Articles

KEY FACTORS INFLUENCING PUPIL MOTIVATION IN DESIGN AND TECHNOLOGY

E. Stephanie Atkinson

Introduction

This article seeks to examine the relationship that exists between pupil motivation and the following internal and external factors: pupil performance in design and technology (D&T) project work, pupil skills associated with D&T project work, pupil personal goal orientation, pupil cognitive style, pupil creativity, teaching strategy, and teacher motivation. The data under discussion were collected as part of a four-year research project. The article examines the research investigated during the final year of the study when a sample of 50, 15 and 16-year-old pupils was selected from eight schools in the northeast region of England.

Data were collected throughout a GCSE[1] Design and Technology (D&T) course work project. A cognitive style test and a questionnaire ascertaining each pupil's perception of their ability and enjoyment in D&T project work were given to the sample at the beginning of the academic year. A case study approach based on observation and informal interviews was then used to monitor the pupils throughout the designing and making of their projects. Upon completion of the project, a summative questionnaire, a goal orientation index, and a creativity test were completed by each pupil. Data about the school's internal moderated mark for each pupil's D&T project were also collected.

In discussing the findings, the relationship between the internal factors and a pupil's ability to perform and be motivated will be discussed. Conclusions will be drawn concerning the influence that external factors, such as assessment and teaching and learning strategies, have upon the attitude and ability of pupils,

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[1]GCSE - The General Certificate of Secondary Education examinations are taken by pupils in England and Wales at the end of compulsory education at the age of 16. There are four separate Examination Boards. Each Board designs their own examinations within a given framework. Under normal circumstances pupils take two years to complete a GCSE examination syllabus. In D&T the examination is in two parts. A 40% examination element and a 60% coursework element. The course work is in the form of an extended design and make task completed during the final year of the course.

while the importance of teacher motivation in sustaining, enhancing or decreasing pupil motivation will also be targeted.

Background to the study

In schools in the United Kingdom (UK), D&T involves a complex integration of processes, concepts, knowledge, and skills (DES, 1992). As the subject area has developed, so has the use of the design process as a method of delivering and examining subject content (e.g. Design Council, 1980; DES, 1987; Kimbell, Stables, Wheeler, Wosniak & Kelly, 1991). These processes have developed out of the linear design models used in the early 1960's (e.g. Kimbell *et al*, 1991). As teachers have become more experienced in working with them and as the subtlety of the process has become more apparent, the models have correspondingly become more complex. By the end of the 1980's many models of the process had been developed (Layton, 1991). It was acknowledged that some models became so complex that they were confusing to those who used them (Kimbell et al, 1991). In 1987 the Department for Education and Science suggested that what was needed was a loose framework to guide designing rather than a well-defined process model which they saw as a straitjacket. This approach was supported by Lawson (1990) who stressed that designing required flexible procedures.

Educationalists would have us believe that the assessment used to judge pupils' work should not dictate the curriculum content. Examination syllabuses should be designed to develop capability and test competence (SEC, 1986; NEAB, 1993). However, the importance of public examination results to pupils and teachers alike dictate that the nature of assessment and its criteria influence what is learned and how it is taught (Scott, 1990; Gipps, 1990). Additionally, the recent need for accountability in the UK has meant that assessment has become overly objective (Wiliam, 1992). As far as GCSE examination syllabuses for Design and Technology have been concerned, this has lead to the use of a prescriptive design process with a very specific list of criteria to be met. Layton (1991) aptly suggested that if teachers were not careful, the process could impose "a procrustean regime" (Layton, 1991, p 5) on the way pupils designed. Pupils have become outcome driven, with the process becoming a series of products. To obtain good examination grades pupils have had to provide evidence that each stage of the specified process has been addressed, irrespective of whether it was appropriate to the design of their particular product or not.

In the UK throughout the 1970's and 1980's it was generally believed that designing and making in the form of project work was an exciting and motivating activity during which the necessary skills, knowledge, and concepts could be taught (Design Council, 1980, Kimbell, 1982; HMI, 1983; Down, 1986). However, during the early 1990's growing evidence suggested that some aspects of that process were forming stumbling blocks for certain pupils (Kimbell et al, 1991; Chidgey, 1994; McCormick, Hennessy & Murphy, 1993). Atkinson (1993, 1994, 1995, 1997) provided evidence that these problems involved a significantly large number of pupils, even though many of them were

able to complete their work and therefore appeared to be successful. Other writers (e.g. DES, 1992; Grieve, 1993; Hendley & Jephcote, 1992) and many teachers placed the blame for the problems on the introduction and implementation of the National Curriculum.

In addition to the approach taken to designing, research has indicated that a complex pattern of factors affect a pupil's performance, learning, and motivation (Kimbell et al, 1991; Naughton, 1986; DES, 1989; NCC, 1993). There are those attributes that a pupil brings with them: their gender, general ability, creative ability, cognitive style, personal goals, knowledge base, and curriculum experience. There are also the attributes of the task itself: its contextual location, its structure, and its likely demands upon the pupil. In the context of D&T, the complex relationship among all these factors and such external forces as culture, context, and parental and teacher expectations cannot be underestimated. Nor can the effect of attitude upon motivation be ignored. Attitudes towards success and failure have a significant bearing upon motivation for both teacher and learner. To identify which attitude has caused motivation or demotivation and then to determine whether attribution could be considered to have been internal or external, stable or fluctuating, and whether it could have been controlled or was uncontrollable is a difficult task (Weiner, 1992).

The theory concerning self-efficacy and personal causation would suggest that individual's have the ability to influence events in their life (Rotter, 1966). In an educational context it has been shown that academically successful pupils are inclined to have an internal locus of control (Atman, 1993). These pupils tend to believe that they are responsible for their own success, while pupils who fail to achieve academic success have an external locus of control and tend to blame their poor results on external factors such as their teacher. McClelland (1961) indicated that those who were academically successful displayed a need for achievement. In addition, he explained that they were able to set goals, determine how to reach them, use data for decision making, delay the reward, and assume personal responsibility for their own behavior. Atman's research during the 1980's led to the development of an instrument that could determine the level of an individual's goal achievement proficiency (Atman, 1993). Her index was designed to provide an individual score for each of the interwoven stages of reflecting, planning, and acting which she, and others, explained were important behavioral characteristics needed in order to accomplish goals. She believed that an understanding of goal orientation was important for design and technology educators as inherent in the design process were two assumptions: (1) that pupils must be able to identify and solve problems and (2) be able to set and accomplish goals.

The terms learning style and cognitive style have been widely used by educational theorists for the past sixty years. Terminology has varied from writer to writer (Curry, 1983, Riding & Cheema, 1991), although most (e.g. Tennent, 1988; Biggs & Moore, 1993; Riding & Pearson, 1994) have agreed that it is a distinct and consistent way of encoding, storing and performing, and one that is mainly independent of intelligence. Riding and Cheema (1991) grouped cognitive style into a Wholist-Analytic Cognitive Style Family, and a Verbalizer-Imager Cognitive Style Family. The Wholist-Analytic style has been

defined as the tendency for individuals to process information in wholes or in parts; the Verbalizer-Imager style has been defined as the tendency for individuals to represent information during thinking verbally or in images. The appropriateness to this study of this categorization of cognitive style can be more easily appreciated when the activity of designing is examined further. The perception and evaluation of information, be it in wholes or in parts, in images or in words, form an integral and important part of the design process used in D&T project work. With regard to the connection between the Wholist-Analytic cognitive style dimension and designing, design methodologists have suggested that for designing to be successful, the process should be an holistic experience (e.g. Kimbell et al, 1991; McCormick et al, 1993; Atkinson, 1997; 1998; NEAB, 1993). Over concern with individual discrete elements "…has frequently emasculated it [the process] by ripping it apart in quite unnatural and unnecessary ways." (APU, 1994, p. 61). Interpretation of this belief in the context of cognitive style would suggest that those at the wholist rather than analytic end of the Wholist-Analytic dimension should make the best designers.

The relationship between designing and the Verbalizer-Imager cognitive style dimension can be understood when one considers the fact that imagining has been shown to be central to the generation and development of ideas (e.g. Kimbell et al, 1991; Garner, 1989; Chidgey, 1994, Liddament, 1993; Barlex, 1994). Glegg (1986) suggested that "…the subconscious has no vocabulary" (p. 87). He explained that when generating ideas in a design situation it was "... important to realize that our subconscious minds will hand up their suggestions in the form of symbols or pictures" (Glegg, 1986 p. 87). In this instance one would expect that those whose cognitive style was situated at the imaging rather than verbalizing end of the Verbalizer-Imager dimension should make the best designers. When a combination of both cognitive style dimensions was considered one would therefore anticipate that Wholist-Imagers should have a potential advantage over pupils in other cognitive style groupings in the context of D&T project work.

During the study it became apparent that delivery programs devised by each school had the potential to be problematic in terms of pupil motivation during their examination project work. The intention of each program was to enable pupils to cover all aspects of the examination syllabus. Each school followed examination guidelines and allowed the same number of teaching hours for the project work. However, in certain schools the examination theory work and the project work were run concurrently while in others one element of the syllabus was dealt with at a time. These two models provided pupils with very different overall time scales for their project work. In some schools the project work was finished in a short period of time while in others it stretched over a full academic year. It was also noted that the actual amount of time used to complete the work did vary greatly from pupil to pupil. The differences were accounted for by the amount of "extra" time each pupil was willing to spend on their project both at home and in school.

Observation of the approaches to designing adopted by the pupils raised a number of motivational issues. Quite naturally, pupil approaches were

influenced by the Examination Board's documentation and the teaching strategies adopted by individual teachers. Observation indicated that teachers tended to utilize one of two strategies to enable their pupils to meet deadlines and address the specified assessment criteria. In one of the strategies the teacher tended to act as a collaborator, while in the other a more 'interventionist' mode of teaching was adopted.

In schools where teachers utilized an "interventionist" approach, pupils tended to move very quickly from designing to the manufacturing stage. Very few pupils produced carefully detailed drawings. Development of the chosen idea was carried out as manufacturing took place. Pupils lost ownership of their project, as decisions were made in a piecemeal, "interventionist" manner by the teacher. Ill-defined, but often in the context of the pupil's existing technological or constructional understanding, adventurous ideas meant that pupils were working in areas beyond their technological capability. This led to many disillusioned pupils and poorly-made, unfinished outcomes.

In schools where teachers exhibited what has been defined as the "collaborative" model, time was given to individual pupil-teacher discussions. Designing and making were a "collaborative" effort in which pupils were able to retain ownership of their project throughout the process. However, for some pupils there were disadvantages associated with this model. The problems tended to center around boredom. Pupils saw the design process stretching interminably ahead of them. The manufacturing stage to which they looked forward seemed an impossible target to reach. This caused a noticeable slowing down of work rates that only exacerbated the situation. For these pupils, deadlines came and went.

Against this complex background the relationship that existed between pupil motivation and certain identified internal and external factors was examined.

Method

Population and Sample

The initial sample of schools used in the study was a non-probability, purposive sample of 150 schools in seven Local Education Authorities (Atkinson, 1993). These schools were used by technology students on an Initial Teacher Training program at a University in the northeast area of England. From this sample 50 schools were selected using data from the Education Authorities Directory and Annual (1992) in order to provide a balance of size, type, and location of school. A questionnaire seeking pertinent background information was sent to each Head teacher and Head of D&T. Forty-five of the 50 schools returned the questionnaire. Analysis of the data enabled a final sample of eight schools to be selected. This selection was carried out in two stages. In the first instance, in order to avoid sampling bias, only schools that offered all three D&T GCSE examinations[2] were considered. The second stage used a four cell matrix based on the location of the school (inner city or large town/suburbia or

[2]Design and Realisation; Design and Communication; Technology.

small town) and the size of 10th grade (Over 125/Under 125). The size of each school's population was not used as a sampling mechanism since the range of ages was variable from school to school. Some schools were 11-16, some were 11-18 while others were 13-18. This meant that schools of the same size did not necessarily have parity between the size of their 10th grade cohort.

The sample of pupils reported in this study initially involved 112, 15 to 16-year-old pupils (85 boys and 27 girls) and their D&T teachers in the eight targeted schools. The research was carried out during the first year in which it was compulsory for all 15 and 16-year-old pupils to study D&T as part of the National Curriculum. This made it possible for the eight teachers to select a single mixed-ability class from their school and for that chosen class to be representative of the 15 and 16-year-old cohort within that particular school. After an initial data collection period, 50 pupils (36 boys and 14 girls) were selected from the targeted sample using a matrix of eight pupil types. This was based upon data concerning a pupil's cognitive style, their ability to design, and their perceived enjoyment of designing and making. These pupils were then observed on a regular basis for the duration of the D&T examination project work with the intention of identifying some of the causes of pupil demotivation[3] that were becoming a concern to teachers and educationalists in the UK.

Instrumentation

The following data gathering instruments were used in the study.

Research instruments that provided quantitative data:

- Appropriately tried and tested questionnaires – administered before and after the D&T project work.
- GCSE examination marks for the D&T project work. The distribution of marks for the sample were checked against the normal distribution curve achieved by the total examinees for the GCSE D&T examination and were found to be similar.
- A computer presented, self administered Cognitive Style Analysis (CSA) designed by Riding (1991). This assessed two fundamental ways of thinking and working (cognitive style dimensions): wholist-analytic and verbal-imagery. The validity of the instrument was supported by " ... the finding of significant relationships between style and a range of school learning performance (e.g. Riding & Caine, 1993; Riding & Douglas, 1993; Riding & Mathias, 1991; Riding & Sadler-Smith, 1992;)" (Riding, Burton, Rees & Sharratt, 1995, p. 115).
- A goal orientation test that set out to assess important behavioral characteristics associated with accomplishing personal goals. This was based on an index designed by Atman (1986). To provide construct validity Atman had undertaken "...correlation studies with several well-

[3]The definition for demotivation is taken from the New Shorter Oxford English Dictionary where it is defined as - to make less strongly moticated (Brown, 1993) and the Collins Today English Dictionary where it is defined as - to loose ones determination to do something (Sinclair, 1995).

known instruments (e.g. Jackson Personality Inventory, the Bass Orientation Index, Nideffer's Test of Attentional and Interpersonal Style, the Myers-Briggs Type Indicator)" (Atman, 1993, p. 4).

· A creativity test in two parts. The first section was used only to stimulate the pupil's creativity and was not scored. It was taken from De Carlo's (1983) *Psychological Games.* The second section was based on the then unpublished doctoral work of Oxlee (1996). This test was particularly appropriate to testing creativity in the context of design activity, although the present author recognized that proof of its validity was minimal since it had been developed by Oxlee so recently.

72 Categorization of pupils as motivated or unmotivated. This was established as an on-going process throughout the observation period. Pupil motivation was determined using a rating scale. A researcher response to each criterion listed below, was located on a coding frame of fixed alternatives at the end of the observation period and a score for motivation was then calculated. This score was checked against the teacher's perception of each pupil's level of motivation and triangulated against data elicited from the pupil questionnaire concerning their perceived level of motivation. Judgments on levels of motivation were made using the following criteria:

- observed enthusiasm for their project;
- observed pupil interaction with their teacher;
- observed pupil interaction with their peers;
- attendance;
- time keeping;
- ability of pupil to stay "on task" during lessons;
- teacher comments on pupil's levels of motivation;
- pupil comments on their own level of motivation;
- on-going scrutiny of design and practical outcomes.

· Categorization of teachers as motivated or unmotivated. This was established as an on-going process throughout the observation period. As in the case of determining pupil motivation, a rating scale was used. A response to each criterion listed below was located by the researcher on a coding frame of fixed alternatives at the end of the observation period. Additionally, a score for motivation was then calculated. Judgments on levels of motivation were made using the following criteria:

- teacher interaction with the whole class;
- teacher interaction with individual pupils;
- time keeping;
- teaching style;
- observed enthusiasm for the subject based on interaction with pupils;
- observed enthusiasm for the subject based on interaction with researcher;
- observed enthusiasm for project work based on interaction with pupils;
- observed enthusiasm for the project work based on interaction with researcher.

Research Instruments that provided qualitative as well as quantitative data:

- Observation of project work. Observation sheets, designed by the researcher, were completed on pupil project progress and skill levels on a regular basis for the duration of the examination project work;
- Semi-structured and informal interviews. These were carried out with both pupils and teachers whenever appropriate throughout the observation period.

For the purpose of comparability between data the scores achieved by each pupil for the different tests were converted proportionally to a four-point scale, with four being the highest and one being the lowest.

Procedures

Instrumentation was developed as reported and the sample was drawn as described. The data were collected between June 1995 and May 1996. Coding and analysis of the data were carried out as each set of data was collected. The statistical analyses included percentage distribution, rank order, one sample *chi*-square test of variance, unpaired comparison of averages using *t*–tests, *chi*-square test for independence, and Fisher's Exact Test for 2x2 tables. Descriptive analysis included mean scores and line charts.

Results

The relationship between pupil motivation and pupil performance

Chi-square analysis of the data collected during the observation period indicated that a disappointingly high proportion of the total sample were unmotivated by the activity in which they were involved. The level of significance was found to be <.0001. The raw data concerning the number of pupils in each motivational category is reported in Table 1.

Table 1

Number of pupils and the mean score for performance, creativity, drawing skills, writing skills, design skills, manufacturing skills achieved by each motivational group

Pupil Motivation Group	Mean Scores (Maximum Score 4)						
	n	Performance	Creativity	Drawing	Writing	Design	Manufacture
Motivated	10	3.20	2.50	2.80	3.30	2.60	3.10
Motivated towards result but unenthusiastic about activity	11	3.00	2.29	2.14	2.71	2.00	2.57
Unmotivated	29*	1.76	2.28	1.55	2.27	1.30	1.58

*$p<.0001$

Analysis of pupil performance and levels of motivation indicated that the relationship between performance and motivation was positive. Pupils who were motivated achieved a high mean score in their examination project work while

those who were unmotivated achieved a low mean score. These results are reported in Table 1.

The relationship between pupil skills, motivation and performance

Data collected throughout the examination project work indicated that there was a positive correlation between a pupil's drawing, writing, design, and manufacturing skills, and their levels of motivation. Those pupils who were motivated achieved high mean scores for their drawing, writing and designing while those who were unmotivated achieved low mean scores. Results are reported in Table 1.

The data as shown in Table 2 indicated that those pupils who were motivated and possessed above average design skills achieved the highest mean score in their project work, while those who were unmotivated and had below average writing skills achieved the lowest mean score.

Table 2 also indicated that a significant number of pupils who were unmotivated had below average design skills. In the case of manufacturing skills it was found that a significant number of unmotivated pupils had below average skill levels while a significant number of motivated pupils had above average skill levels.

The relationship between personal goal orientation, motivation, and performance

In order to analyze the relationship between a pupil's personal goal orientation, motivation, and performance, the individual scores for reflecting, planning, and acting were calculated for each pupil. The results indicated that a pupil's ability to "act" tended to remain constant whether they achieved high or low marks. These results are reported in Table 3. However, with regard to "planning" and "reflecting" there were significant differences between those who performed well and those who did not, as indicated in Table 3.

Table 3

The mean scores (max. 4) achieved by pupils for their GCSE project work when grouped by personal goal characteristics

	Average Mean Scores for Total Sample *n*=50	Mean Scores for Those Who Achieved Low Marks *n*=16	Mean Scores for Those Who Achieved High Marks *n*=16
Acting	2.49	2.44	2.44
Planning	2.44	0.98*	3.00
Reflecting	2.47	0.97**	3.13

**t*=5.550, df 30, *p*-value <0.0001

***t*=5.028, df 30, *p*-value <0.0001

Table 2

The mean project work score achieved by each motivational group when split by drawing, writing, design and manufacturing skill level (n in parentheses)

Pupil	Above Average Skill Level				Below Average Skill Level			
Motivation	Drawing	Writing	Design	Manufacture	Drawing	Writing	Design	Manufacture
Motivated	3.50(6)	3.43(7)	3.67(7)	3.25(8)*	3.00(4)	2.67(3)	3.00(3)	3.00(2)
Motivated towards result but unenthusiastic about activity	3.00(3)	4.00(3)	3.61(3)	3.00(4)	3.00(4)	2.25(4)	2.50(4)	3.00(3)
Unmotivated	2.00(5)	2.42(12)	1.87(3)	3.00(3)	1.71(28)	1.38(21)	1.87(30)*	1.63(30)*

*p<.0001

It was found that when the relationship between goal orientation and motivation was investigated it could be seen that there were similarities between the data collected and the data concerning the relationship between goal orientation and performance as portrayed in Figure 1.

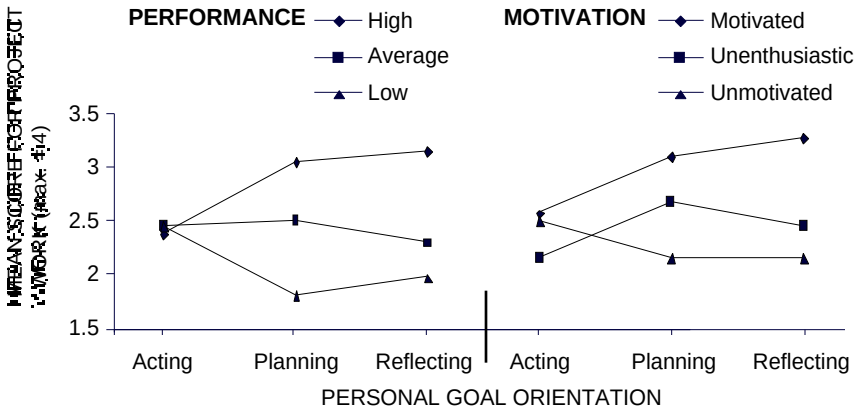

Figure 1. A comparison between the data for motivation and the data for performance split by the three behavioral characteristics: Acting, Planning and Reflecting.

The relationship between cognitive style, motivation and performance

The data collected during this research project indicated that those pupils who were Imagers and Wholists were the ones who achieved the poorest results during their project work, while the data collected also indicated that those who were analytic, whether they were Imagers or Verbalizers, tended to achieve high marks. This is portrayed in Table 4.

When the targeted sample of 50 pupils was scrutinized, 18 pupils were found to be Analytic-Verbalizers; 13 were Analytic-Imagers; 10 were Wholist-Imagers; and nine were Wholist-Verbalizers.

In the case of the Analytic-Imagers, Wholist-Imagers and Wholist-Verbalizers, a significant number of them were unmotivated in comparison to those who were motivated. Analytic-Verbalizers were more evenly spread between the motivated and unmotivated categories. See Table 5 for Chi-square test results.

Table 4

The average percentage mark achieved by the original sample of 112 pupils (minus eight pupils who were withdrawn from the examination) grouped by the selection of sample factors

Cognitive Style	Enjoyed designing and can		Enjoyed designing but can't		Preferred making and can design		Preferred making and can't design	
	Analytic	Wholist	Analytic	Wholist	Analytic	Wholist	Analytic	Wholist
Verbalizers	75	67	40	22	64	45	43	39
Imagers	88	48	62	20	66	36	32	28

Table 5

A Chi-square test on levels of motivation for each cognitive style group

Cognitive Style	Motivated	Unenthusiastic about the activity	Unmotivated	Variance	df	Chi-square	*p*-value
Analytic-Imagers	2	2	9	24.5	1	24.5	<.0001
Wholist-Verbalizers	0	3	6	18.0	1	18.0	<.0001
Wholist-Imagers	2	0	8	18.0	1	18.0	<.0001
Analytic-Verbalizers	6	2	10	8.0	1	8.0	.0094

The relationship between creativity, motivation and performance

Analysis of the data collected in this research study indicated a positive relationship between creativity and performance as portrayed in Table 6. This is in contrast to the data in Table 1 where it was shown that there was not a significant difference in the level of creativity between those pupils who were motivated and those who were unmotivated.

Table 6

The relationship between a pupil's creativity level and performance (max. score 4)

Level of Creativity	Poor Level	Average Level	Good Level
Performance Mean Score	1.41	2.05	2.82

The relationship between teaching strategy, motivation and performance

Table 7 illustrates the relationship that exists between teaching strategy, motivation, and performance. Pupils attained higher levels of achievement in schools adopting an "interventionist" approach. However, 72% of the pupils in those schools were found to be unmotivated in comparison to only 55% of pupils in schools adopting a "collaborative" teaching strategy.

Table 7

The mean score achieved by the sample grouped by teaching strategy and pupil motivational level

	"Interventionist" model		"Collaborative" model	
Motivational Level	*n*	mean score	*n*	mean score
Motivated	5	3.75	5	2.80
Motivated towards result but unenthusiastic about activity	4	3.60	3	2.00
Unmotivated	23	2.04	10	110
Total	32	2.50	18	1.72

It was considered that project work completion may be an indicator of levels of motivation. In the case of schools adopting an "interventionist" model there was less motivation and also a considerable number of pupils with incomplete projects when the project deadline was reached. These data are portrayed in Table 8.

The relationship between pupil motivation and teacher motivation

In order to examine the relationship between pupil motivation and teacher motivation data were collected throughout the observation period using the list of criteria indicated in the methods section. The number of pupils in each motivational category is displayed in Table 1. As far as the teachers were concerned, analysis of the collected data indicated that in only three of the eight schools could the teacher be said to be inclined towards high levels of

motivation. In each of the other five cases the teachers were found to fall predominantly at the unmotivated end of the motivational spectrum.

When the data concerning teacher motivation and pupil motivation were compared, it was found that a significant number of the sample of pupils being taught by unmotivated teachers were unmotivated themselves as indicated in Table 9.

Table 8

The percentage completion rates of pupils (n=50) in schools adopting either "interventionist" or "collaborative" teaching strategies. The Fisher's Exact Test for 2x2 tables was also carried out on the data

Completion Rate	"Interventionist" Model *n*=32	"Collaborative" Model *n*=18
Complete	34% (11)	61% (11)
Unfinished	66% (21)	39% (7)

Fisher's Exact *p*-value=.0827

Table 9

The mean score (max. 4) achieved for the examination project work grouped by teacher motivation and pupil motivation

Pupil Motivation	Motivated Teacher	Unmotivated Teacher
Motivated	3.40 (5)	3.00 (5)
Motivated towards result but unenthusiastic about activity	3.57 (7)	2.50 (4)
Unmotivated	1.86 (7)	1.41 (22)*
Total number of pupils	19	31

**p*=<.0001

Discussion

The relationship between pupil motivation and pupil performance

The data collected during this research project supports the well-documented belief that there is an association between motivation and performance (e.g. Weiner, 1992; Bandura & Dweck, 1985; Dweck & Leggett, 1988; Elliot & Dweck, 1988). Performance has been shown to affect motivation and motivation has been shown to affect performance. In the case of this study with its emphasis on GCSE examination work this belief was found to be particularly pertinent and well founded.

There is a theory that behavior is controlled by the pleasure-pain principle in which people maximize the pleasure linked to success and minimize the pain generated by failure (Weiner, 1992). It was expected that this theory would apply to this study and that many of the pupils would be motivated by their desire to achieve good results in their examinations and also by their wish to make an artifact of which they and their parents could be proud. However, by

the end of the study it was disappointing to find that only 42% of pupils were found to be in this category and only five percent of this sub-sample was enthusiastic about the process in which they had been involved. The following discussion concerning the identified factors provides an insight into possible reasons for these findings.

The relationship between pupil skills, motivation and performance

In all schools in the sample, the lack of skills and understanding regarding processes and materials were found to present a major problem for many of the pupils during both the design and the manufacturing stage of their project work. Analysis of the evidence during the observation period suggested that pupils' ideas, when carried through to the manufacturing stage, caused many of them to work beyond their technological and craft capability. Teachers had indicated that they were all aware of this problem. They were disappointed by the quality of the artifacts produced by the majority of their pupils. In an attempt to support all pupils throughout their project work, teachers were seen to develop a strategy in which they designed solutions to pupils' problems in their heads, as the need arose. The necessity for many pupils to have an understanding of the direction in which they should head was given a low priority. However well intentioned this course of action may have been, the evidence would suggest that it had a demotivating effect upon many of the pupils. They became very frustrated by their inability to proceed without continuous reference to their teacher. The common belief that ownership develops a sense of responsibility, pride, and the motivation to succeed would support the use of strategies that would enable pupils to retain ownership of their idea throughout the project rather than the loss of ownership witnessed among many pupils during this research project.

The relationship between personal goal orientation, motivation, and performance

The analysis of goal orientation data indicated that there was little difference between those pupils who were motivated and those who were unmotivated with regard to their belief in their ability to act. Although it should be pointed out that unmotivated pupils could be said to have an inflated image of this ability if their poor completion rate in the project work was taken as an indication of an inability to "make it happen."

An essential element of each aspect of the design process, and one which is highly prized in the GCSE examination marking criteria, is an ability to reflect upon and evaluate personal thoughts and actions. The very high score achieved by motivated pupils in this aspect of goal orientation along with the high score they achieved for "planning" were seen as providing one of the possible reasons why these pupils achieved high project work marks. Those pupils who were categorized as unenthusiastic about the activity also scored relatively highly in their ability to plan. This gave some support to their above average mean project work mark. However, their belief that they were generally not as good at "reflecting" and that they were particularly poor at getting on with a task provided a possible explanation for their lack of enthusiasm for an activity

which demanded good reflective skills and an ability to complete each stage of the process by a given time.

The relationship between cognitive style, motivation and performance

Due to the nature of the design activity central to this study, the expectation had been that Wholist-Imagers would achieve high marks for their project work. However, this was not the case, Wholist-Imagers achieved the poorest results. Analysis enabled the researcher to identify and quantify the reasons for this unexpected feature of the data. Factors concerning the design processes adopted provided an explanation for this sub-sample achieving a low mean score.

It is well accepted that for designing to be successful it should be a holistic experience. However, in order to ensure that pupils met each of the assessment criteria, teachers were seen to split the process into easily managed units of work. Observation showed that these were tackled often in isolation before the next aspect of the process was discussed. The holistic nature of the process was therefore fragmented, thus playing into the hands of those who were analytic.

Analysis of the process indicated that since drawing is such an important aspect of designing, one might have expected Verbalizers who preferred processing information verbally to achieve significantly lower marks for their projects than those pupils who preferred working with images. This was not, however, found to be the case. Not all Imagers were able to draw. Nor could the majority of Imagers rely upon their writing skills, as these skills were generally found to be unsatisfactory.

For those Imagers who avoided writing, their on-going evaluation was mainly to be found hidden in subtle forms within their drawn images. Access to a pupil's immediate thoughts at the time of the conception of ideas was impractical. Moreover, it was not easy to credit these thoughts objectively at a later date during the assessment process. In comparison, those who were Verbalizers communicated their thoughts in a form that was more easily interpreted by teachers during assessment, thereby gaining them praise from their teachers and valuable marks for their examination.

The relationship between creativity, motivation and performance

Evidence from the study supported the researcher's hypothesis that there was a connection between a pupil's level of creativity and the strategies they would adopt while engaged in project work. Much has been written concerning the high levels of motivation and performance witnessed amongst those who are creative (e.g Amabile, 1985; McAlpine, 1988; Osche, 1990). With regard to performance, the evidence collected during this study supported these findings. However, with regard to the relationship between creativity and motivation the evidence did not provide a clear-cut case. There was a similarity between the mean creativity scores for each motivational category. Once again, analysis of the process used by the pupils to complete their examination project work provided an explanation for the lack of a positive relationship between creativity and motivation.

The data collected enabled the researcher to categorize those who were creative and those who were not creative into two sub-groups. The inherently creative could be divided further into those who were able to design within the constraints of the GCSE examination process model and those who were inhibited and unmotivated by such a structured approach. The latter group encompassed the majority of pupils and within it there were those who were neither creative nor receptive towards working with the design process models offered to them. This group was seen to become increasingly unmotivated as the project work progressed. The other sub-group was willing to accept the design methodology taught, although they too were not naturally creative. At the start of the project these pupils were motivated because they wished to produce satisfactory outcomes of which they could be proud. However, as time progressed they too became increasingly dissatisfied with the process they had been asked to adopt. This group maintained motivation by concentrating upon achieving a good examination result rather than enjoying the activity.

The relationship between teaching strategy, motivation, and performance

As explained earlier, the research had identified two basic strategies that were adopted by teachers in the schools, a "collaborative" approach and an "interventionist" approach. Schools adopting "interventionist" approaches tended to use delivery programs that were completed in a short period of time. In these schools, deadlines tended to be well before the deadline set by examination boards. This provided pupils with extra time in which to complete work that was unfinished.

In schools adopting the "collaborative" model, deadlines tended to coincide with examination board deadlines. The consequence of this was that pupils did not have extra time to finish incomplete work. This had a detrimental effect upon final performance scores for these pupils. Pupils achieved lower scores in each motivational category in these schools. However, it was interesting to note that as far as motivation was concerned there was a higher percentage of motivated pupils in schools adopting a "collaborative" approach.

An analysis of the teaching strategies suggested reasons for these differences. In schools where teachers exhibited what has been defined as the "collaborative" model, time was given to individual pupil-teacher discussions. Detailing of ideas was a "collaborative" effort between pupil and teacher, with pupils retaining ownership of their idea. Many of those who succeeded in reaching the manufacturing stage of their project were able to complete their work in time for assessment. For those pupils who did not, the problems associated with this model came about through boredom. From a fairly early stage these pupils saw the design process stretching interminably ahead of them. The manufacturing stage to which they looked forward seemed an impossible target to reach. This caused a noticeable slowing down of work rates that only exacerbated the situation.

Evidence would suggest that the speed of the process used by schools adopting an "interventionist" approach failed to provide pupils with enough time for the maturation of thoughts and ideas at each stage of the process. Although pupils in schools where "collaborative" strategies were used technically had the

same number of hours for their projects, the evidence would suggest that the spread of this time over months rather than weeks allowed pupils access to this important maturation time. "Collaborative" approaches also gave teachers time to familiarize themselves with pupils' projects. This enabled them to prevent some of their pupils from making unwise design decisions, whereas many teachers using "interventionist" strategies were found to be frustrated by their inability to prevent design disasters from occurring.

As far as the design folders prepared by the students to document the design process were concerned, very few were completed without considerable pressure being applied by the teachers. Motivated pupils in all schools were persuaded to re-work or "pretty-up" existing work and fill gaps in their design process. The limited time spent on the folder work in the "interventionist" model meant that the folders, of even those who believed that they could design presented little evidence of using designers' thought processes at the various stages of the project. In an attempt to present the required evidence for assessment, pupils were encouraged to complete written sections describing their decision-making procedures. This was often carried out retrospectively on the pupils' own time when they were pulling their design folder together.

The design work of those working in schools where a "collaborative" approach had been adopted displayed two different levels of success relative to their design folders. Those who enjoyed the act of designing produced visually excellent folders that contained creative thinking. At the same time, they showed a considerable amount of re-worked and over-worked sheets. Those who did not enjoy designing produced numerous sheets of work attempting to satisfy the examination criteria but showing little evidence of a designer's thought processes.

With regard to pupils developing a sound understanding of the process of designing, analysis of the two strategies adopted by the schools indicated that neither the "collaborative" or the "interventionist" model were successful. Feedback from pupils after they had finished their examination projects supported the researcher's findings. Pupils' reactions indicated that although some of them were able to obtain satisfaction from achieving success in the examination, many of the pupils in schools adopting either approach were unmotivated and skeptical about the validity of the process they had been asked to adopt.

The relationship between pupil motivation and teacher motivation

Throughout the observation period a growing picture emerged that indicated the importance of teacher motivation when considering the causes of reduced pupil motivation in D&T. The reasons for reduced teacher motivation were found to be as complex and numerous as the reasons for the loss of motivation among pupils. However in the context of D&T these summarily included the developing ill-defined philosophy of D&T, the introduction of the National Curriculum, accountability, financial constraints, and the speed of the changes in direction imposed by each revision of the National Curriculum.

In the schools where the D&T teachers were enthusiastic, there was an air of optimism surrounding the classroom/workshops. This was despite the fact that they, like the unmotivated teachers, believed that external pressures affected the work they were carrying out with their pupils. The "optimistic" teachers seemed to treat these pressures as a challenge rather than as an excuse for poor results. In each case it was also noticeable that the teacher was part of an enthusiastic team of D&T staff lead by a motivated Head of Department. In the five schools where teachers lacked enthusiasm for their work it was found that in three instances the noted despondency prevailed across the whole D&T department, including the Head of Department.

As stated earlier, only ten out of the 50 pupils were found to be motivated by the end of their project work. The data collected did indicate some support for the researcher's hypothesis that fewer pupils would be found to be unmotivated in schools where enthusiastic, motivated teachers were teaching the D&T lessons. However, it was disappointing to find that there was not a statistically significant difference between the two groups of teachers. Twenty-six percent of the sample taught by motivated teachers were enthusiastic about their project work in comparison to 16% of the pupils taught by despondent teachers.

Conclusion

Analysis of the research findings indicated that only twenty percent of the pupils studying at 10th grade were motivated by their D&T examination project work. Using the collected data it was found that a significantly larger number of pupils, just under sixty percent, were categorized as unmotivated. A further twenty-two percent of pupils had not enjoyed the activity, although their wish to perform well in their GCSE examinations had been a contributing factor in keeping them motivated in their D&T project work.

The evidence of the research concerning reasons for the differing levels of pupil motivation painted a complex picture of interactions between internal and external factors. A positive relationship was established between a pupil's ability to perform and their level of motivation. Such factors as a pupil's ways of thinking and working, personal goal orientation, and skills appropriate to D&T were found to show a positive relationship with both performance and motivation. On the other hand, although a pupil's level of creativity was found to relate positively to performance, no similar relationship was found between creativity and motivation. An equal number of pupils at both extremes of the creativity spectrum were found to be unmotivated. Analysis suggested that the prescriptive nature of the examination design process models adopted, as well as the effect of GCSE D&T assessment criteria upon ways of working, were frustrating for many pupils, particularly those who were creative. It was also evident that external factors such as delivery programs, as well as teaching strategies adopted by teachers to meet examination deadlines and requirements, influenced both pupil performance and pupil motivation.

The researcher would suggest that lessons to be learned from the findings include, firstly, the need for Examination Boards to develop holistic assessment procedures that will encourage the use of more appropriate, flexible, design

process models. Secondly, the study supported the generally held belief that most teachers need to feel in control of classroom activities. To achieve this "control" in the context of D&T many teachers were seen to remove ownership of ideas from pupils at an early stage of the process. The common belief that ownership develops a sense of responsibility, pride, and the motivation to succeed has tended to be overlooked. In order to remedy this teachers need to develop strategies that will enable them to guide pupils through the process in a partnership where ownership is a joint affair. To achieve this teachers need to develop a far deeper understanding of the activity involved in designing than the present evidence would suggest is the case.

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