IMPACT OF COMPUTER TECHNOLOGY ON DESIGN AND CRAFT EDUCATION

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ABSTRACT

This research aims to answer the question, 'How has the use of computer technology benefited the compulsory education system, focusing on Design and Technology?' In order to reply this question, it was necessary to focus on interactive whiteboards, e-portfolios and digital projectors as the main technology formats. An initial literature review was carried out to establish the views of academics on this subject area and therefore direct the primary research in a useful way.

An online survey including 10 questions was created to collect data in order to answer the questions and to maximise the number of people that this survey became available for. The questionnaire included questions about general technology use within the Design and Craft classroom as well as specific quantifiable questions concerning interactive whiteboards and digital projectors. The research, among other things, concluded that using advanced technology inside Design and Craft relies on teacher is imagination and creativity to truly make full use of the products available. The products advertise themselves as tools for teaching and learning that enhance children's performance in a simplistic way, but this can only be done by well trained teachers who are willing to adapt their teaching style to incorporate them.

Keywords: Compulsory Education, Computer Technology, Design and Craft.

INTRODUCTION

The primary aim of this work was to establish to what extent the development of computer technology has benefitted the school system for pupils aged 6 to 16, with a focus on the Design and Craft subject area. The use of technology within this area was looked at to establish whether the modernisation of the subject and increased use of computer technology has affected the teaching and learning of the pupils. Initial research of the literature base surrounding the area helped to concentrate the primary research on to the use of interactive whiteboards, digital projectors and electronic portfolios (e-portfolios). This allowed the research to be teaching and learning based as opposed to a general discussion of technology benefits.

Questionnaires were given to teachers and ex-pupils to ascertain whether technology change has a visible impact on the teaching and learning of pupils in recent years. Mainly closed questions were used to make it comparable and quick to complete. Two open-questions were asked to ensure the questions weren't too guided and therefore the results were reflective of the true reality of the situation. Through both literature review and primary research, it was evident that the variation between schools in terms of technology use is vast. With this difference, it made it possible to establish the use of interactive whiteboards, digital projectors and e-portfolios and has benefitted the subject Design and Craft within state schools (Barrett, 2004).

Literature Review

The Office for Standards in Education (OFSTED) is the governing body for education an England and Wales, with regular reports being produced and monitoring of schools taking place to maintain a high standard within them. These reports can be used to compare different schools as well as improvements or deterioration in a particular school. In the recent years, OFSTED hasw produced national statistics open to the public called 'Data View' that allows people to compare various regions and the overall country statistics. As they are the governing body they have a very rigorous and standardised form of testing in schools so the statistics acts as a good guide to compare the difference in standards in the last three years. There has been a slight improvement in England over the last three

years with 18% of schools in 2012 being rated as outstanding as opposed to 14% in 2009. It is evident that schools are improving but this report intends to uncover whether this is due to, or influenced by, technology improvements. Technology within schools can vary dependent on their catchment area and the geographical area by which their pupils come from. Due to the variations in society, different places have varied wealth and therefore this can be reflected in the standards of schools in terms of what can be provided. It is important to understand whether technological products do have a major effect on the teaching and learning of pupils to then understand whether wealth affects the standards of teaching within school.

Kimbell (1997) noted that data technology itself is used as an assessment tool by governing bodies which allows it to be used as a tool to improve standards in schools. This assessment can focus on problem areas relating to the personal circumstances of children in order to boost those into are struggling. This is an indirect attempt of improving pupil's learning through the use of technology as the pupils themselves are not using the technology to learn. Using assessment tools that can establish the areas of focus in schools, teacher's time can be allowed to be used more effectively and therefore can improve the teaching and learning of pupils.

On the other hand, Kimbell then proceeds to explain the problems with using technology as an assessment tool, acknowledging that it can sometimes skew the results. Whilst watching two teachers from Essex assessing their Design and Craft class using Statutory order of Assessment (SoA) ticking, it is found that, the teachers disagreed with the overall outcome of the pupils which meant that they retrospectively revised them after to ensure pupils were getting the marks that they deserved for their subject ability. Although it is possible to assess pupils using technological systems, it can go against a teacher's intuition of the pupils meaning that they may overrule its outcome. So, a teacher will ultimately decide their own goals and areas of focus based on intuition, so an assessment tool may be good for helping others to understand a teacher's view, but it may not actually assist the individual teachers.

This leads on to technological tools and products that pupils are able to use themselves. An e-portfolio allows children to digitalise their Design project work and create a working story of how it was developed. Kimbell, et al. (1991) spoke of how a teacher's prior knowledge as the 'expert' in the field, steers the pupil to the solution within the project. This restricts the amount of knowledge taken on by the pupil as it is selective teaching and therefore the question is whether they are learning the process or memorising it? If this is the case, the use of e-portfolios makes it easier for teachers to allow pupils to continually change their work to what they believe to be correct. Kimbell (1997) later states that it has evolved from being an assessment of pupil's knowledge and skills to being an assessment of how they can use technology in order to tackle technological tasks. Kimbell continues by saying that the subject has become more about the use of technology within design and so the priority within schools has changed.

It is clear that the use of technology is now integrated into our everyday lives. So Design and Craft in schools has started to reflect that. Technology is being used within lessons to aid the teaching and learning of pupils in a way that they are used to. It has become necessary to teach how to use particular products to ensure that pupils have enough knowledge to become competitive in the working world.

Middleton (2008) also highlighted that the teaching of Design involves greater use of computer technology. Middleton proceeds to explain that computers are commonly used for pupils to control machinery such as lathes, mills and robots and to design new products through the use of 3D CAD. However, Middleton acknowledges that although, computer technology is more frequently used within schools, no research has been done to prove the extent to which it improves the learning of expert software use. The problem with researching this area, was that there is a lack of true experts within CAD. In addition to this, Middleton (2008) stated that "experience does not always equate with expertise", saying that experienced CAD users often continued and opted for the use of sub-optimal strategies.

So, whilst it is clear that technology has become a part of

the Design process in schools, it has not been proven definitively whether or not it has improved pupils' knowledge of how to use expert tools. It would require an expert to research this to prove whether the increased use of technology on products such as lathes has created a more knowledgeable compass of Design pupils leaving schools.

Middleton (2008) later goes on to speak of an area of design that has been transformed by the use of technology i.e portfolios. With the use of computer technology increasing worldwide, the collation of work has become an e-portfolio which is a computerised catalogue of work. Within schools, it is now used to present the story of how their work has developed, having the ability to be continually updated and improved upon for the marking process. A noted problem with this type of documentation is that, it is an activity that takes place after the designing activity. It is a backward glance at what work has already been undertaken and therefore can present a skewed version of events.

Kimbell (1997) also believed that the use of computers to produce an e-portfolio was backwards. Kimbell pointed out that the workshop in which pupils work to produce their work is often messy as well as the pupils being dirty or oily they would be unable to work on a computer simultaneously. This shows how the technological side of the designing process is not necessarily carried out in way in which it is presented later on and therefore not being utilised to its full potential.

Kimbell (1997) agrees, believing that e-portfolios lack a vital element; annotation. Kimbell states that, it may be clear how the project was developed, where the student's voice is missing from the project. If the marker is unable to establish what the student was thinking it creates a gap in the marks that the pupils are capable of obtaining. However, the research process can actually enhance the project's potential. The area that can be researched is significantly increased by the use of the internet with a wider access to journals and articles as well as the opportunity to speak to experts in the field without having to leave the area of work. This saves considerable amount of time which is a major consideration within school projects, thus making way for the creation of a better project and a better understanding of the area being studied.

Owen-Jackson (2000) notes the importance of acknowledging the use of technology within the industry in order to better understand the subject. The subject can only be truly understood, if it is realised that the designing of a product is inextricably linked to the processes that created them(Davies,1999). Therefore, in order to prepare the students for working in the design industry it is important to provide them with an understanding of various technologies.

It is clear that there are varied opinions from academics on the subject of technology use within the teaching of Design and Craft but it is also important to acknowledge the views of the people at the heart of the teaching process. So, primary research was carried out to gather the views of the teachers involved in Design and Craft as well as ex-pupils who have experienced the other side of this.

Research Methodology and Data Collection

A survey comprising of ten questions was created online to minimise the time needed to complete the survey and for the ease of use for sending it out. This maximised the number of people that the survey became available for. Saunders and Thornhill (1997) state that unlike the data collected from interviews, questionnaire data can be more readily analysed as well as it is less time consuming.

In addition to this, the same survey was printed and sent to the people that were regarded as the primary target market for the questionnaire to ensure there was a big enough range of respondents. This was because many people who would receive and respond to the questionnaire on online would typically be in the age range of 18-23 and in the ex-pupil category. So it was necessary to send printed versions to teachers in a range of schools to achieve an accurate and unbiased result. By sending the same survey to both groups of people it kept the results comparable and stopped the questions from being too directed at individual people or groups.

The questionnaire included questions about general technology use within the Design and Craft classroom as well as specific quantifiable questions concerning interactive whiteboards and digital projectors. Both digital

projectors and interactive whiteboards are commonly used within the training of new teachers as tools for aiding the teaching of pupils. Each completed questionnaire was gathered and data collated.

Once the data was collected it was then interpreted by comparing and contrasting actual results against the literature, which enabled the conclusion drawn to be a more realistic overview rather than a summary drawn purely from the immediate environment. The questions that had set answers provided quantitative data which was analysed using a numerical system making it easy to compare and draw a definitive conclusion (Saunders, Lewis and Thornhill,1997).

The qualitative answers were more difficult to compare as they were open to interpretation but they did provide more information about the feelings towards the technology which the quantitative data could not do. Cooper and Schindler (1998) highlight that offering incentives, like the which findings of the research will be shared with the participants, has a positive effect on response rates. Also sending covering letters have been found to make participants feel more comfortable in taking part along with anonymity.

Analysis of Findings

Of the 30 participants who were contacted specifically with a printed questionnaire, only 21 completed it, which highlighted the importance of having an online version available for a more open range of responses. In addition to this, it allowed the results to be genuinely anonymous as there was no way of tracing who had filled in this version of the questionnaire. This also added an additional 18 participants, making the total number of people to complete the questionnaire as 39.

Implementing the technology

The most notable result from the survey was that the technology in schools was not utilised fully. A mix of both ex-pupils and teachers stated that teachers were not fully trained to use some of the technology what were provided for them. This resulted in teachers avoiding the products and therefore resorting to traditional teaching techniques which they felt more comfortable using from their training.

Confusion

There was also confusion between a data projector and an interactive whiteboard, with many teachers using an interactive whiteboard simply to project their laptop screen and so it was no longer being used as an interactive tool. 80% of the people said that their school has/had an interactive whiteboard, however only 50% of these people believed that the interactive whiteboard was being used to its full potential. This statistic could be distorted due to the nature of the questionnaire. As it was self-assessed it is unlikely that many teachers would admit to not using their resources properly.

A common answer that arouse was that the interactive whiteboards don't allow for normal whiteboard pen use. This means either you are restricted to just using the technology or having another, separate, whiteboard for quick drawings. Many teachers struggled to draw diagrams on the interactive whiteboard, opting for a pre-drawn diagram, using a separate board, or even paper. Sometimes, it is necessary for a teacher to produce a quick drawing for something that needs to be explained that they didn't expect. So it is not always possible to prepare in advance with a neat electronic diagram.

Support to class discussions

Nevertheless, interactive whiteboards were also said to be a great asset for class discussions. It tends to encourage more children to actively participate due to the uniqueness of the product, with intrigue and curiosity acting as a persuasive tool. Many ex-pupils who had experienced the use of interactive whiteboard said that it made the lesson more fun. Teachers concurred with this, believing that interactive whiteboards helped to keep focus in the lessons for the more boring topics on the syllabus.

E-portfolios a support for teachers

E-portfolios were perceived in a positive light with many ex-pupils commenting on how they promote the use of internet based research to enhance their project at the early stages. The research stage of the project tends to be where many pupils fall behind as they find it boring and don't always understand the relevance to their project. If an e-portfolio can help to make this stage easier for pupils it has got to be a positive step in improving their course work.

In addition to this, some ex-pupils said that they found they were able to include more work in this format due to the way they could edit their work, enabling them to present it in chronological order even if it wasn't produced in this way.

Although this is one, Resistant Materials, as teacher mentioned, can distort the true working process carried out by a pupil, creating the illusion that the pupil 'ticked the boxes' first time round. In reality, most children forget to do certain things until they see a mark scheme in the later stages of the project. The teacher should note that children shouldn't be marked down for doing things in the wrong order, but encourage to include things as they happen. So that the research is a true reflection of the physical product and not a 'box ticking exercise'.

But, in the same respect, some teachers also acknowledged the flexibility of e-portfolios provided. They allow the distribution of several copies of the pupils course work to be viewed by various people whilst not damaging the progress of their work. By being able to have several people view the work with no extra financial or time costs it is possible to gain large amounts of feedback from a variation of people. Course work is, after all, designed to be reviewed and improved from research and feedback.

Benefits of using the technology for students

The benefits of technology use within the school environment seemed to be highlighted by the ex-pupils, with them having the more positive view on its use. The results showed that, of the 24 ex-pupils asked, 23 preferred using an e-portfolio to paper coursework. An example of a reason given for this was that they could edit their work right up until the point of submission, making it easier to get higher marks after feedback from teachers. This shows that the ex-pupils knew how to utilise their freedom with e-portfolios. They were aware that they could get feedback again and again to improve their work at the earlier stages even if their product wasn't necessarily improving as a result. This poses the question. Is an e-portfolio a distorted view of the real process involved in the making of a product by a pupil?

The e-portfolio process certainly appears, visually, more professional but does this cover up the backward thought process involved in this style of presentation? And does this truly reflect a working process that would be used in a professional environment? An e-portfolio certainly allows for more intense research which can only be the positive. Moreover, this research is used properly down to the pupil, but the technology opens up a forum by which a pupil can obtain higher marks and a more thoroughly thought about product.

One teacher stated that, an e-portfolio allows the pupil's course work to be marked again and again without interrupting the progress of the child's work. Whereas paper course work would require the pupil to give up their work for a week, but an e-portfolio can be emailed to the teacher to mark when they see fit. In a school environment where time is limited and valuable this is a huge benefit to the pupils. It also helps teachers to assist on product developments.

Use of the technological product on a daily basis

82% of participants stated that, pupils are/were able to use the technological products within the school on a regular basis if needed. This is a major benefit, showing that in most schools, pupils are able to make full use of the technology available within their school. It also implies that, pupils are able to use the products independently at times, which often leads to a deeper understanding of how the product works as it allows for a stronger interaction with the product. The more access of a pupil to the product the more confidently they will use it and therefore try new things. Within design, it is important that trying new things is promoted to encourage innovation.

An interactive whiteboard is designed to be used primarily by the teacher with controlled interaction from the pupils. Interactive whiteboards, from a teacher's point of view, seemed to help for the structure of the lesson. From the research it appeared that it allowed pupils to contribute and discuss subject related problems rather than just do their own work. Peacock, Ashton and Henderson (1989) believed that, group work enabled flexibility and advances in knowledge. This highlights the need for group work within a designing environment to allow for innovation. Interactive whiteboards functionality is advertised as being a part of group interaction, thus promoting innovation.

Martin (2007) believes that without innovation, society can

stagnate. So it is important that innovation is promoted within a design environment, in order to encourage new designers and change makers into the society. A major element of Design and Craft is creating an innovative product which helps to inspire innovation.

The impression is that digital projectors have been used for longer in schools and therefore teachers feel that they are more comfortable using them. It is apparent that confidence in technology use results in better implementation of the product. So whilst interactive whiteboards are still relatively new, there is time for improvement in their use within the classroom.

Limitations

As with any product or change, they come with limitations. The e-portfolio format seems to work well for the pupils however, there are obvious concerns that it is not a genuine reflection of the pupils work process. This can't be ruled out unless it is compared directly with the 'old style' paper working in a controlled environment with the same project. From the primary research it seems to be a positive use of technology, but is this just because it seems to help getting better marks? If the higher mark is not deserved then surely is it not a good use of technology?

In addition to this, it appeared from the research that some pupils found sketching and annotating as the project progressed in a workshop could have been a faster way of producing the same quality of work. This is mirrored by Martin (2007) who states that, for the experienced, sketching in a paper format and annotating at the same time is quicker than producing the same work digitally. With this in mind it seems illogical to use a process that takes more time and removes the creativity from what is known as a 'creative subject'.

Differences between schools

There appears to be a significant difference between schools and classrooms in terms of what products are provided. The questionnaire was focused on interactive whiteboards and digital projectors. 38% of the participants said they had both an interactive whiteboard and digital projector in their Design and Craft class whilst 56% only had a digital projector. This shows a large gap even within the small group of people who participated in the survey. So, if technology does improve the teaching and learning of pupils, this gap is a major problem.

Just having access to a digital projector isn't necessarily a problem if the use of the product is innovative and successful. However, as teachers stated, an interactive whiteboard aids the structure of the lesson and allows for a more creative start to the lesson. In a lesson such as Design and Craft where creativity is an important aspect, it is essential that the start of the lesson reflects this to allow the pupils to develop it in the short time they have in that environment.

An interactive whiteboard advertises itself as a product that helps teachers bring collaboration and interactivity into the classroom. They are designed to be an evolving product that is easy to use by teachers. However, a digital projector alone requires teacher innovation and imagination to get an interaction from the pupils. With there being a large gap between what products the schools provide, it means that pupils at different schools are interacting with different technologies and therefore learning different things.

Teacher training

The national curriculum doesn't specify the products that teachers use to assist learning for the pupils such as a digital projector or an interactive whiteboard and yet it seems it can affect what and how much they learn, so should this too be something that is standardised to ensure equal learning opportunities at different schools? The state school system, at present, aims to create equal opportunities for children of all backgrounds.

Some teachers and ex-pupils highlighted that the interactive whiteboard is rarely used because the teachers struggle to use it properly. Many teachers believed they didn't have necessary training to use the interactive whiteboard as more than just a digital projector and therefore it was being wasted. So while it is a great tool to have, if the teachers aren't confident in using it, they will just revert to more traditional teaching methods.

Whilst it appears that technology is a forward step, it does require additional teacher training to ensure it is utilised effectively. It also relies on the teachers putting in extra time and essentially learning a whole new style of teaching. However, from the research, it is apparent that pupils don't

need as much directed teaching of how to use the technology they are presented with as the teachers, which may be due to how it is integrated into their daily lives already.

New opportunities for students

But it appears that technology alone can affect the opportunities available to children. Any product that consistently assists the teaching and learning of pupils should be made available for schools to help improve the standards of children and to increase their potential when they finish school. Children tend to understand the way technology works through trial and error whereas adults often want to read a manual or be taught. This curiosity that is evident in children is enhanced through technology use. Design relies on curiosity and creativity to enable pupils to come up with an innovative idea so technology can be essential for creating and building up these vital skills.

Wellbourne-Wood (1999) stated, after a thorough analysis of research into the e-portfolios in the UK that, it is not a question of whether e-portfolios are necessary. He believes it is more a case of developing a way in which e-portfolios should be assessed so that it fits with the way in which Design and Craft pupils work. E-portfolios allow pupils to have their work marked several times over the course of the year without it stopping their progression. With paper coursework, in the past, children had to hand their work in and this would then take away the option to do work during a preliminary marking process. Therefore by having an electronic portfolio, it is possible to check work several times over without affecting the pupil's progress. This allows teachers to provide more regular feedback and therefore the work submitted becomes a higher standard. It also gives teachers the peace of mind that their pupils are at the right stage in the project and not leaving things to the last minute.

Risk taking in teaching and learning leading to innovation

Risk taking within design, still, is thought to lead to innovation. Crusader Solutions and Services (2013) believed, after a research study, that risk taking came when children were allowed to think without consequence and this seemed to happen in an open discussion environment, thus supporting an interactive whiteboard style approach whereby children are encouraged to discuss as a group rather than being continually assessed.

Interactive whiteboards, from the results of the questionnaire, appear to be successful in encouraging the teachers and pupils to engage in the topic and making the classroom more of an open environment for discussion. Many teachers, spoken to, stated that interactive whiteboards have helped with the structure of their lessons due to the ease at which a starter and review activity can be compiled for a productive discussion with in the class.

But this in itself can take away from a teacher's individual style. By relying on an interactive whiteboard for structure within a lesson, it can in fact take away the imagination of the teacher, making one teacher's lessons the same as another's. Without something unique in the lesson, it is unlikely to be remembered by the pupils. Differentiation between lessons allows pupils to remember the vital information required for the exams further down the line.

The benefits of compulsory education

It is important to compare both the primary research findings and the work of academics to establish whether recent technology introductions to Design and Craft as a subject area have benefited the compulsory education system. Martin (2007) spoke about e-portfolios being a distorted view of the real 'story of work' taking place during the project's lifespan, this view was reflected in the comments from the teachers who participated in the questionnaire. They stated that the e-portfolios allowed several research changes to take place when a product had already been completed, meaning that the research, in fact, had no effect on the outcome of the product. This in itself proves that e-portfolios can be a skewed view of a pupil's real time workings.

OFSTED, has shown that between 2009 and 2012 schools have improved. But could this be, like e-portfolios, a skewed view. Have children genuinely improved in intelligence and attendance? Or is it just the schools have learnt to 'tick the boxes'? If so, could this be how e-portfolios have worked, they simply present what is expected of a Design and Craft project rather than presenting an innovative and 'blue sky' thinker who would one day become a great designer?

OFSTED do, however, appear to like the integration of technology into the classroom. As the subject title states, it does involve technology in the working world and so this needs to be apparent within schools too. The use of computers and the internet has changed the way industry works, allowing companies to communicate across the globe. So schools need to prepare children for this way of working with regular internet access.

Thorsteinsson and Page (2004) pointed out that the research area is significantly widened with the use of a computer and an e-portfolio to document the work. Ex-pupils who answered the questionnaire felt that the use of a computer not only widened their research but also allowed them to research areas when they were too shy to ask for help. This shows that by using technology, pupils can have access to higher marks than they may have been capable of, without it as a support forum.

Kimbell et al. (1991) believed that the teacher's prior knowledge of the subject area tends to make them steer pupils in a set direction. With the adaptability of e-portfolios making it so easy to continually change their work, it allows pupils to change their work accordingly. Pupils stated in the research that they felt they could get higher marks because of the amount of times they could change their work before the submission.

This could mean that as the project progresses, more of the work can be influenced by the teacher's knowledge and therefore less of it being the pupil's ideas. Benson and Lunt (2009) believes that e-portfolios lack a vital element; annotation of thoughts. He states that while it may be clear how the project has developed, the student's voice is missing from the project. This wasn't acknowledged by teachers or ex-pupils in the primary research, but this does not mean it is not the case. If a teacher is able to check the coursework several times and advise on changes, then it is possible that the lack of annotation is eradicated by the end of the project.

An interactive whiteboard is used by the teacher providing the work to be discussed or used in an activity prior to the lesson. Kimbell et al. (1991) pointed out that teachers tend to use their prior knowledge to direct pupils. An interactive whiteboard allows this habit to be used in a positive way, starting pupils in the right direction but giving them the freedom to come up with their own ideas. A digital projector alone however relies on teacher innovation and imagination to create this type of discussion and interaction. A digital projector obviously has the capacity to be a tool used for discussion, but it cannot be used in the same way as an interactive whiteboard, whereby pupils can walk up and touch the board to make changes on the screen. Pupils are naturally drawn to things that are new and unique, so a digital projector that just projects a standard screen on to a flat surface is no longer creating the same buzz as it once was.

Technology within schools has undoubtedly increased in use over the past 20 years, but the question is, to what extent has it affected the education system? With a more technological society, it is important that what is taught in schools reflects the real world. It is necessary to teach pupils how to utilise technological products within their work in order to prepare them for working life. But is this being done in a way that allows the teaching and learning of the pupils to be improved?.

It seems that while an e-portfolio format allows for a more in depth research process, it does not allow for a chronological way of working as it appears. This should be reflected in the marking, with it being marked as a folio of work rather than a working process. An e-portfolio format appears to create more thorough work and appears to suit pupil's ways of working, but the way in which it is marked doesn't reflect what is produced.

Kimbell (1997) stated that, Design and Craft has become more an assessment of how technology can be used in order to tackle technological tasks rather than being an assessment of pupil's knowledge and skills. It is clear that the introduction of products, such as interactive whiteboards, have altered the style in which Design and Craft is being taught within state schools. From the primary research, it was evident that, when the technology was used as it was designed, with the full interaction taking place, it was generally a successful innovation for schools. However, the problem in the current school environment is that many teachers haven't had any training to use these products in the same way they are trained to teach. This leads to a

number of teachers avoiding or unable to use the interactive whiteboards and digital projectors to their full extent. A simple course or manual is what some teachers have suggested to help them with this. In reality, all teachers have access to the internet and therefore they could search for things themselves in order to develop their understanding of the product. It is evident therefore, that teachers are simply scared of getting it wrong in front of the pupils.

The governing body of schools and teachers, OFSTED, regularly produce reports detailing their findings from the schools they visit. Recent national reports have shown that schools, overall, have improved over recent years, but it is difficult to determine whether this is inextricably linked to technological advances. If the technological products do however aid the teaching and learning of pupils, like the primary research implies, then this would be the case. The mix of people being asked questions within the research process was vast. Due to the questionnaire being anonymous it is impossible to know who answered what, other than the year they left school being a pointer. Different character traits obviously result in different answers and opinions, which would make the results opinionated. Opinions are formed from experience, so it is important to acknowledge that not every participant had/has the same school experience and so their answers would have reflected that. Gender can also be a variable factor when it comes to technology use. Wellbourne-Wood (1999) reported that studies have shown that boys are more likely to have a computer than girls whereas girls are more likely to simply have access to a home computer. The less technology tends to be used, the harder it will be to use it to its full potential.

Wellbourne-Wood (1999) stated that, within Design and Craft there was a clear gap created by stereotypes; girls typically shied away from the subject because it was a 'boy's subject'. This would imply that boys were more likely to be the subject of the questionnaires, although it is not possible to prove due to the anonymous nature of the questionnaire. On the other hand, girls typically, are more likely to complete a voluntary questionnaire than boys. Design and Craft tends to be male orientated, so if this is the case and more girls answer the questionnaire than boys, this could potentially present slightly skewed opinions and therefore results.

As OFTSED shows, schools can differ massively in the way they perform in subject areas depending on their geographical area. A school that gave the most feedback from the postal questionnaires is classed as the 3rd quintile for most areas such as exam results and attendance, so this was classed as an 'average' school. However, the online questionnaires may have been completed by people who have attended or worked at higher schools. All of these variables can affect the results but it was important to obtain anonymous results to ensure honesty in the answers given. In addition to this, a mix of teachers and ex-pupils were asked to get a rounded view of the area. This in itself makes way for a large variation in answers and viewpoints, had teachers and ex-pupils been compared separately, the results probably would have told a different story.

Conclusion

By looking at the way in which technology has been used in schools, it allows for a better understanding of whether this has been a benefit to the teaching and learning of pupils in compulsory education.

It is evident that, e-portfolios are growing in use within state schools and with this their usage is being enhanced. Pupils are learning to use the e-portfolio format to their advantage to gain better marks and illustrate their design process. Wellbourne-Wood (1999) pointed out that an e-portfolio helps to encourage pupils to gain a wider research base through the use of the internet, having access to journals, articles and the opportunity to speak with experts in the field.

Crusader Solutions and Services (2013) spoke of how the collation of work in an e-portfolio allows pupils to continually update their work. A noted problem was this, type of documentation takes place after the 'messy' designing process and so it is not necessarily a true story of work.

The nature of e-portfolios makes them a very flexible way of working so that pupils are able to have their work assessed whilst continually moving the project forward. However, it was suggested that this can lead to teachers directing pupils down a specific route in their project that they would

otherwise not have taken. Because e-portfolios make it easier for repeated teacher feedback compared with paper style coursework, it highlights the need for an updated assessment process to ensure pupils are receiving the marks they deserve.

There is no doubt that e-portfolios have enhanced Design and Craft in schools, allowing their work to reflect that of a professional. But it is necessary to acknowledge the need for a change in the way it is assessed as it is not simply paper coursework put on to a computer. With an e-portfolio, pupils should be expected to obtain higher marks due to the wider access of resources available to them.

Interactive whiteboards are arguably the most used technological innovation by teachers in recent years. With this in mind, it is important that they are used effectively by the teachers to ensure enhanced learning for the pupils. From the research gathered it is evident that, a large proportion of schools now have access to them. Many teachers are still unable to use them to their full potential, thus limiting their effect.

It was stated that, many teachers in state schools find interactive whiteboards confusing without prior teaching. They felt that they were expected to use them and yet they weren't provided with the education in which to do this. This resulted in many teachers simply using them as a digital projector. If the product is not used as designed, it is essentially a waste of school resources. However, for those teachers who had the confidence or support to learn how to use the interactive whiteboards properly, it was a very good tool. An interactive whiteboard has the capacity to be used for large, interactive group work which, within Design, helps aid innovation. With innovation comes higher marks, so it is a necessary teaching style to help the teaching and learning of pupils.

Crusader Solutions and Services (2013) spoke of how a teacher's prior knowledge in a subject can affect and what they teach to their pupils. An interactive whiteboard allows both controlled and directed discussions whilst still helping pupils to come up with their own ideas. Barber, Cooper and Meeson (2007) state that technology is important to better understand a subject. The use of technology within Design and Craft is essential to prepare students for when they enter the industry. With technology advances being so rapid it is important to prepare pupils for how this will be integrated into the careers they may enter in later life.

A digital projector relies on a modern and imaginative teaching method to utilise the technology. This is hard to assess through self-assessed questionnaires as teachers will generally perceive themselves to be relatively imaginative. Digital projectors are used in most schools in the country, making them an essential to teaching and learning for many teachers. But this does not mean that they offer much more than a traditional blackboard and chalk for pupils. It is simply a tool that makes lessons easier to prepare for the teachers, with a PowerPoint presentation being produced before the lesson and simply projected when needed. This, arguably, benefits the pupils as teachers spend less time writing on the board and more time discussing and engaging with the students.

While technology advances make creative discussions and sharing of information easy within a school environment, it relies on teacher imagination and creativity to truly make full use of the products available. The products advertise themselves as tools for teaching and learning that enhance children's performance in a simplistic way, but this can only be done by well trained teachers who are willing to adapt their teaching style to incorporate them. So, it has become clear from the research that teachers now need to adjust with the modernisation of their subject in order to prepare their pupils for life in the Design industry.

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