The Relationship Between the Time Spent Studying Subject Knowledge and the Attitude of Trainee Teachers to the Subject(s) They Will Teach

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Abstract

The study emanated out of a mounting concern regarding the lack of subject knowledge of students training to become teachers of Design and Technology (D&T) in England and Wales. The article presents the research carried out to establish whether or not the length of time a student spent studying subject knowledge might have some bearing upon how positive their attitudes and beliefs were about the subject and teaching it. The data were collected from a cohort of 83 D&T Initial Teacher Training (ITT) students from a University in the North East of England using a self-completed attitude measurement scale comprising 22 statements concerning a student's attitude to teaching D&T, their beliefs about the subject, and their perception of their own D&T ability with particular reference to design activity. The results of the survey were discussed in detail, and conclusions and implications were drawn.

Keywords: subject knowledge, designing, attitudes, trainee teachers

In this article the author considers the relationship between attitude and the time available to study subject knowledge for students who are training to become teachers of Design and Technology (D&T). Literature has indicated a strong link between positive attitudes, motivation and being successful in whatever task is undertaken (e.g. Atkinson, 2009; Sternberg, 2005; Weiner, 1992). This is particularly so in tasks where creativity is an integral part of that activity (Cropley, 2001; Hennessey, 2007; Sawyer, 2006). In D&T taught within schools in the United Kingdom and elsewhere around the world, designing which involves creativity forms a central aspect of the subject. The literature on creativity would suggest that pertinent knowledge is required for creativity to occur (Cropley, 2001; Sternberg, 2005; Urban, 2007) as well as it being crucial for a teacher to be successful (Barlex & Rutland 2003, 2004; Ball, Hill, & Bass 2005; Lewis 1996; Simmons 1993). The lack of substantive knowledge acquisition during the training of D&T teachers in England and Wales has become a concern of researchers and practitioners over the past decade (e.g. Banks & Barlex, 1999; Martin, 2008; Rutland, 1996, 2001; Tufnell, 1997; Zanker, 2005).

Although it is recognized that subject knowledge in the context of D&T can refer to a plethora of skills, knowledge, and understanding, in this study it is the knowledge, skills, and understanding that surround the central and fundamentally important activity of designing, which have been targeted.

Data collected from previous research (Atkinson, 2009) concerning the difficulties D&T students on Initial Teacher Training (ITT) programs had with the activity of designing hinted that the longer students studied D&T the better their attitude became toward D&T in general, the activity of designing, and teaching D&T.

This article presents the research carried out in 2009 to establish whether or not these indications were accurate and if so what the implications could be. In this instance data were collected from a cohort of 83 D&T ITT students from the same University in the North East of England where the previous research had been carried out.

Initial Teacher Training of D&T Teachers

There are eight routes available in the UK for those wishing to achieve Qualified Teacher Status (QTS) that will enable them to teach in state-maintained schools throughout England and Wales (see Table 1).

Referring to these eight routes the Training and Development Agency for Schools (TDA) (2010) for England and Wales explained that the "…training comes in all shapes and sizes, providing options to suit everyone – no matter what the qualifications, experience, preferences or personal circumstances are." There are six employment-based or training-based routes that enable trainees to qualify while working in a school and there are routes offered by a number of Universities that after rigorous and frequent inspection by the government are allowed to

provide programs of ITT. These programs either combine training to become a teacher while completing an undergraduate (UG) degree of two or three years duration, or, for those who already possess a degree, there are postgraduate (PG) programs of ITT that last for one or two years. The research presented in this article concerned University based ITT and not employment-based ITT.

Table 1. The Eight Routes Available in the UK for Those Wishing to Achieve Qualified Teacher Status

Route		Explanation
University based	Postgraduate Certificate in Education (PGCE)	One-year Program for Graduates
	Undergraduate BA/BSc (Honors) with QTS or Bachelor of Education degree	Students study for a degree and complete ITT at the same time
School-based	School Centered Initial Teacher Training (SCITT)	Graduates train in a school environment
	The Graduate Teacher Program (GTP)	Graduates achieve QTS while teacher training and working in a paid teaching role
	Teach First	Graduates train to be effective teachers in challenging schools
	Registered Teacher program (RTP)	Employed by a school, earn a salary complete a degree and work towards QTS all at the same time
	Assessment-based training	Candidates with substantial school experience may be able to qualify with minimum teacher training
	Overseas Trained Teacher Training Program (OTTP)	Program for teachers qualified outside the European Economic Area

Reason for the Study

In the UK a recent report into teacher training for the Department for Children Schools and Families (CSFC, 2010) suggested that the government should withdraw its financial support for UG Secondary ITT programs. The reason given was that PG ITT programs provided a better quality of teacher. If this report were to be accepted then all UG D&T ITT programs would cease to exist, as such programs would become unviable without government financial support. This would mean that D&T teachers would be trained by either employment-based routes or within a University environment using the One-Year PG route only, which provides little time for students to develop any further subject knowledge upon which to base their Pedagogical Content Knowledge (PCK) (Shulman, 1986; 1987) and subject constructs (Banks et al., 2004) that are essential if they are to become successful D&T teachers. This possibility is therefore of great concern to all those who wish to provide the best possible D&T teachers to meet the educational needs of school pupils in the future.

It was therefore decided to carry out a small-scale study looking at the attitude and beliefs of 83 D&T students at the University in the North East of England where Three- and Two-Year UG and One- and Two-Year PG ITT programs were all being studied. It was believed that the data from this project could add to the picture gained from earlier research (Atkinson, 2009) by indicating which program provided the students with the most positive attitude and beliefs about the subject they were training to teach.

A Review of the Literature

Attitudes and Beliefs

As explained in the introduction attitudes and beliefs have a bearing upon being successful in achieving a goal. In this article that goal is for each student to become a successful teacher of D&T. Galletta & Lederer (1989) suggested that attitudes provide people with a framework within which to interpret the world and integrate experiences, whilst the aim of attitude measurement has been shown to derive indices of socially significant behavior (Lemon, 1973) or as Ajzen & Fishbein (1977) suggested, that by understanding an individual's attitude towards something, one could predict an individual's overall pattern of responses to a situation.

Fishbein & Ajzen's (1975) definition of attitude as a ". . . learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (p. 10) is an accepted definition although different researchers would tend to place different emphases, or have different understandings concerning each element of that definition. In 1993 Robson agreed suggesting that ". . . the term 'attitude' is somewhat slippery" (p. 256)

leading to a lack of response consistency in attitude tests, partially because of the plethora of interpretations of the definition and partially because it is not easy to assess something like attitude by means of a single question or statement. To help rectify this problem the attitude scale devised for this study using a Likert-type scale included several items targeting the same attitude from different angles in an attempt to provide triangulation and allow a much fuller picture of the attitude under question to be built-up. The researcher was aware that problems could arise in statement selection in terms of demonstrating that the different items were related to the same attitude and determining that the method used to pull together the responses in terms of the numbers assigned to particular answers were justified, while being aware that combining statements relating to several dimensions on the one scale may well reflect the underlying structure of the attitude, but could make it difficult to interpret cumulative scores.

However, given all these pitfalls, Robson (1993) explained that a well-designed Likert-type scale could be quick, and easy for respondents to complete and that respondents were more likely to co-operate and provide considered replies than when using other forms of questionnaire that could be seen as boring.

The Importance of D&T Teachers Understanding the Process of Designing

Archer and Roberts suggested in 1992 that:The design act is one of discovering and elaborating and adapting requirements and provisions to match one another. The problem is obscurity about what the requirements might be, ignorance as to what sorts of provisions might be suitable and uncertainty as to how well the one might fit the other. (pp. 3-4)

In 2004, Miliband (then a junior Minister in the government's Department of Education and Skills) wrote that "designing is the combination of, and movement between, thought and action and an aspect of D&T that helps to make it distinctive in the curriculum" (p. 4). That statement continues to provide a sound educational reason for designing being part of every child's education, while within the D&T curriculum itself designing continues to play a vital role. Without it, the subject, as we know it in England and Wales today could not exist. Unfortunately, taught poorly it has been shown to taint the view that many pupils have of the subject (Atkinson, 2000) and regrettably there has been considerable evidence from the Office for Standards in Education (OFSTED) (1998, 2000) and others (e.g., Toft, 2007) who suggested that too often designing in schools has not been taught as well as it could be.

One of the aims of D&T teachers should be to develop a pupils' understanding of how to design effectively and efficiently so that they can make functionally appropriate, creative, and innovative products that are fit for purpose. Through various appropriate forms of design activity pupils can learn to appreciate the relevance of designing as a significant part of their D&T curriculum, not the unpalatable means to an end, which it is perceived to be by many pupils today (Atkinson, 2000). The "end" being referred to here is the activity of "making," which is understandably enjoyed by the majority of pupils. In terms of manufacturing a well-crafted product "measure twice and cut once," says it all. Sadly, the complexity of designing is such that it cannot be summarized in as simple a maxim. It is this complexity that has caused various educators over the past 50 years to produce simplified models of the activity for teachers and their pupils to follow.

Pupils should be able to enjoy designing as much as making, and some of them do, although quite often the reason for their enjoyment is nothing to do with the process of designing itself and more to do with an enjoyment of the individual skills that they use during that process (Atkinson, 1994). Pupils need to believe that although it can be a challenging learning experience, it can, if carried out successfully, lead them into making their design into a product that they will be proud to own. Although teachers need to be aware that badly designed products however well made, and whatever new skills have been learnt along the way, will be a disappointment. Such outcomes are frustrating to those pupils who were born with, or who have developed tacit design intelligence that enables them to understand what is or is not well designed. Unfortunately these very pupils are the ones who easily become bored by the simple step-by-step models that they are often expected to follow. Frequently, these are the pupils who become disenchanted with the entire subject. However, at the opposite end of the spectrum are many D&T pupils who need a structure to follow. They require considerable

help in order to understand what they must do, how they must do it, and what they should be thinking about in order to achieve the level of "designerly" thinking that should be inherent in the activity.

Designing can be divided into two main sets of knowledge and understanding. It is essential that both sets are explained, thought about, and taught if teachers are to provide the necessary support and learning required by pupils when they are carrying out the activity. There is a set of easily taught physical skills and there is a set of difficult, intangible concepts that include intellectual thinking skills. The first set incorporates areas of learning such as drawing skills, presentation skills, CAD and CAM skills, researching skills, specification writing skills, 3D modeling skills, and tasks to encourage creativity. This set also embraces a plethora of practical skills concerning appropriate materials, components, and processes that need to be understood well enough to be used when turning ideas into reality. These are all straightforward to teach, but very time- consuming. It is the second set, the intangible designerly thinking aspects of the activity that are difficult for teachers to provide a simple and yet not constrictive set of explanatory guidelines for pupils to understand.

Acquiring new conceptual tools consists of putting a complex series of individual ideas, or unconnected pieces of knowledge together to make sense of them as an integrated whole (Antonio, 2009). The point at which the pieces come together as a whole is the point at which our minds have grasped hold of a new conceptual tool (Polanyi, 1958), and it is these conceptual tools which the author believes are the crux of the problem for pupils in schools and for some of their teachers. Especially as many teachers seem to be unaware that such skills have to be developed slowly over time rather than being taught just once, or worse still not at all, when it is believed that they are skills that everyone possesses and therefore do not need to be taught.

Designing has been considered problematic within D&T in the UK by educational researchers since its incorporation into the school curriculum in the early 1980s (Secondary Examinations Council [SEC], 1986). The process itself, the procedural knowledge required, the practical skills, the thinking skills, the creative skills and an understanding of the complex relationship among them, have provided the author and other researchers with aspects requiring in-depth study (e.g., Baynes, 2009; Kimbell & Stables, 2007; Nicholl, McLellan, & Kotob, 2009; Norman, 2008; Toft, 2007; Spendlove & Rutland, 2007; Welsh, 2007). As early as 1986 the SEC indicated concern about the rigid design process model that was being used in school design activity, while in the early 1990s Archer and Roberts (1992) and many others (e.g., Atkinson, 1993; 1994; Kimbell, Stables, Wheeler, Wonsiak, & Kelly1991) referred to the use of rule-based models that failed to help pupils solve design tasks with briefs that appeared simple but were in fact often ill-defined and complex. Part of the problem has been that all the models produced over the years have been of necessity a simplification of the real process. A simplification that is useful as a set of reminders of what might be involved (SEC, 1986) but unhelpful in explaining the complex, interactive nature of the activity. Hennessey and McCormack (2002) provided a pertinent insight into what they called "a veneer of accomplishment" (p. 119) in which pupils appear to use a process (and hence have apparently learned it) but in fact may not have understood it. By comparison, teachers and pupils have tended to find the knowledge and physical skills required to support design activity straightforward to teach and/or learn, although the sheer volume of knowledge and skills required and whether this should be learned before or on a need-to-know basis has attracted much attention and debate.

For the past ten years OFSTED reports (1998; 2000) have identified that designing skills lag behind making skills. The author's own research (Atkinson, 1997) and that of Barlex and Rutland in 2003 and 2004 have all suggested that this has consistently been the case since the introduction of D&T into England's National Curriculum. This would appear to be due to a combination of factors. First, there are difficulties in teaching pupils the necessary conceptual tools, and yet there is the need to do so as many pupils without tacit design intelligence are unable to develop an understanding of these tools. Second, designing was not part of a craft teachers' training at the time designing was introduced into the curriculum. This has had a "knock-on" effect over the past 20 years because of the cyclical

movement of knowledge from teacher to pupils who then become teachers and lecturers training the next generation of teachers to design. This has inevitably resulted in many teachers in schools today still not displaying a deep understanding of the activity within their teaching. While many would suggest this is caused by a lack of teachers with the necessary required physical skills, others would lay the blame at the door of GCSE and A level [1] examination boards, citing imposed assessment regimes as the cause of the problem. However, the author would suggest that although this may be the case for some teachers, for many others the problems arise more from the lack of a secure understanding of designing and the feeling of security that the examination board models of assessment provide for them. For one can find examples from schools of excellent practice where examination work has not been strait-jacketed by the process undertaken, and where design activity has achieved top grades plus the "wow" factor that well-designed outcomes deserve.

Unfortunately, in recent years this is far from the norm. Evidence from visits to schools, from work as an external examiner at a number of different universities, and from applicants who wish to study at the author's own university having completed their school examinations in D&T, would suggest that many pupils are still not encouraged, even at A level to understand the complexities inherent in the activity or how they can design creatively within an examination structure. Unfortunately, the model of the activity that is used is all too often just a repeat of the simple model used earlier in their education – re-enforced by their Grade A at GCSE level leading them and their teachers to believe that pupils must have been taught to design correctly to achieve such a good grade, so a repeat of the same is all that is required at A level. Sadly their beliefs are often supported by "good" A level grades too. Once at University these students expect that the "successful" design process used in school will continue to serve its purpose; however, many of them find that they have to spend valuable time struggling to come to terms with their misconceptions and poor design practice. The more mature UG students who come to train as teachers of D&T do not necessarily have A Level D&T qualifications but have experience and qualifications appropriate to an industrial setting. These students also tend to have either limited or no design skills having been in the school system at a time when they either used the tightly structured simple design model already described or attended school before design activity was carried out at all. Many of them have then spent time in an industrial setting building up practical expertise pertinent to a narrow aspect of D&T with little attention given to developing their understanding of designing as that has often not been a requirement of their occupation.

There are of course students studying to become D&T teachers whose designing activity is excellent and whose skills are such that they will be able to transfer that knowledge into an appropriate form for use in the classroom when they become teachers. However the author does not believe that the D&T community can be complacent about the group of students that do not fit into this category, either for the sake of the pupils they will teach in the future or the prospect for our subject in the years to come.

Six small-scale research projects carried out by the author (Atkinson, 2003, 2005, 2007, 2008, 2009) over the past 10 years have identified that there is a growing number of students training to become teachers for whom the activity of designing is problematic. The analysis of the data collected has indicated factors that could be causing these problems. For instance, students on D&T programs at the university under question are now drawn from all four material specialisms that form the D&T curriculum found in state-maintained schools in England; that being Materials Technology (MT) (wood, metals, and plastics), Electronic Communications Technology (ECT), Textile Technology (TT), and Food Technology (FT). This breadth of applicants' subject knowledge means there is significant variation in their understanding of designing. In addition students who come to the university straight after completing A level examinations, are arriving with weaker D&T knowledge than they had in the past.

Time Spent Studying Subject Knowledge

Out of these earlier studies a third factor has emerged. Students are now studying subject knowledge during their degree programs for less time. Until the early 2000s D&T teachers were mainly trained on a Four-Year UG program. On such programs they studied subject knowledge

that was equivalent to three years of the total program study time and learned how to teach for the equivalent of one year, both sets of skills interwoven throughout the four years. This schedule meant that these students carried out at least nine minor design projects during the first three years of their degree program followed by a major design project that lasted throughout their final year. This timetable provided plenty of opportunity to revisit misconceptions and misunderstandings about designing that enabled the students to develop conceptual tools and the procedural and physical skills required to carry out the processes. They also developed the ability to teach these skills during school placements, while developing understanding of the process, which helped them to refine both

Due to pressure from the government and competition between ITT institutions, Four-Year programs were re-designed to last for only three years. At the university in this study this was achieved by reducing the three D&T material specialisms (MT, ECT and TT) studied by all students in the Four-Year program to the government's minimum requirement (Design and Technology Association DATA, 2003) that students in ITT programs must study any two out of the four possibilities (MT, ECT, TT and FT).

At the same time in line with other ITT institutions, school placements and all knowledge, skills, and understanding concerned with learning how to teach were placed in the final "professional year" of all ITT programs, meaning that subject knowledge on Three-Year programs was undertaken only in the first two years of that program. Unfortunately, this has meant that students only have time to complete two minor and two major design projects meaning that there is not enough time to re-visit misconceptions and misunderstandings about the design process to the same extent as in the past. Nor, as mentioned previously, are students able to develop their understanding of how to teach pupils to design in parallel to the development of their personal understanding of that process.

In an even worse position are UG students in a shortened Two-Year program. These students will have already studied some aspect of D&T during a Two-Year Higher National Diploma (HND) course aimed at industry. These courses will not necessarily have included appropriate design activity and will have targeted one rather than two D&T material specialisms. In only one year these students must acquire enough physical and conceptual skills to address the D&T core and their two chosen material specialisms to degree level, for as already mentioned their second year is the professional year, which is devoted to learning how to teach. During the subject studies year these students can only complete one minor design project and one major design project, providing virtually no time for visiting misconceptions and misunderstandings.

In terms of PG provision, there are One-Year and Two-Year programs. Those in the Two-Year PG program will have studied at least one aspect of the D&T curriculum to degree level; however, that degree will not have covered a second specialism or in some cases aspects of the common core. These students like the Two-Year UG students will study one year of subject knowledge followed by the professional year, although they do have the advantage of having studied certain aspects to degree level rather than only to HND level. Finally there are One-Year PG students. These students have already successfully studied to degree level some aspect of D&T, although this will have been targeted at an industrial context and not aimed at developing the understanding of the subject required for teaching pupils in schools. These students devote the whole of their year at University to learning how to teach. There is no time for them to complete any design projects at all in order to develop their personal understanding of the process, even though like HND students, their first qualification may not have required them to design in a manner that is akin to the activity carried out in school D&T. Any limited subject knowledge time during the professional year is devoted to converting subject knowledge into school knowledge (Banks et al., 2004) referred to as Pedagogical Content Knowledge (PCK) by Shulman (1986, 1987) and others.

Observation of students training to become D&T teachers over many years has led the author to believe that students are unable to determine their PCK, how they will teach designing, unless they have a secure understanding of the activity of designing beyond that of the simple models many of them used in the past. Also, for these trainee teachers

the development of their subject constructs using unsound content knowledge can lead to the next generation of pupils with unsound designing skills themselves and cyclically lead to the next generation of D&T teachers with misconceptions apropos the activity.

It was therefore decided to carry out a small-scale study looking at the attitude and beliefs of 83 D&T students at the University in the North East of England where Three- and Two-Year UG and One- and Two-Year PG ITT programs were all being studied. It was believed that the data from this project could add to the picture gained from earlier research (Atkinson, 2009) by indicating which program provided the students with the most positive attitude and beliefs about the subject they were training to teach.

Methodology

Measuring Instrument

A self-completed attitude measurement scale with 22 statements concerning beliefs and attitudes regarding D&T was developed through an analysis of existing attitude scales and the methodology surrounding them. The statements themselves were developed by a focus group of specialist D&T lecturers from the university involved in the study. The scale was then trialed using a small cohort of D&T students not involved in this study. Interviews with a selection of the sample after completing the scale led to changes in the wording of three statements—due to mixed understanding of the precise meaning of those statements.

Contextual data concerning the program being studied, how many years of study had been completed; and each student's major specialism was collected at the start of the questionnaire using a tick box system alongside a list of appropriate possibilities. This was followed by the 22 statements concerning a student's attitude to teaching D&T (5 statements), their beliefs about the subject (10 statements) and their perception of their own D&T ability with particular reference to design activity (7 statements) (see Appendix for a list of the 22 statements). These were placed in a mixed order. Dispersed at irregular intervals throughout the scale were 5 statements that were negatively scored. It was expected that a student with a positive attitude would disagree with these particular statements and therefore a high score for disagreeing with the statement was fitting. Students were asked to pick what they believed was the most appropriate response to each statement using a four-point Likert-type scale (strongly agree, agree, disagree, and strongly disagree).

There was an additional column that could be ticked at the right hand side of the table, for those who held no opinion on an individual statement. There is evidence (Robson, 1993) to suggest that if no option is given for those with no opinion, that a substantial number of people will manufacture an opinion, which could then provide inaccurate data. In this study the use of this column was highly insignificant at 1.2% (variance 1569992.000, df 1, chi-square 1569992.000 p-value <0.0001) compared to the 20% usage of a "no opinion" option generally expected when using Likert-type scales (Robson, 1993).

The Analysis of Each Statement to Check for Its Discriminative Power

In order to test the ability of the statements in the attitude scale to discriminate between a positive and negative attitude, each item (i.e., statement) in the scale was subjected to a measurement of its discriminative power (DP). That being its ability to discriminate between the responses of the upper quartile (25%) of respondents and the responses of the lower quartile using the overall mean attitude score for each member of the sample to establish a rank order.

Items with the highest DP indices were then chosen for the final scale. Five statements were not used because of their low DP values, meaning that 17 out of the 22 statements were retained when scoring overall beliefs and attitudes, although the data concerning these five statements were kept for analyses of individual statements when it was pertinent to do so.

Sample

The sample was made up of 83 students from seven program cohorts studying on the four D&T Education programs taught at the author's university. In terms of PG D&T students there were 30 One-Year students; 17 Year 1 students from the Two-Year PG and nine Year 2 students from the same program. In terms of the two UG programs, the cohorts from the Three-Year and Two-Year programs were amalgamated, as the two cohorts on the Two-Year UG program were so small (two students in each year). This provided an UG sample of 18

Year 1 UG students and nine Year 2 UG students. There were no Year 3 UG students as the program had only been running for two years.

In terms of the specialism choices of the sample, there were 30 whose major specialism was MT, three whose major specialism was ECT, 32 whose major specialism was TT and 18 whose major specialism was FT. As can be seen, students were unevenly distributed among the material specialisms, with nearly double the number of Material Technologists and Textile Technologists compared to Food Technologists. Because there were only three students studying ECT it was not viable to keep them as a separate group, and they were added to the MT cohort to form a single group of students studying what traditionally used to be the only specialism studied prior to 1994, that being the combined subjects of MT and ECT.

Data Collection

In terms of data collection, all students were given the single-sided attitude measurement scale to complete during a taught session toward the end of the Autumn Term 2009. This supported the high return rate of 98%. Only one Year 1 student from the Two-Year PG program and one Year 1 student from the Three-Year UG program were absent and therefore unable to take part in the study. After explaining to each cohort what the purpose of the research was and providing them with an assurance that individuals would not be identified from the information given, each member of each cohort completed the scale without discussing it with peers. It took between five and eight minutes to complete. Methods of coding had already been established when the attitude scale was designed enabling the researcher to score and analyze the data using the software package StatView

Results and Discussion

The mean score for the total sample in terms of attitudes and beliefs was 3.1 (the maximum possible score being 4 and the minimum possible score being 1). This result indicated that overall the students had an above average positive attitude. When the mean scores for each member of the total sample were scrutinized the highest score was 3.6 and the lowest score was 2.7. Therefore, even the least positive student achieved an attitude score above the mathematical mean—that being 2.5.

The Five Statements Gaining the Most Positive Mean Scores

Out of the five statements that gained the highest mean scores the two most positive statements were as predicted. One would expect potential teachers of D&T to be passionate about D&T education (mean score (*ms*) = 3.7) and also one would expect them to be looking forward to teaching the subject (*ms* = 3.7). It was also gratifying to see that being a creative person (*ms* = 3.5) and believing that pupils could be creative within D&T (*ms* = 3.5) both ranked highly in the students' beliefs. It was also heartening to see that students thought that it was important to invest time in teaching pupils to design (*ms* = 3.5), as this is something that OFSTED and many others have referred to as being problematic in schools today and is something that is discussed with all students during their training.

The Five Statements Gaining the Least Positive Mean Scores

In terms of the five statements with the least positive scores, although as already pointed out, these were all above the mathematical mean; it was disappointing to see the low score for the statement: Knowledge skills and understanding are better understood and remembered if they are acquired on a needs to know basis whilst designing and making (*ms* = 2.8) as the modules that the students study have been designed by academics in the belief that knowledge skills and understanding placed in a context rather than taught in isolation is a sound teaching/learning strategy and one that is often discussed with students.

In one of the statements that was scored negatively it was disappointing to find that there was a low score for Designing to meet assessment criteria is more important than designing to achieve a creative solution (*ms* = 2.8) as creativity and the lack of it in D&T in schools has been discussed at great length by OFSTED and educational researchers during recent years and the fact that well-designed creative outcomes can easily meet assessment criteria is often discussed with students during subject studies modules. Students with a true understanding of designing should have strongly disagreed with this statement and as it was negatively scored it had been expected that this statement would achieve a much higher mean score. It was especially disappointing as so many of the students had

indicated that they were creative and believed that one could teach pupils to be creative. Nor did their indicated belief that it was possible to teach pupils to be creative marry with their lack of belief in the statement that pupils could be taught to design successfully (*ms* = 3.0).

In terms of finding it easy to design (*ms* = 2.9) the low mean score was disappointing, although it might help to explain why so many of the sample do not believe that pupils can be taught to design successfully if they themselves found it difficult.

Beliefs and Attitude Scores Split by Program

Once the attitude and beliefs data were split into the separate program cohorts the results supported the indications reported in earlier research (Atkinson, 2009) in that the length of study of D&T subject knowledge did appear to have a bearing upon how positive students' beliefs and attitudes were (see Table 2).

Table 2. The Mean Attitude Scores Split by Program with an Indication of Years Studying D&T

Program	Mean Score	Rank Order	Yrs studying D&T
Two-Year PG – Year 2	3.31	1	5
Two-Year PG – Year 1	3.19	2	4
UG – Year 2	3.16	3	2
One-Year PG	3.12	4	4
UG – Year 1	2.92	5	1

The data indicated that Two-Year PG students who had studied D&T for a total of five years (four years subject knowledge made up of three years on their UG degree and the first year of their Two-Year PG, followed by one year of learning how to teach) had the most positive attitude (*ms* = 3.31). First-year UG students, who had only studied D&T in Higher Education for one half of a year, had the least positive score (*ms* = 2.92). Students in Year 1 of their Two-Year PG program who had studied D&T for a total of four years had a mean score of 3.19, while second-year UG students had a mean score of 3.16. If the One-Year PG students were removed from the analysis it was evident that the longer students studied D&T the more positive they became. If the PG students were kept in the equation the analysis was not as clear-cut. They bucked the trend, for they were the second least positive cohort in terms of attitude and beliefs (*ms* = 3.12) and yet on completion of their program, these students would have studied for a total of four years in HE, one more year than any UG student.

In trying to tease out possible reasons for this result the differences in terms of the length of time students spent studying subject knowledge pertinent to teaching on a degree program specifically targeted at ITT and the time students spent studying subject knowledge for an industrial context on degree programs which were not designed to train students to become teachers was scrutinized. Analysis of this data suggested that the time spent studying subject knowledge pertinent to teaching D&T could be the factor that made the difference, for as already discussed One-Year PG students did not have the opportunity to study subject knowledge pertinent to teaching during any of their four years of university study.

However it was felt that the specialism of the students might have influenced the results, for as mentioned earlier there was an uneven distribution of students following the different material specialisms within each cohort (see Table 3).

Table 3. Percentage of Each Cohort Studying MT/ECT, TT and FT

Program	RO in terms of Attitude	%MT/ECT	%TT	%FT
Two-Year PG – Year 2	1	11	56	33
Two-Year PG – Year 1	2	41	47	12
UG – Year 2	3	33	22	45
One-Year PG	4	50	40	10
UG – Year 1	5	39	28	33

Beliefs and Attitudes Split by Specialism

The Beliefs and Attitude Data for the total sample indicated that there was indeed a difference in the attitude of those studying different material specialisms (see Table 4). Textile Technologists were the most positive (*ms* = 3.23). Food Technologists were the least positive (*ms* = 3.01), closely followed by Material Technologists (*ms* = 3.06).

When the relationship between specialism data and program data were combined the data continued to indicate differences that might affect the interpretation of the results. As can be seen from Table 3, 56% of the most positive

Table 4. The Overall Mean Scores of Textile Technologists, Material & ECT Technologists, and Food Technologists

Specialism	Mean Score	Rank Order
Textile Technology	3.23	1
Material Technology & ECT	3.06	2
Food Technology	3.01	3

Two-Year PG students were Textile Technologists (see Table 3). A conclusion from this finding could be that because there were fewer Textile Technologists with a positive attitude in the One-Year PG cohort that this could be the reason why they were less positive than Year 2 of the Two-Year PG program.

However when looking at the data for the least positive specialism in terms of attitude—Food Technology, it was found that only 10% of One-Year PG students were Food Technologists in comparison to 33% of Two-Year PG Year 2 (see Table 3). This data analysis would suggest that Year 2 of the Two-Year PG should be the least positive because such a large proportion of their cohort were Food Technologists, and yet as already discussed this was not the case (see Table 2).

Therefore to try to tease this out further a final analysis of the mean scores for each specialism split by the five program cohorts in the study were scrutinized and the rank order was calculated.

From these data (see Table 5) it can be seen that no matter which specialism was targeted Year 2 students from the Two-year PG were the most positive and One-Year PG students varied between third and fifth in the rankings.

Table 5. Mean Scores Split by Program and Specialism

Program	Overall RO	TT	RO	MT	RO	FT	RO
Two-Year PG – Year 2	1	3.33	1	3.25	1	3.30	1
Two-Year PG – Year 1	2	3.21	3	3.14	2	3.00	3
UG – Year 2	3	3.26	2	2.99	4	3.23	2
One-Year PG	4	3.19	4	3.08	3	2.82	5
UG – Year 1	5	2.97	5	2.98	5	2.99	3

Conclusion

In conclusion, it would seem that there is support for believing that in the context of the students within this small study, that in terms of attitude and beliefs about D&T those students in the UG ITT degree and the Two-Year PG programs benefitted from being taught subject knowledge that not only targeted personal knowledge and skill acquisition, but also set out to develop an understanding of the underlying processes that were pertinent to being able to teach those processes to pupils in school. It is therefore a concern that governmental pressure may close these very programs because it believes that a graduate with a degree targeted at industrial employment plus a one year ITT program will provide a better teacher than students trained on UG programs. This belief was not supported by the data collected in this research project.

The data also indicated that Textile Technology students had the most positive attitude and beliefs about the subject, and that their perceptions of their own D&T ability, with particular reference to design activity, was strongest. This would therefore suggest that more rigorous support mechanisms need to be put in place during subject knowledge inputs to help Material Technology, ECT, and Food Technology students to develop more positive attitudes and perceptions regarding their own ability, particularly in the field of designing, which is as stated at the start of this article, central and fundamental to D&T activity within schools in the United Kingdom.

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[1] *GCSE is the General Certificate of Secondary Education that is taken by pupils at the end of compulsory education (Age 16). A Level is the Advanced GCSE which is taken two years later by those who continue to study in order to gain a qualification that will enable them to apply for a place at University*

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Appendix

List of the statements used in the Beliefs and Attitude Scale

1 One must be a good designer to be a good teacher of D&T

2 I understand how to design in the context of D&T

3 Knowledge, skills & understanding of materials & processes must come before one is expected to design

4 I am passionate about D&T education

5 A well designed creative solution will achieve a high mark when assessed

6 One does not need to teach a pupil how to design as it is a skill that everyone has

7 I find it easy to design

8 Designing is a key feature of successful D&T education

9 I am a creative person

10 I am passionate about wanting to teach D&T

11 Knowledge, skills & understanding of materials & processes are better understood and remembered if they are acquired on a needs to know basis whilst designing and making

12 I think I am good at designing

13 I am more passionate about making things than designing things

14 The process of designing needs to be taught

15 All pupils can be creative in D&T

16 I understand enough about the processes involved in designing to help others to design

17 I am passionate about 'designing' as an activity in D&T education

18 I believe it is important to invest time in teaching pupils how to design

19 Designing isn't something I need to think about, I just do it

20 Teachers need to understand the activity of designing to be successful D&T teachers

21 Designing to meet assessment criteria is more important than designing to achieve a creative solution

22 Everyone can design successfully if taught to do so