they might have missed. However one problem with allowing them to use the laptops for independent learning is that not all pupils will do the work they are supposed to be doing. Another problem is with the internet is despite restriction on certain websites, such as social networking websites, there are still websites the pupils are able to access and this can cause the pupils to lose focus on what they are doing, it is therefore important to make sure whilst the students are working you are walking around the room checking on the pupils progress and also checking the pupils understanding of the work they are doing. It is clear after researching this area that there are low numbers of research studies that specifically look at the value of ICT in science.

With the advances and increasing amount of technology available it is likely that the use of ICT in science lessons will increase which might produce more studies in this area. After critically analyzing all the research on the use of ICT in science, it is clear that it is more effective than ineffective when it

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comes to enhancing learning. However Current research would suggest, however, the role played by the teacher is still critical.

How I can maximise the use of ICT in teaching science is by being clear on how the ICT will support the lessons objectives and by using it as a tool and not just an information resource (Betts, 2003) When using ICT, such as simulations, it is also important that this does not lead to misconceptions, such as how the science works behind the concept and also using realistic values, as some pupils may try to use values you would never get just to see what happens (Osborne and Hennessy, 2003). The teacher is important for carrying out for ICT-supported learning through using the appropriate technology resources, and conducting appropriate activities. It is important that when using resources, they will be used to increase the learning effectively and for the right purpose. This is up to the teacher to decide and it can depend on the learners in that class, as some might benefit from it and others not. Research also suggests that whilst ICT is being used in the class, especially for independent learning, it is important that the teacher still remain involved to correct any misconceptions and to ensure learning is occurring. From looking at the research I have found that when I go to teach a lesson it is important to look at the practical considerations before deciding whether ICT should be used. This includes looking at the teaching objectives and see if they can be met effectively if using computers.

It is also important to see if the classroom that I will be teaching in has computers and if so how many and also if the laptops are available and to decide weather pupils should work individually or in groups. It is also important to consider whether a particular use of ICT is any more effective

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