

Can pupil perception of D&T be changed to affect engagement?

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Abstract

In recent years design and technology (D&T) has seen a decline in the number of pupils choosing to study the subject at Key Stage 4 (KS4). While this may in part be due to changes within the National Curriculum (NC) it may also be attributed to pupil perception of D&T.

This research project focuses on pupil perception of D&T and some measures that can be taken to improve engagement within the subject. Various questionnaires were performed to ascertain pupil perception, what pupils found more or less enjoyable and what could possibly be improved. Pupil engagement was monitored by a classroom teacher in both cases in addition to lesson enjoyment questions completed by pupils at the end of the lesson.

The research has found that strategies included using relevant subject matter to pupils, increased use of technology and the delivery of content by the teacher can all affect pupil engagement.

Introduction

The way in which pupils perceive a subject can directly affect enjoyment and, in turn, engagement within the classroom. Pupil experience and perception can be insightful and very significant when trying to understand both teaching and learning (Benson and Lunt, 2011) and also have the potential to enhance achievement and learning (Nixon et al, 1996, cited in Flutter and Ruddock, 2004). This was taken into consideration after observing pupil reaction in relation to D&T classwork in two placement schools where pupil perception of the subject was often one of indifference or negativity especially in regard to none practical work. It was decided that a study would be undertaken incorporating various strategies in an effort to improve pupils perceived value, interest and engagement of D&T projects and associated academic work. This could possibly encourage more pupils to choose a D&T related subject to study in KS4.

Literature review

In England, D&T has a relatively short history. A history that has often been challenging due to the subjects craft based origins, where design was not a central component (McLain, 2012 and Martin and Riggs, 1999 cited in McLain et al, 2014). D&T has undergone many changes since its introduction into the NC and when it was first included in 1990 under the name Technology, teachers met it with uncertainty (Benson, 2000, cited in Wakefield and Owen-Jackson, 2013). The methods by which pupils were to be exposed to the subject, as well as the subject's purpose and content were continuously debated (Wakefield and Owen-Jackson, 2013) and this often led to untested tactics and classwork (Mark and Houghton, 2002 cited in Wakefield, 2013).

D&T was introduced as a compulsory standalone subject in 1992 being 'the product of a sustained period of innovation,' (Toft, 2007, p.265) and has continued to evolve whilst going through four NC reviews between 1993 and 2012 (Roberts, 2014). In 2013 a new programme of study for D&T was introduced nationally to be 'taught in all maintained schools in England from September 2014' (DFE, 2013b). Although academies, independent publicly funded schools, can decide how to deliver the curriculum (DFE, 2014a), the design

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and technology association (DATA) 2014, envisage academies still use it as a 'basis for their own curriculum.'

During D&T's life, the NC has also developed and this has, in recent times, been viewed to the detriment of D&T especially in relation to the English Baccalaureate (EBacc). The EBacc is not a qualification but a non-compulsory performance measure to display to parents 'where pupils have secured a C grade or above across a core of academic subjects at key stage 4,' (DFE, 2014b). The EBacc only encompassed the subjects of English, mathematics, history or geography, the sciences and a foreign language. Steers (2014) identifies that many people questioned why arts-based subjects such as D&T, religious education and citizenship were not included with the 'limited range of "academic" subjects' included within the EBacc. White (2011, cited in Steers, 2014) distinguished the EBacc as archaic, comparing it to the 1868 Taunton report's curriculum, which although possibly suitable at that time, was far from appropriate in 2010. Plans for the EBacc to replace existing GCSEs were scrapped in February 2013 by the Education Secretary at the time, Michael Gove (Politics.co.uk, 2013). Unfortunately by that time, many people invested in D&T's future felt that a great deal of damage had already been caused by the EBacc which not only affected the numbers of pupils choosing a D&T subject for KS4, but also the amount of trainee teachers willing to specialise in the subject (Green, 2014, cited in Burns, 2014).

DATA performed a survey answered by 1300 of its members. The survey found that 89% agreed that the EBacc and its successor Progress 8 (DfE, 2014c) influenced 'option choices [...] resulting in lower D&T numbers' (DATA, 2015). DATA also published comments associated with the survey, highlighting that some teachers felt their pupils were missing out on D&T related subjects due to the EBacc, 'they are being pushed (against their desires) into additional sciences and Ebacc subjects in which they have no interest,' (DATA, 2015).

This almost mirrors a poignant conversation held with one female pupil during a teaching practice placement. The pupil, who both enjoyed and showed an aptitude for D&T, explained why she would not be taking the subject into KS4. The conversation included the pupil's opinion that D&T was viewed as a non-academic subject; the pupil also wrote a letter explaining this and her experience during the option process. In contrast, while it seems that education and NC reform are at least partly to blame for the decline in D&T's take up into KS4 there are other contributing factors, not least pupil perception of the subject.

Overall experiences and research in two placement schools highlighted that many pupils often perceived D&T indifferently and/or with a lack of engagement. Comments such as 'I can't do this,' 'this is boring,' or 'why do we have to do this?' were commonplace. Although anecdotal in nature, these are first-hand experiences that many teachers undoubtedly face and while they may be relatively common place, they are far from what the NC purpose of study describes D&T as; 'inspiring, rigorous and practical subject.' (DFE, 2013a).

The way in which a teacher communicates a subject can undoubtedly affect factors such as pupil enjoyment, engagement and possibly attainment.

A young person's enjoyment of a subject is going to be influenced not only by factors individual to them but also by, for example, the way in which the subject is taught. McCrone, Morris and Walker (2005, p.32). Wakefield (2013) identifies that pupils are recently more engaged in D&T classrooms in many schools across the country, due to the fact that teachers now employ a wider range of resources and techniques than in previous years. This, Wakefield concludes is attributed to various projects and initiatives that have taken place over a long period of time since the early 1980s which have provided both support and encouragement from outside agencies. Ofsted (2011) reported that one of the top five reasons headteachers valued D&T's contribution was pupils' 'huge enjoyment' of the subject. However, that was in

2008, before the introduction of academies, the EBacc and new NC. The report also did not specify why pupils enjoyed the subject.

Describing pupil engagement can prove to be extremely problematic. Harris (2008) illustrates that engagement is difficult to define, as there is often disagreement as to what actually constitutes pupil engagement. Fredricks, Blumenfeld, and Paris (2004) specify pupil engagement as time spent learning academic activities rather than behavioural engagement. However, Lankshear & Knobel (2005) highlight that pupils can easily appear engaged whilst they are actually disengaged or involved in other activities. Part of the problem with pupil engagement may be related to the volume of content that is now delivered within D&T, which can differ greatly depending on a schools interpretation of the NC. Examining skills that are related to D&T, Martin and Owen-Jackson (2013, p. 67) discuss ‘while new skills have been added to the curriculum [...] “old” skills have been retained.’ See Figure 1 for a table highlighting skills and knowledge.

Skills	Up to 1960s	1970s	1980s	1990s	Present	Future?
Hand tools						
Machine tools						
Drawing skills						
Designing skills						
2D CAD						
3D CAD						
Rapid prototyping						
<i>Knowledge</i>						
Properties of materials						
Materials processing						
Manufacturing systems						
Strategic knowledge						
Technology and society						

Fig. 1. D&T skills and knowledge.

This can put pressure on teachers to fulfil NC aims for D&T as outlined in the programme of study. Enabling and preparing pupils to be able to ‘participate successfully in an increasingly technological world,’ (DFE, 2013a) can be very challenging. Nicholl et al (2013, p.87) assess the complexities of providing an ever-changing curriculum: ‘it is widely acknowledged that knowing precisely which skills will be required in the future is increasingly uncertain.’

The aforementioned assertions of Martin and Owen-Jackson and Nicholl et al seem very credible, the world and indeed technology are constantly evolving which can continue to add to the skills and knowledge that pupils may need in order to function effectively within modern society. From experience, holding pupils’ attention is less difficult when related to many of the more modern aspects of D&T, such as computer aided design (CAD), 3D printing, laser cutting and other practical based learning activities. Non-practical activities such as product analysis, specification writing and evaluation, are often met with frustration and a lack of engagement. Welch, Barlex and Taylor (2005) cited in Barlex, (2006, p.157) reported similar findings when interviewing year 10 pupils regarding their design folders, ‘All you need is the idea sheet. You don’t need much else at all [...] I just want to get on with doing practical things because I really enjoy that.’

After taking into consideration the external and school based curriculum pressures that can affect the perceived value of the subject, the purpose of this research paper is to examine if pupils' perception of D&T can be changed or enhanced to affect their engagement whilst in the classroom. Owen-Jackson (2008) discusses teaching D&T should be relevant, fun, motivating and exciting, explaining that D&T teachers are in an almost unique position to develop and deliver new curriculum content due to constant technology developments. Spendlove (2009) critiques too much fun in the classroom, warning that while it is prudent to have an enjoyable learning process, the fun must not eclipse the learning experience. Thus, when engaging pupils, a number of different strategies were employed in an effort to keep the subject enjoyable whilst remaining relevant to ensure continuity regarding learning.

Research methodology

A mixture of questionnaires and action research was used to carry out the research project. Bell (2010) assesses action research as suitable in any context providing that 'specific knowledge is required for a specific problem in a specific situation,' (Cohen and Manion,1994 cited in Bell, 2010, p.6). It was decided the first component of research would involve a Likert scale questionnaire to ascertain if people understood D&T and if it was seen as an academic subject. The questionnaire (see Fig. 2) comprised of only four possible answers to avoid "central tendency bias" a problem that can affect five point Likert scales where respondents avoid choosing an extreme option (Brown, 2006 cited in Croasmun and Ostrom, 2011).

Design & Technology survey

	Strongly Disagree	Disagree	Agree	Strongly Agree
I understand D&T as a subject	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D&T is an important part of education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D&T is an academic subject	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are benefits to studying D&T at Key Stage 4 (choosing it as an option at year 9).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I am a: Parent/carer Pupil Teacher

Fig. 2. Likert scale questionnaire used to ascertain D&T's academic stature as viewed by parents and pupils.

The second part of the research took the form of an online multiple-choice questionnaire as the data from multiple-choice questionnaires can easily be totalled (Cohen, Manion and Morrison, 2011) and this can and did save valuable time (Wright, 2005) as more pupils from various classes completed it.

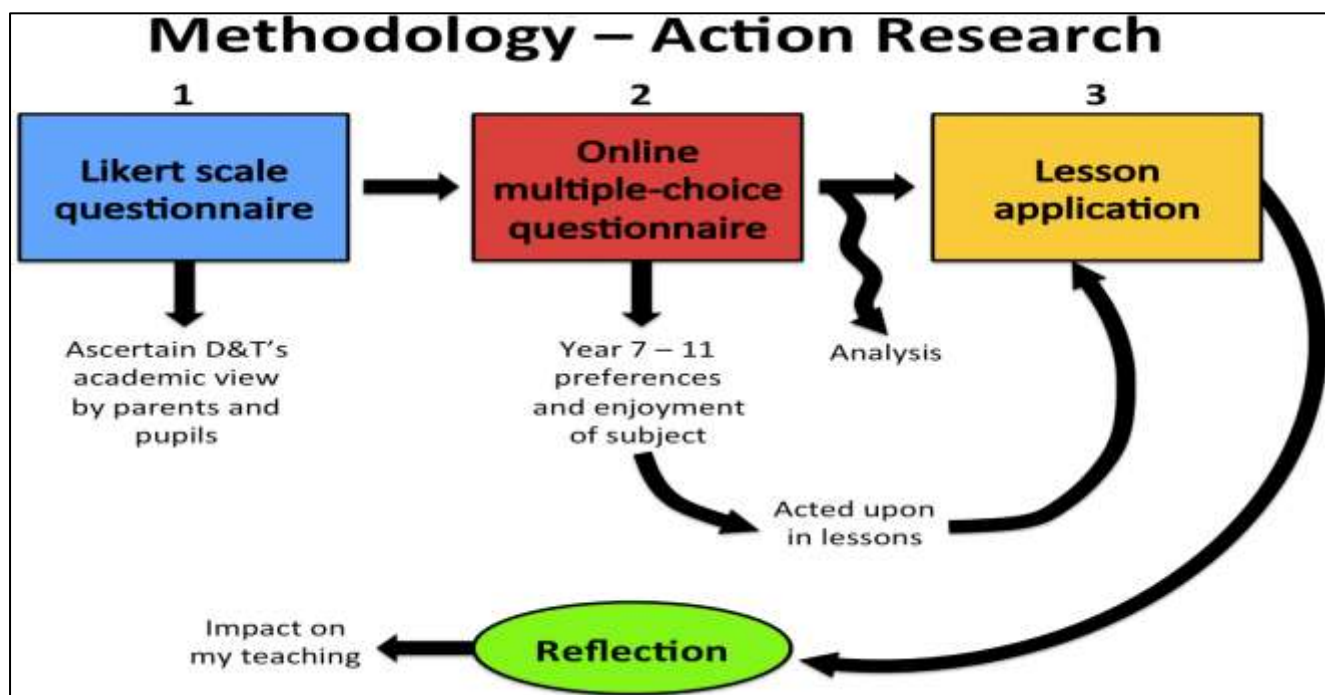


Fig. 3. Displays the action research nature of the study.

The online nature of the questionnaire which continuously updated the results and information gathered, helped to inform and improve my own practice in the classroom 'the greatest strength of educational action research,' (Sharp, 2009, p.58) even whilst there were pupils still yet to complete it. Finally, two one-off lessons were conducted based on some of the findings of the questionnaire; classroom strategies were also employed based on feedback and questionnaire results. The two lessons were observed by the class teacher who recorded the engagement of pupils throughout the course of the lesson.

Participants

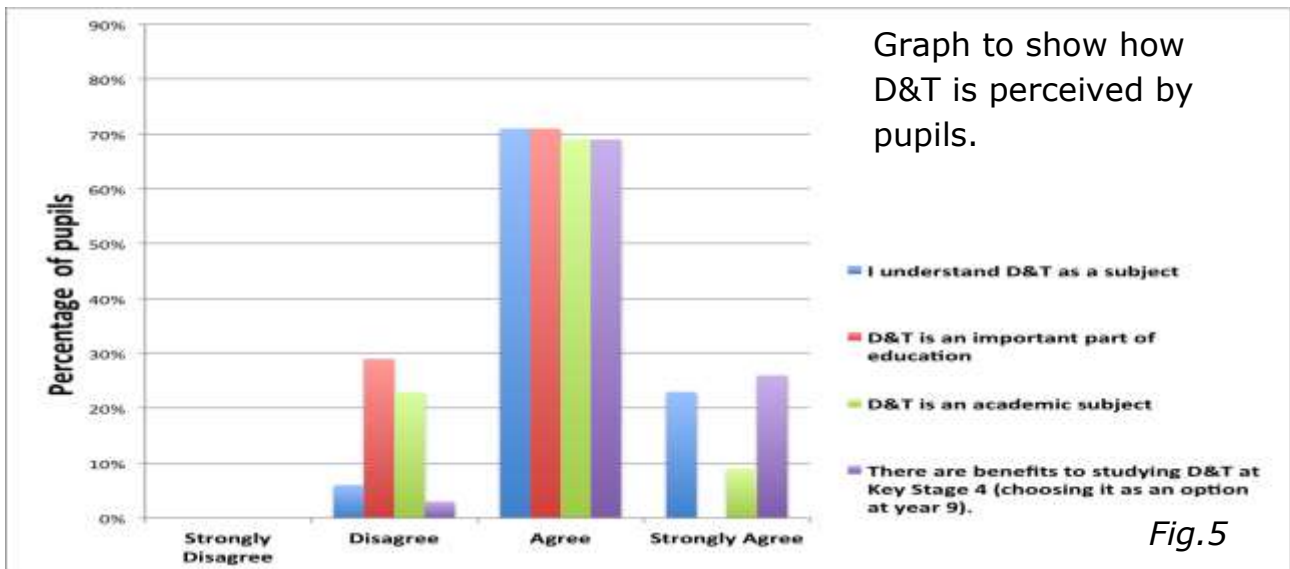
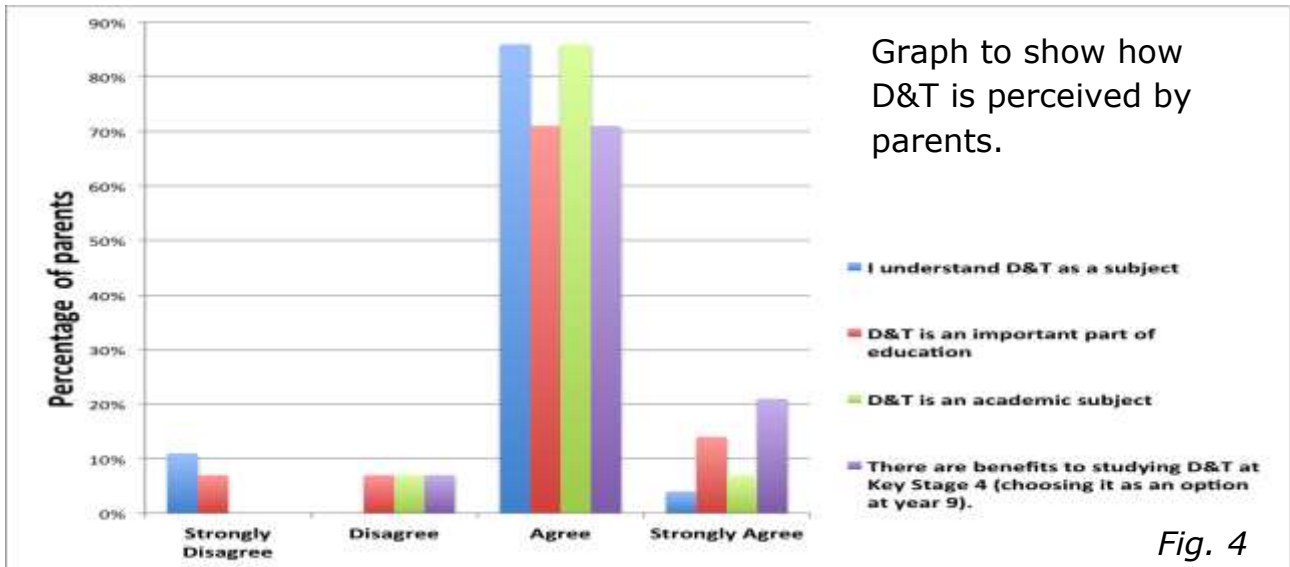
The research was conducted in a school that caters for approximately 1300 pupils and has slightly below national average GCSE results in English and Mathematics. The parents of all pupils sign various consent forms at the beginning of year 7 regarding the conduct of the school in relation to pupil welfare and safeguarding. Therefore, it was not necessary to ask for informed consent before conducting any research and this was confirmed with the school ITT coordinator prior to research being undertaken. In total, 28 parents of year 9 pupils and 35 year 9-11 pupils completed the Likert questionnaire, all were approached on a year 9 options evening. A total of 130 pupils completed the online multiple-choice questionnaire, 75 were female (58%) and 55 were male (42%). The age of the participants completing this part of the research encompassed school years from year 7 to year 11. The one-off lessons were conducted to two different year 7 groups who had no previous knowledge or experience regarding the lesson content.

The research was carried out using convenience sampling within a secondary school. Convenience sampling involves choosing respondents with whom the researcher has easy access (Cohen, Manion and Morrison, 2011). Therefore, all participants that contributed to the data collected were members of the classes that had direct contact with the researcher.

First questionnaire

The first element of research consisted only of the Likert questionnaire which produced varying data. The graph (Fig.4) highlights that almost 90% of the 28 parents at least agreed with all statements on the Likert questionnaire. Additionally 35 year 9 and above pupils were asked the same questions; here the results were slightly different.

Although there were more pupils than parents questioned, the answer to “D&T is an important part of education” saw a drop to 70% (fig 5).



Through informal conversations held with KS4 pupils, it is surmised that this drop is attributed to pupils who had not chosen a D&T subject to study at KS4 as they had instead followed EBacc subjects. The initial hypothesis was that D&T was seen as an unimportant and non-academic subject. However, the results of the questionnaire disproved this hypothesis, both parents and pupils perceived D&T far more positively. These results led to the creation of a new questionnaire with varying levels of enquiry and possible responses.

Second questionnaire

The questions contained within the new questionnaire were carefully chosen after conversations with academics, teachers from the school's D&T department and pupils. Cohen, Manion and Morrison (2011, p.384) identify that questions choices must 'capture the likely range of responses to given statements,' which was taken into consideration when the questions and choices were written. In order for the entire age range of pupils to understand the questions posed to them, the word *enjoyment* was used in substitution for the word engagement which, it was felt, would require increased explanation to some pupils. Although the words enjoyment and engagement are not directly interchangeable, Crook et al (2008, p.41) explain 'High levels of engagement hold when enthusiasm is present, suggesting that enthusiasm plays a critical part in the formula of enjoyment, engagement and achievement.' Gregerson et al (2013) agree, classifying a correlation between motivation, enjoyment, engagement and academic performance. Therefore, the enjoyment of pupils was thought to be a sufficient gauge when trying to determine their engagement.

Pupils were reminded that taking part in the research was voluntary and that names of those completing it would not be recorded. Additionally, although question 9 allowed for any comments or opinions regarding D&T, pupils were urged to not record any comments that could identify themselves should they wish to remain nameless. Cohen, Manion and Morrison (2011, p.209) discuss questionnaires as being more reliable than interviews and that they promote 'greater honesty because [they are] anonymous.' Conversely questionnaires also have some disadvantages; a lack of understanding of the questions posed can lead to a low number of returns and the data gathered can only be regarded as basic statistics (Cohen, Manion and Morrison, 2011). Although this may be correct, it was felt the questionnaire format would supply a sufficient enough overview of pupil perception, which could then be acted upon to affect engagement. Also, as the respondents completed the survey in class, the researcher was present to address any confusion surrounding the questions. Furthermore, as the questionnaire was performed online, it continuously updated making it possible to keep an account of the number of pupils completing it. This also benefitted the action research based format of the research as it allowed for comments and results to be acted upon in a relatively short space of time.

130 pupils performed the multiple-choice questionnaire and they broke down in year groups as per the Fig. 6 below.



Fig. 6 (left) shows the number and school year of the pupils who completed the multiple-choice questionnaire.

As previously stated, the questionnaire was performed using convenience sampling; only the pupils with whom the researcher had direct contact with, were questioned, hence the disparity between the numbers of pupils represented by different year groups. Additionally, there was often not enough time for every pupil from all classes used in the research to complete the questionnaire, which also accounts for lower representation from certain year groups.

Fig. 7 shows that the most popular D&T subject was *food* by a considerable margin. This came as a slight surprise as there were only two food classes asked to perform the

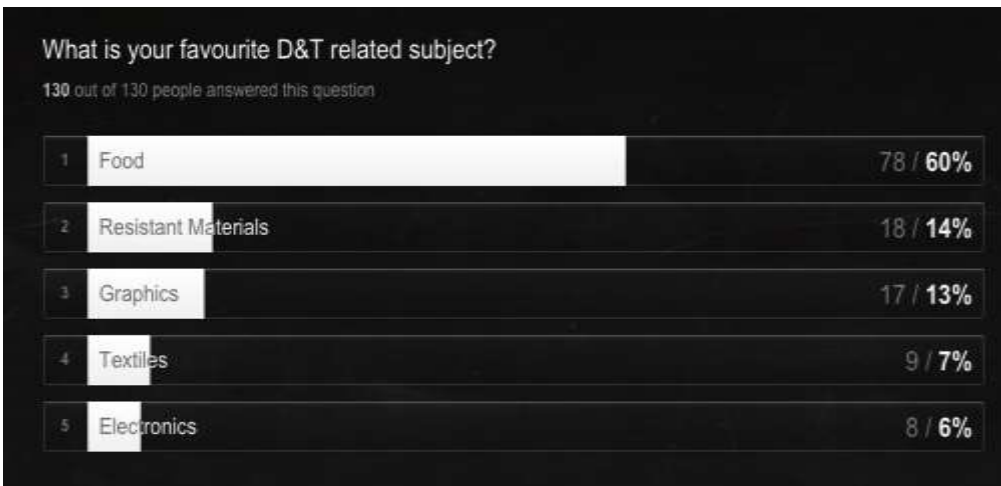


Fig. 7 (left) shows the favourite D&T related subject of all pupils questioned.

questionnaire; the other classes consisted of three KS3 resistant materials (RM) groups and one KS4 graphics group.

Unsurprisingly, the most popular aspect of D&T chosen by pupils related to practical activity as seen in Fig. 8.

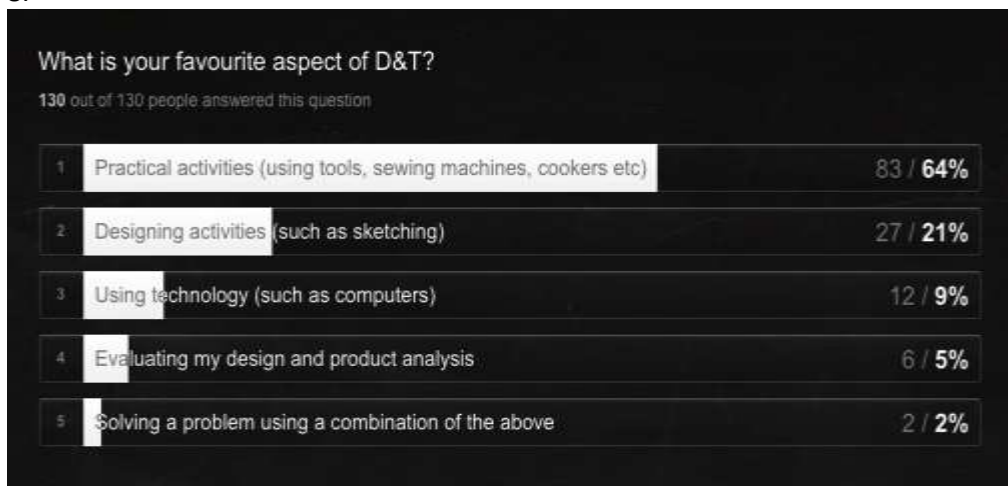


Fig. 8 (left) shows the favourite aspect of D&T chosen by all pupils questioned.

In contrast, 11% (14 pupils) reported that practical activity was what they most disliked about D&T, Fig. 9.

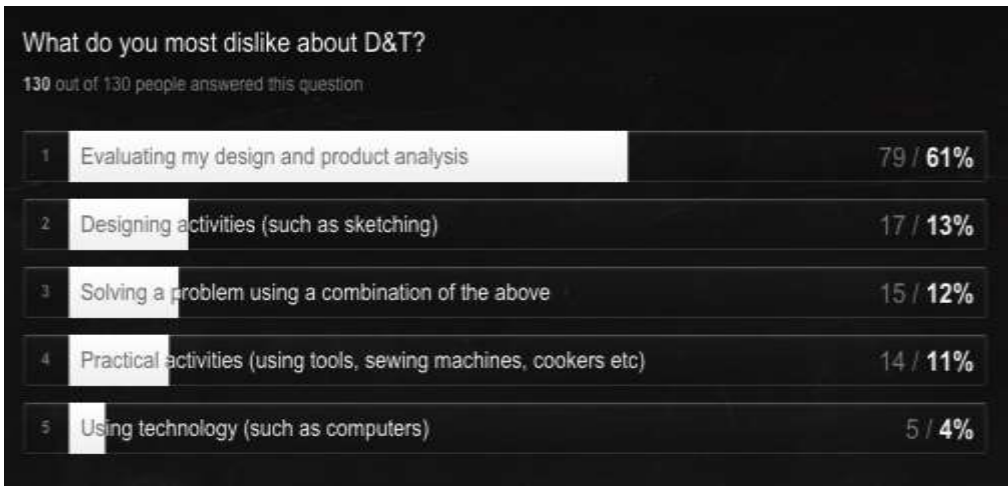


Fig. 9 (left) shows what is most disliked in D&T by all pupils questioned.

This question was asked in a similar way in an attempt to gauge pupil’s opinion in regard to the written work that often accompanies practical activities in D&T. This question showed 77% of pupils thought that written work made D&T less enjoyable, Fig. 10.

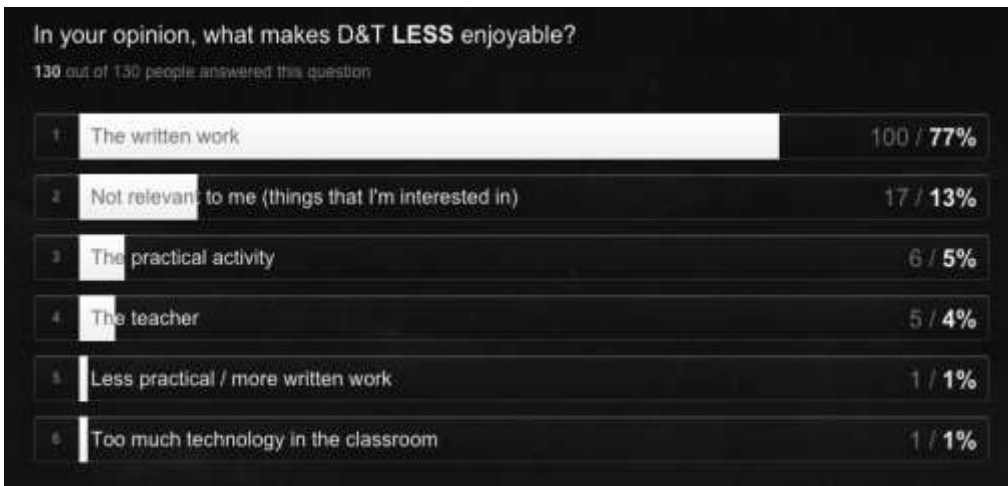


Fig. 10 (left) shows what pupils consider to be less enjoyable in D&T.

Analysis and discussion of questionnaire findings

Though the most popular D&T related subject was food (Fig.5) as previously discussed, it is worth pointing out that the two food classes that performed the questionnaire were one year 10 class and one year 11 class, meaning that these pupils had already chosen to do their ‘favourite’ subject. These classes were also made up of two-thirds female pupils, which may have had some bearing on the questionnaire results. Interestingly, when studying Cambridge Assessment’s (2014) uptake of GCSE subjects 2013 it is evident that although food technology is more popular among girls and RM more popular amongst boys, overall RM is the most popular overall D&T related subject.

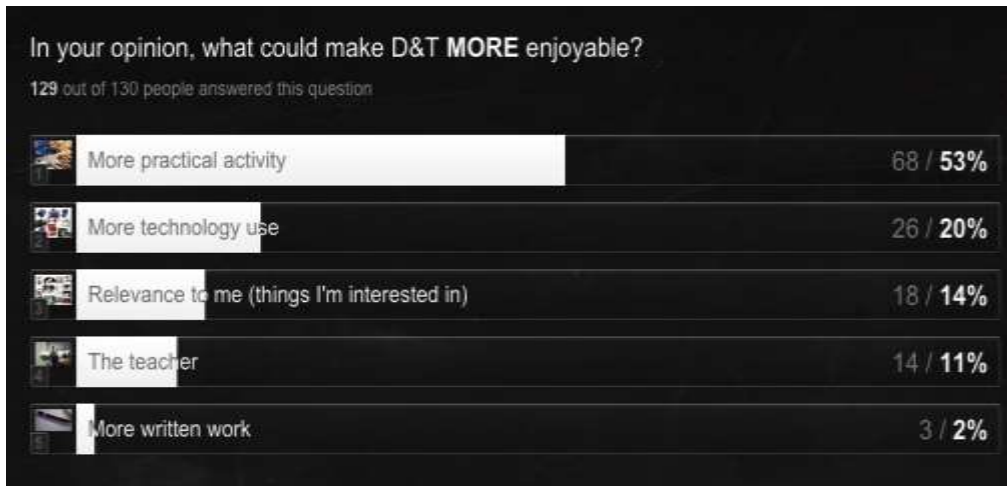


Fig. 11 (left) shows what pupils consider could make D&T more enjoyable.

It was decided that the study would focus on affecting what pupils believed could make the subject more enjoyable and hopefully in turn, more engaging. Fig. 11 shows that 47% of pupils felt that D&T could be more enjoyable if areas other than practical work were addressed.

Two lessons

The final part of the research involved conducting two separate lessons on the theme of *ergonomics* to two different year 7 classes, one familiar with the researcher and a control group who were not (referred to as the usual group or control group). The ergonomics lesson was shaped partly around the premise of relevance to the pupils in an attempt to engage them. At the start of the lesson, no pupils had even heard of the term *ergonomics*. There was a game controller displayed among other pictures that featured ergonomic design and once the main part of the lesson had been revealed (the redesign of a game controller) pupils really began to understand and engage with the theme of ergonomics. Callahan (2013) identifies that 91% on children aged 2-17 are *gamers*, therefore it was hypothesised that a large amount of pupils would be interested in video games prior to the delivery of the lessons and this did appear to be the case.

During the lessons, a classroom teacher performed structured observations in the form of a pupil engagement chart similar to one suggested by Thomas (2009 p.185). The same classroom teacher was used to record engagement for both lessons. The purpose of the control group was to eliminate any possibility of over engagement through pupil familiarity with the researcher. At the end of the lessons, pupils were asked to fill in a Likert scale regarding their enjoyment of the lesson. The theme of the lessons were selected as it was important to not cover subject matter that pupils had already been exposed to, this was to eliminate any possibility of disengagement through boredom on the part of the pupils. Additionally, the lessons needed to involve relevant content to D&T; ergonomics involves the relationship between users and products, systems and processes. This can be classified as understanding user needs, which the D&T KS3 programme of study specifies under the heading *Design* (DFE, 2013a).

Throughout the ergonomics lessons delivered to two year 7 classes, the classroom teacher observed 10 pupils at 5-minute intervals in respect to their engagement. The pupils were chosen randomly, regardless of ability or gender. A mean figure for their engagement was then derived by totalling the percentage score before dividing by the number of pupils recorded. In the case of the *usual* group, the overall figure of engagement equated to 84%. The group also filled in an enjoyment slip and the results of this can be seen in figure 12.

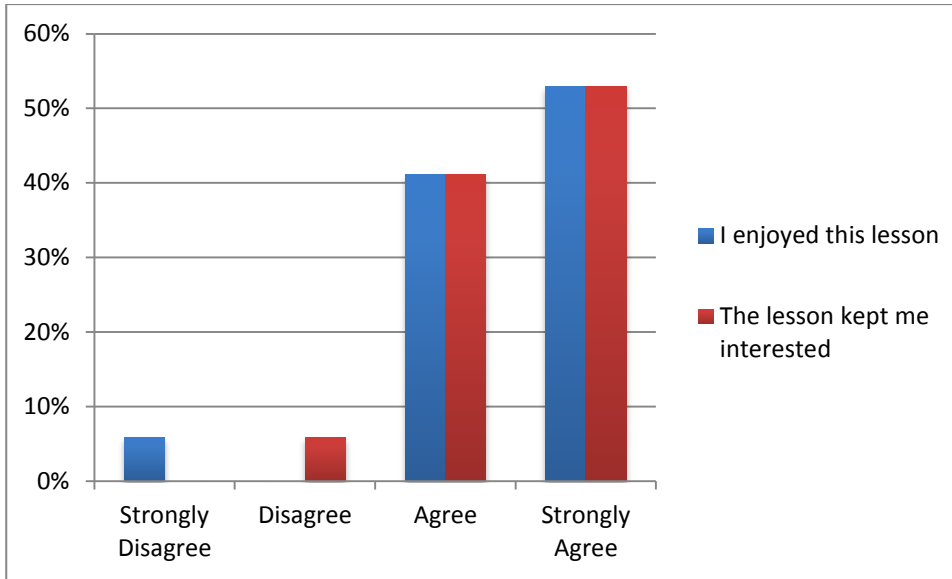


Fig. 12 (left)

Graph shows how the ergonomics lesson was enjoyed by the usually taught group.

The control group averaged 96% engagement which was contrary to what was expected, both the classroom teacher and myself were surprised by the increase in engagement in the control group compared to the usual groups' figure.

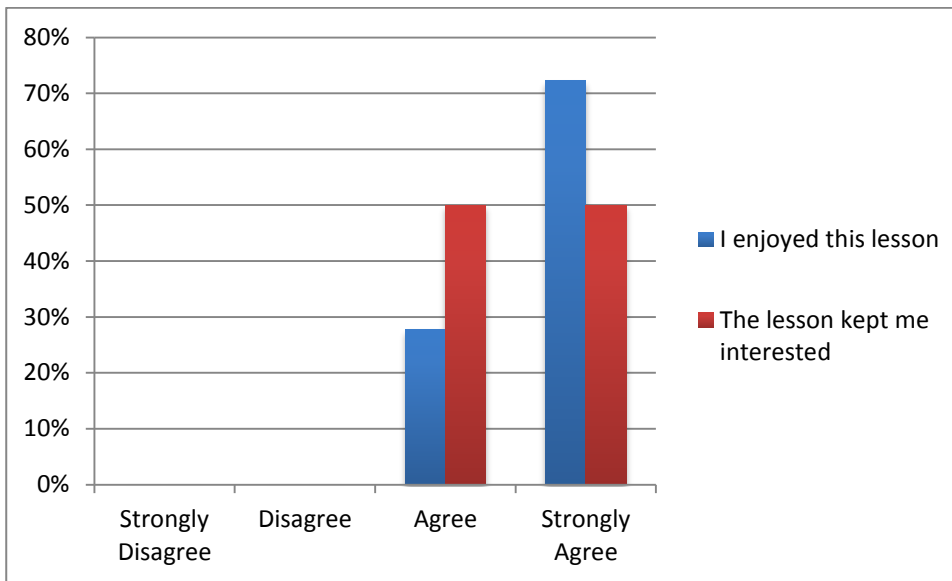


Fig. 13 (left)

Graph shows how the ergonomics lesson was enjoyed by the control group.

The Likert scale questions regarding pupil enjoyment also contrasted between the two groups, the control group again saw a rise, this time by 19% in pupils who strongly agreed to having enjoyed the lesson Fig.13. Other results in the questionnaire highlighted that evaluation and product analysis were top among the dislikes in D&T (Fig. 9). The reasons that pupils may not like or actively disengage with product analysis can be varied but experience whilst in the classroom (and through the research data gathered) has shown me that pupils mainly dislike the written nature of the task. Couple the written nature of product analysis with a lack of relevance surrounding the products to be analysed, or even the entire project in general, and pupils can often feel completely alienated, leading to disengagement.

In an attempt to engage pupils when performing product analysis, a product was used that would be instantly recognisable to pupils. Pupils were to analyse 3 different mechanical toys for their automata/mechanical toy project before writing a design brief and specification. The toys that the pupils would usually analyse would be traditional automata or pull-along toys but during this lesson a *minion* from

a popular film franchise by Disney was also included. Three-quarters of the pupils chose to write their low-level product analysis about the minion and were engaged when doing so. It is believed the minion provided an opportunity to include all pupils in the written activity, an activity in which some pupils would usually not engage. For the purpose of personal observations in lesson, *engagement* was defined as the pupils being on-task throughout the exercise. Additionally in this lesson, questions regarding product analysis were structured around games consoles and companies that analyse their competitors' machines, controllers and games in order to improve their own products. Although mentioning games consoles had no significance to the project being taught and could be considered an untested tactic previously highlighted by Mark and Houghton (2002 cited in Wakefield, 2013), they were relevant to the pupils. The pupils appeared to gain a clear understanding of why product analysis is performed and its importance in manufacturing due to their engagement surrounding topics with which they were familiar.

One of the most interesting aspects of the research occurred during the two one-off lessons surrounding ergonomics. The control group, with whom there had been no previous contact, were more engaged than the usual group. Additionally, the Likert scale questions that they completed subsequently also saw an increase in their enjoyment.

Given the considerable good rapport with the usual group, they were expected to be engaged whether they enjoyed the lesson or not, due to them having prior knowledge of the teacher's behaviour management and classroom expectations. It was thought that by teaching an unfamiliar group, pupils' engagement using the chart would be easier to gauge and there would possibly be more behavioural issues as pupils tested the boundaries of a 'new' teacher. This not only proved to be very inaccurate as previously discussed, but also the comments section on the pupil enjoyment slips yielded some interesting remarks. Upon studying the comments sections, it was realised that the teacher and/or delivery of the lesson was also a factor the pupil enjoyment of the lesson. Comments from the control class included:

'The teacher was encouraging us.'

'I enjoyed sir teaching us, it was fun.'

'It was a fun lesson learning about a new world and how it affects us! The new teacher was nice as well!!!!'

There was only one comment from the *usual* class regarding the teacher;

'I thought sir made it even more interesting.'

Although the role of the teacher was considered to play a part in pupil engagement, it was mistakenly not foreseen to be a factor during the two ergonomics lessons.

Conclusion

This research was undertaken in an effort to promote pupil engagement whilst in class. The questionnaires highlighted areas that could be improved upon in the classroom and some of these were trialled successfully.

The research found that written tasks were the least enjoyable aspect of D&T. So, in an effort to combat pupils' lack of enthusiasm or engagement whilst completing written work, teachers should attempt to increase engagement by making the subject more relevant. One of the ways that engagement was increased was through the use of, or reference to familiar items/objects, which were significant to the pupils. By providing real-world examples which pupils understood, a sense of inclusion, increased enjoyment and engagement was observed in many pupils. This research project has helped to develop professional practice both in and out of the classroom. Considering topics or subject matter which will engage pupils when planning and delivering lesson content has improved pedagogy and in turn, pupil enjoyment and effort whilst in D&T lessons.

Future recommendations

Future research could incorporate the following elements:

- Ascertain why food technology was the most popular choice for 'favourite subject' by pupils.
- Small focus groups could be used to record pupil opinion over an extended period of time, before, during and after engagement strategies have been implemented in the classroom by the teacher.
- Groups of pupils who have/have not chosen D&T at KS4 could be questioned in more depth separately to gain increased understanding of individual factors influencing their decisions.

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