Taking the Softer Option? Aspects of Year 9 Pupils' Attitudes to Using Materials

Abstract

This paper is developed from research undertaken as part of a Masters degree programme at Middlesex University by T. Ford. The objective of the research was to try to understand Year 9 pupils' attitudes to the activity 'making'. It was hoped to abstract from the data:

- whether pupils preferred working with certain resistant materials over others and to derive a comparison with previous Crafts Council findings ('Pupils as Makers', 1995)
- pupils' views on the realised, practical outcomes of the making activity

The work develops and to some extent supports the view that pupils have clear ideas of their own about the materials that they like to work with and how they should be applied to making products. These preferences correlate to the above Crafts Council findings.

Introduction

It may be argued that the one salient feature of design and technology which distinguishes it most clearly from other curriculum subjects is that children learn by making things. It is this aspect of the subject that many teachers enjoy teaching and most pupils enjoy doing. It brings the challenge of creativity realised through practical application and the reward of making something that works. It is tangible, real and unique. It is the pragmatic outcome of the reflective decision making process that is designing. The statute upholds this as a teaching objective:

> Pupils should be taught to develop their design and technology capability through combining their Designing and Making skills with Knowledge and Understanding in order to design and make products.

The research programme set out to explore whether the values of this statement were indeed understood, shared and practised by pupils.

Conducting the research

A set of questionnaires were sent to 12 secondary schools in north east London. Year 9 pupils were chosen as they were the group most likely to have been exposed to a full key stage of designing and making whilst not yet becoming specifically material focused within a particular GCSE syllabus. The questionnaire invited these pupils to respond to a set of 24 statements based around six themes. Each theme set out to explore distinct aspects of pupils' values in making using resistant materials.

The six themes on which the statements were based were:

- The extent to which 'alternative' types of design technology are integrated into making products (a 'cultural' theme). Put simply, are pupils actually being taught new ways of using resistant materials and trying them out in their practical work rather than repeating well rehearsed techniques?
- The extent to which the teacher influences the form of the finished product. Are teachers' values being subconsciously imposed which then manifest in the objects that pupils make?
- The possible existence of a hierarchy of resistant materials based upon pupil preferences. Do pupils prefer one material over another and can these preferences be ranked? (This theme forms the main line of enquiry with the other five themes providing 'secondary' lines of enquiry along closely related issues.)
- The value that pupils place upon making as a design and technology activity. Do pupils share our belief that making things is a good way of learning?
- The degree to which creativity is valued by pupils when using resistant materials. Do pupils really engage in a creative activity when making or do they simply apply what they already know or have been shown?
- Pupils' concepts of desirable form. Do pupils share any views on what defines a good product?

Pupils were asked to indicate agreement/disagreement against each statement on a one to five point scale with one being 'I strongly agree' to five, 'I strongly disagree'. Although this steps outside of the normal Likert scale framework, a mid-point (3) was included to ascertain undecided responses.

The 24 statements abstracted from these themes and given on the questionnaire were:

1. I spend most of my lesson time on practical work.
2. I try to make all of my practical work to my own design.
3. When I make I try to copy what my teacher has shown me.
4. My teacher usually gives me ideas about the things I can make.
5. My teacher often shows us how to use tools and machines properly.
6. I like using metal.

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RESEARCH

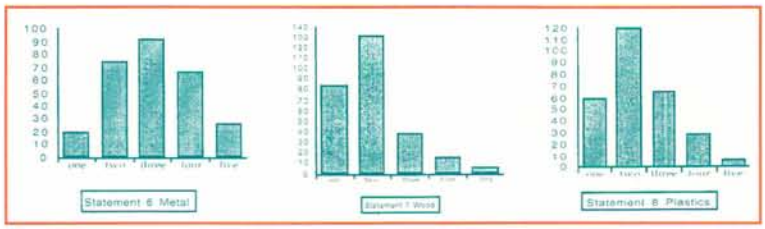


Figure 1: 1 strongly agree ... 5 strongly disagree

7 I like using wood.

8 I like using plastics.

9 I think that a good quality piece of work has a smooth polished finish.

10 I think that the finish of an object is very important.

11 I like making unusual objects .

12 When making I like to copy things that I have seen.

13 A well made product always looks attractive.

14 My teacher usually decides how something should be made.

15 I usually have my own ideas about the best way to make something.

16 I often experiment with using materials to try out new ideas.

17 I usually know what I want to make as soon as a project starts.

18 My teacher usually shows us a finished object at the start of project.

19 I like to know what my practical work should look like before I start to make it.

20 I am not bothered if my ideas change whilst I am making.

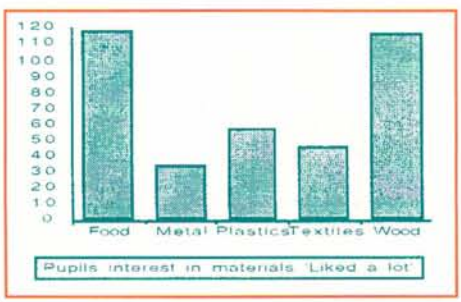
21 I like to make things that look different to the rest of the class.

22 Technology has more to do with electronics, machines and computers than designing and making.

23 I have looked at products from other countries when I have been doing a project.

24 The design work (folder) is the most important part of a project.

Figure 2



The six themes were explored by clustering together related sets of statements. For example, theme 3 (material preferences) could be referenced against statements 6, 7 and 8, and theme 4 (is making a good way of learning?) could be explored by referring to statements 16, 17, 19 and 20.

In total 280 questionnaires were completed, giving 6720 responses for analysis. There were only 39 statements to which no response had been made (0.58% of the total).

Summary of research findings

It is perhaps implicit in an analysis of the use of resistant materials at Key Stage 3 that a relatively low use of metal (and 'metalwork') in secondary schools would be found. This may be due to the material being perceived to an extent by pupils and teachers as 'dirty' and unyielding and to be used only in 'engineering'. Woods and plastics may be more widely used as they are perceived to be 'clean' and are more compliant. This is born out in the 'Pupils as Makers' report which substantiates a 'hierarchy' of materials used at Key Stage 3 in the order of precedence wood, plastics, metals.

To focus thinking on the use of resistant materials, statements 6, 7 and 8 (which required pupils to say to what extent they liked using wood, metal and plastics) are primarily considered within the context of this article.

Figure 1 shows that pupils have given their most positive response ('I agree' or 'I strongly agree') to working with wood, (77.8%) followed by plastics (64.2%) and then metals (33.7%). The distribution of responses to statement 6 ('metals') contrasts strongly with the other two results ('wood' and 'plastics'). Significantly, whilst woods and plastics are generally 'liked', metal is not viewed as positively. The survey shows that as far as the sample is concerned, pupils do seem to hold a hierarchical view of the three most commonly used resistant materials.

These findings correlate to some extent with the work of Steggalls (1996) which, in part, asked pupils which of the major design and technology materials they enjoyed working with. A summary of this part of Steggalls' findings is given in the following graphs:

Steggalls' data does not seem to show such a positive hierarchical ranking for plastics as Ford's. This may be due to the fact that pupils can experience disappointing (shattering!) outcomes from working with brittle acrylics, often with an 'all or nothing' result, and a bad experience may put them off future use.

Ford's data therefore naturally poses some serious questions about why pupils hold such views and what we can do about changing them. In order to explain the possible origins of these beliefs, it is important firstly to note the nature of the distribution for responses to metal. This distribution, though largely uniform, has the highest proportion of pupils indicating 'undecided' (number 3 on the five point scale) with roughly even numbers of responses indicating a positive and negative view of the material. This contrasts with opinions relating to woods and plastics where the trend is towards the positive bands. Such a trend could possibly be explained if pupils have had little experience of using metal and therefore can't express an opinion about it. Alternatively, pupils who have worked with metal may still feel indifferent about it afterwards. In either case, pupils are largely saying that they don't know if they like it or not (33% of responses to statement 6 were in the 'undecided' band). Steggalls throws some light on this aspect in his analysis of materials most frequently used in Key Stage 3 design and technology project work:

Steggalls' findings indicate that wood is the most frequently used material, with plastics following closely second and with food being the least frequently used. The place of food may have something to do with it being optional in the Orders for design and technology at Key Stage 3. Again, the hierarchy in which the materials are used follows the same pattern as that established by the Crafts Council report and therefore presumably follows a national trend in usage.

The combined evidence does support the view that pupils hold hierarchical opinions on material preferences which addresses the main theme of the research. The other five 'secondary' themes can now be scrutinised in the same way by referring to the distribution of responses to a 'cluster' of statements. For ease of reference, the graphs displayed in the following section are defined by one of five descriptors which summarise the distribution under analysis:

1 strong agreement a distribution in which the responses are largely inthe positive bands of distribution, numbers 1 and 2

2 moderate agreement a distribution in which the responses are largely in band 2

3 general balance a distribution in which there is an approximate balance between positive and negative responses

4 moderate disagreement a distribution in which the responses are largely in distribution band 4

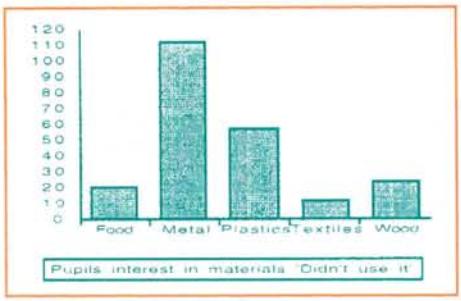


Figure 3

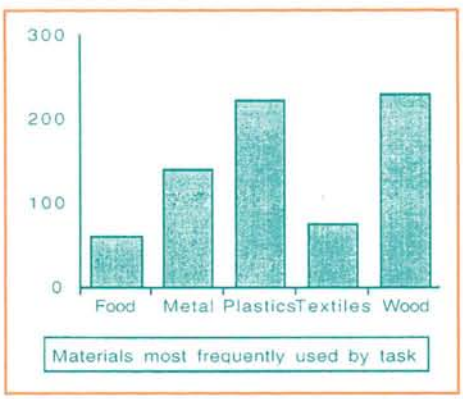


Figure 4

5 strong disagreement a distribution in which the responses are largely in distribution bands 4 and 5.

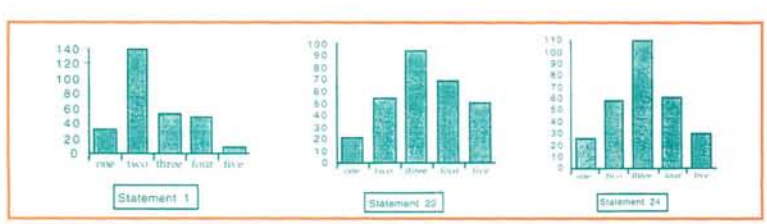
Responses to statements 1, 22 and 24 (Fig. 5) relate to the value that pupils place upon making products (theme 4). In response to statement 1 'I spend most of my lesson time on practical work (making)' the results showed moderate agreement.

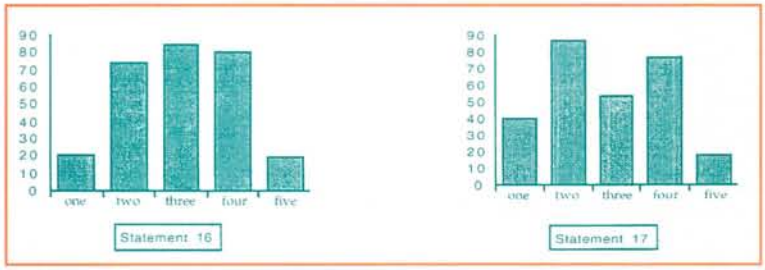
Whether the specific use of lesson time is at the discretion of the pupil or not was not under scrutiny. The results do show that pupils regard their lesson time as being generally spent on making activity.

Pupils may also only have considered their current 'project work' when filling in the questionnaire which could account for the 19% response in the negative bands 4 and 5. In addition, these negative responses may indicate a proportion of pupils whose design and technology diet does not include a substantial making element.

Statement 22 'Technology has more to do with electronics, machines and computers than designing and making' and statement 24 'The design work (folder) is the most important part of the project' both display a

Figure 5





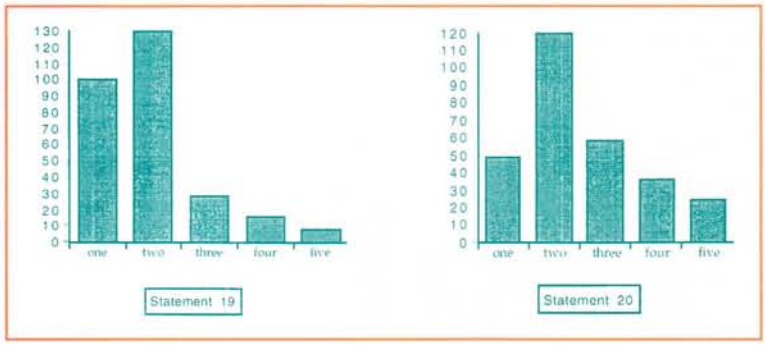


Figure 7

general balance. Both statements explore the value that pupils themselves place upon making within the wider context of design and technology. The 'undecided' category accounts for the highest proportion of respondents in both cases (see Fig. 5), which makes it difficult to draw firm conclusions. The evidence does suggest that pupils may regard design and technology as an integration of all of these elements and so will not be drawn to a specific response in relation to either statement. This strand really requires a distinct research component if it is to meaningfully explore opinion on the various components that make up educational design and technology.

Statements 16, 17, 19 and 20 required responses relating to the creative use of materials in the making activity (theme 5). Statement 16, 'I often experiment with materials to try out new ideas' and statement 17, 'I usually know what I want to make as soon as a project starts' displayed a general balance of opinion, with low numbers of responses in extreme bands. (Fig. 6)

However, there is a noticeably more positive response to statements 19 and 20, 'I like to know what my project work should look like before I start to make it 'and, 'I am not

Figure 8

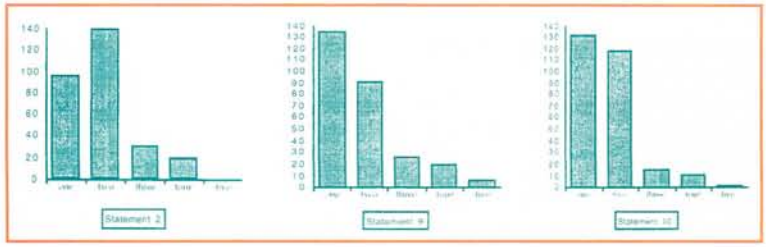


Figure 6

bothered if my ideas change while I am making'. (Fig. 7)

These two results may appear to make a contradictory comment upon the making process. On the one hand, pupils are saying that they like to know the objective of their work – this is what it should be like when it is finished – but on the other, they seem to accept change during the making process.

Statement 19, however, does not suggest that ideas cannot change after the initial form of the product has been considered and this model may explain the trends in both sets of results.

The evidence could support the view that most pupils like to know what their product should look like before they begin making in order to define a line of progression or create a design reference point from which their work develops. The results appear to show that pupils accept the notion of ideas changing during the making process after the initial stages have begun. The suggestion here is that pupils make by referring to a finished product at the beginning of a project and then make changes to it as the need arises.

Statements 2, 9, 10, 11, 13, and 21 seek to find out if pupils have opinions about what their products should look like (their 'form' – theme 6). As a group of results this strand produced responses of moderate agreement to all six statements. In particular, statement 2, 'I try to make all of my practical work to my own design', statement 9, 'I think that a good quality piece of work has a smooth, polished finish', and statement 10 'I think that the finish of an object is very important' evidenced strong agreement. (Fig. 8)

The overall response to statement 2 indicates that pupils value individualism in making. Whilst it may not be practically realised, the evidence shows that it is a component that forms a positive objective. This may confirm the initial conclusions discussed in relation to statement 20 – 'I am not bothered if my ideas change while I am making'. These two results would further justify the claim that individuality and change in making occur after making has begun, possibly as modifications to a common form suggested by the teacher at the early stages of a project. Statements 9 and 10 both show a trend of strong agreement which perhaps indicates that these are statements which hold less ambiguity when being answered by pupils. Statement 10 indicates that pupils regard 'the finish of an object' as very important and subsequently statement 9 shows that the finish

is generally desired to be 'smooth' and 'polished'. The concept of 'finish' indicates the latter end of a making activity and the notions of 'smooth' and 'polished' imply applied processes learnt by a pupil. It could be presumed that all three concepts ('smooth', 'polished', 'finished') have been comprehended within the context of the taught subject and therefore influenced to a degree by the values implicit in individual teaching style. The results indicate that pupils think smoothness and regularity are desirable objectives in a made object. This could reinforce the desire to work in the softer materials – woods and plastics – as they are 'easier' to finish in this way than metals. If this were not the case then we would expect to see larger numbers of pupils disagreeing with the statements or indicating an 'undecided' response. For the majority of pupils, the statements appear unambiguous as responses are largely in the bands 1 and 2. It would be fair to conclude that pupils do value a uniform surface finish which may be one of the reasons why they don't like using metal as this type of finish simply takes longer to achieve and is a 'dirty' process.

In response to statement 11, 'I like making unusual objects', and statement 13, 'A well made product always looks attractive' respondents have indicated a general balance and moderate agreement respectively. (Fig. 9)

The response to statement 11 shows only a slight trend towards agreement. This would indicate that considerable numbers of pupils do not like making 'unusual' objects (25.3%). This may mean that the concept of an 'unusual' object suggests risk or failure to a pupil or perhaps that pupils do not seek to work outside known parameters. The resulting product could also possibly be viewed negatively by others within the wider school culture of teacher, other pupils and family. This interaction of values would serve only to uphold well rehearsed work in woods and plastics if metals were considered 'unusual' materials to work in. However, significant numbers of pupils have indicated that they do like making unusual objects (44%). Perhaps the opportunity to work in an unknown direction presents a challenge and a chance to impress. This certainly has implications for the teacher, specifically regarding the planning and execution of making which encourages working outside of the expected.

Statement 13 shows a response of strong agreement indicating that pupils regard the appearance of an object as an indication of how well it has been made. This evidence could uphold the suggestion that the visual characteristics of objects are valued by pupils

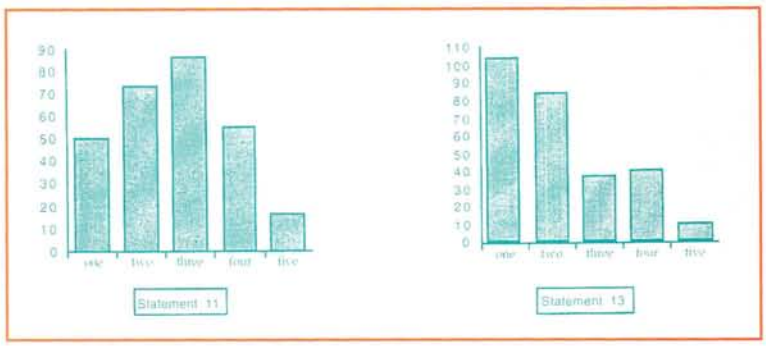


Figure 9

to the extent that they overshadow appreciation of function. More specifically, it could be argued that pupils are judging objects by their appearance and are therefore applying a personal view of aesthetics. Perhaps as teachers, we could be guilty of supporting teaching which values form over function and this is subconsciously absorbed by our pupils. For example, a teacher holding up a previously made product at the beginning of a project can only allow pupils to assess the product based on what they see – but do we devote enough time to describing and exploring with our pupils how well the product functions? Practical work which is displayed also imparts this subconscious value – it looks good but do we know how well it works? It could be suggested that over time pupils become implicitly 'taught' to accept visual judgement as a means of assessing product performance as it is upheld by teaching methods and often an environment that do not distinguish fairly between form and function. The strong trend towards agreement to statement 13 suggests that this is an unambiguous area for pupils to comment upon and that for them, the quality of a product correlates directly with its visual characteristics.

In response to statement 21, 'I like to make things that look different to the rest of the class' pupils have again indicated strong agreement. (Fig. 10)

This presents an interesting comparison to statement 11, 'I like making unusual objects'.

Figure 10

References

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Steggalls, D (1996). An Analysis of Aspects of Practical Tasks in Design and Technology Education at Key Stage 3, page 87, unpublished Middlesex University MA thesis.

Steggalls, D (1996). An Analysis of Aspects of Practical Tasks in Design and Technology Education at Key Stage 3, page 73, unpublished Middlesex University MA thesis.

The distinguishing element between these two statements is that statement 21 incorporates a notion of visual characteristics: 'I like to make things that look different to the rest of the class' whereas statement 11 refers only to the more generic term 'unusual'. The results would indicate that when asked to comment about the visual characteristics of a made object pupils can respond more definitively than when asked to consider objects that are 'unusual'. It would therefore appear that whilst pupils generally seek individualism in their products they do not seek it so strongly as to make products that have unusual characteristics, either in their appearance or function. The desire to establish individualism in the appearance of an object may satisfy a need to manufacture personal items but without overstepping the bounds into risking failure. It could also be suggested that it is easier to alter the appearance of an object than to alter its function or the manner in which it works. We can change the packaging of the things we make with much greater ease than we can interfere with the complex mechanics of what lies inside – and we should bear in mind that increasingly this includes technology over which we have little real ability to incorporate change, such as electronics.

If pupils are believed to be part of a culture that responds more vehemently to form rather than function, then it may be no surprise that pupils seek to establish individualism through the simplest means, the product's form, and by the use of materials with which they feel confidence in manipulation.

Conclusions

The evidenceshows that woods and plastics are regarded positively by Year 9 pupils in comparison to metals. It suggests that pupils must therefore be applying some sort of value criteria in making this judgement which is influenced by their misconceptions about the 'correct' ways in which the material has to be used. Metals can be employed within design and technology activity in many ways provided a wider perspective is taken on the part of the teacher in developing an understanding of appropriate techniques. The study indicates that as there is an imbalance in the way that materials are viewed by pupils. Plastics and woods are viewed positively as being clean and compliant with metals being viewed negatively as being dirty and hard. Opportunities to work with metal are inhibited by this viewpoint and a perspective for learning is missed. To address this inhibition it would seem that teachers would first need to familiarise and appraise themselves not only of meaningful (to Year 9 pupils) projects that could be made using metals but also of suitable forming and finishing techniques that would fit within the pupils' concept of a 'good' product. This may prove problematic as metals are not readily associated with the small scale production of aesthetically pleasing artifacts that have become so much a part of design and technology making activity and which in most cases can be relatively successfully delivered using plastics and woods.

There is obviously going to be a need to develop a more positive view of metals in pupils leading to a more balanced understanding of the role that all materials play in generating new ideas and subsequently new technology. However, this bias is going to have to be initiated and delivered by the teacher, and this presents its own challenges.

The evidence has shown that in terms of 'liking' a material, wood for Year 9 pupils is the most popular choice, plastics are second and metals are third. This substantiates at a local level previous national research into this area. The subsequent themes explored in the study also suggest a complex relationship between the views expressed by pupils in the study and the values which are implicitly imparted by teachers and the school environment. There seems to be a link between pupils' concepts of what makes a product good and the way in which the making activity is delivered. Even the presence of good display has been argued to support a bias toward valuing visual appearance over the degree to which a product functions well. The natural progression from these conclusions is perhaps to ask not pupils but ourselves as design and technology educators, where and how these values originate.