How do D&T teachers value design and technology education?

Abstract

We have previously reported on the validation of our Subject Values Instrument for Design and Technology Education (SVA-D&T) (Hardy, Dunn & Trigg, 2021). In this paper we share our analysis of 19 D&T teachers' (a data subset from our main project) responses to the survey. There are 2 aims to this analysis: first to identify the grade of importance that teachers attribute to the Design and Technology subject in five dimensions (1) Creative and Critical Thinking, (2) Making and Creating, (3) People's Relationship with Technology, (4) Careers, Life, and the Economy, and (5) Transferrable Skills for Personal Development; second, to identify whether there was any value consensus or dissonance between the teachers.

The teachers rated 28 statements, each a different value of design and technology, by indicating on a 5-point Likert scale how important the statement was to them. In addition to the Likert scale questionnaire, the teachers were also asked to respond to three open questions, that asked them to describe what they thought the purpose was of D&T.

Quantitative analysis showed the Creative and Critical Thinking dimension was the most highly rated and Making and Creating with the lowest average rating. Comparative analysis by school role, gender and whether they studied D&T at school shows that teachers attribute different values to D&T dependent on their school experience, school role, and gender. At the PATT39 conference and in a future publication we will share our interpretation of the differences in relation to these factors.

The next steps for our study are first to complete the validation of the SVA-D&T and then to analyse the pupils' responses from step 3 in a similar way to the teachers' responses.

Keywords: value, teachers, subject-values, consensus, dissonance

INTRODUCTION

We are interested in teachers' beliefs and values because there is a view that teachers' agency is affected by their beliefs (Biesta, Priestley & Robinson, 2015) and because there appears to be little consensus on the value of the school subject D&T (Hardy, 2015; Hardy, Gyekye & Wainwright, 2015; Hardy, 2016; 2018a).

Taking the first reason, the relationship between agency and beliefs, Biesta et al. (2015) have drawn attention to the importance of teachers' agency as a factor in motivation and stress, arguing that teachers experience higher levels of stress where their values do not align with those implicit with their work context than where they do align and within a supportive context. Following Biesta et al.'s (2015) call for more research, Hadar and Benish-Weisman (2019) have quantitatively "...examined how teachers' values affect their professional agency." (p.138) They selected particularly values from Schwartz's (1994) Schwartz Values Theory (SVT), a taxonomy of human values. Whilst SVT and Hadar and Benish-Weisman's work is useful it does not help with understanding how values and beliefs affect teachers' motivations and behaviours towards the subject they teach.

In technology education, there are instruments used, such as the PATT (pupils' attitude towards technology-survey) tool (Ardies, De Maeyer & Gijbels, 2013). This is tool is well established within technology education (Ardies et al., 2013), although originally designed to measure pupils' attitudes derivatives have been used to measure teachers' attitudes towards technology (Ankiewicz, 2019). Other studies have used instruments to quantitatively measure perceptions and attitudes held by teachers and pupils towards STEM education (e.g. Julià & Antolí, 2019; Ersoy & Kavaklioglu, 2020) or used qualitatively data to explore teachers' perceptions towards technology education (e.g. Nordlof, Hallstrom & Host, 2017). These approaches do not address the context of design and technology education in secondary education nor provide a validated way of measuring the comparing the values attributed by teachers, pupils and others to design and technology education.

In England, design and technology education has risen in popularity and status, but since 2004 it has seen a dramatic decline in pupils studying it beyond 14 years old, the number of design and technology teachers in schools and the number training to become teacher has also declined (Tuckett, 2022). Possible causes for this decline have been well reported (summarised in Spendlove, in press), whilst there have been efforts to define its uniqueness (McLain, in press) and justify its place in the curriculum (Barlex, 2007) this has not stemmed the decline nor led to a consensus (Hardy, 2016). We do not think a consensus can be achieved, so instead we want to understand where there is consensus and dissonance to give us a baseline for exploring where and why there are different views about the value of D&T.

We have previously reported on the second validation step of our Subject Values Instrument for Design and Technology Education (SVA-D&T) (Hardy, Dunn & Trigg, 2021), which we hope will provide us with a method of collecting and then analysing different groups' values. (We have yet to report on the first step however preliminary work is available in Hardy, 2013; 2015; 2018b). To date we have received over 2000 responses from pupils and 19 from teachers as part of the third validation step for the SVA-D&T. In this paper we share our analysis of 19 D&T teachers (a data subset from our main project) responses to the survey. The sample in this paper is small and therefore the aim of this paper is twofold: piloting the analysis process and reporting on this third step in our process of validating the SVA-D&T.

METHODS

Participants

We recruited 19 teachers (5 females; 14 males) from seven English schools, following a call placed through the first author's network of D&T teachers: two student teachers, eight classroom teachers, seven subject leaders, and two senior leaders. Two identified as Irish, the rest described themselves as British. We did not collect data on age or years of teaching experience, but we did record whether the participants studied D&T at school (five had not – all classroom teachers), and at what age they finished formal study of D&T (one aged 12 years, two aged 14 years, two aged 16 years, seven aged 18 years, and two aged 21 years). The data for the sample are cross tabulated in Table 1.

Table 1 Sample Data: Sex, Role and School Experience

		Studied D&T at school				
		Yes	No	Yes	No	Total
Gender		Female	Female	Male	Male	
Role	Student Teacher	1		1		2
	Class Teacher		3	3	2	8
	Subject Leader			6		7
	Senior Leader	1		2		2
Total		2	3	12	2	19

Procedure

The teachers answered a series of questions about their experience and values relating design and technology teaching. The survey questions were presented on Qualtrics (https://www.qualtrics.com), an online survey tool, using a bespoke link provided to them by the researchers. The survey included some basic demographic questions (gender/sex, ethnicity), job role, whether they studied D&T at school, and at what age the finished formal study of D&T their studies. They also completed a 28 item, Subject-Values Instrument for Design and Technology

(SVA-D&T) education questionnaire (Hardy et al., 2021). The SVA-D&T, which can be administered to adults or children, assesses five validated dimensional subject-values:

1. Careers, life and the economy (CLE)
2. Creative and critical thinking (C&CT)
3. Making and Creating (M&C)
4. People's relationship with technology (TD)
5. Transferrable skills for personal development (TSkPD).

A description of each dimension is provided in Table 2.

Table 2 Definitions of the five dimensions

Dimension label	*Dimension definition*
Careers, life and the economy (CLE)	This theme has two parts: (1) pupils learning new knowledge and skills for their own benefit and (2) how this learning can benefit businesses and the economy. They learn skills, like problem solving, that could be useful for businesses. Because they learn such skills and knowledge, they could end up contributing to the country's economic growth when work after leaving school. What they learn in D&T (e.g. practical or making skills) could be useful for potential careers, for a D&T related career or for other careers; as well as useful for themselves in their home lives.
Creative and critical thinking (C&CT)	D&T gives pupils space to develop their curiosity, having the freedom to be creative. They also learn to be a critical thinker who can evaluate existing designs including thinking about how these designs affect the world.
Making and Creating (M&C)	In D&T, pupils can make and create something, and whilst making they learn new things. When they have finished making something, they feel a sense of achievement shown by them taking home what they have made. The space to make and create in D&T provides pupils with a different classroom environment to other school subjects.
People's relationship with technology (TD)	Pupils understand the symbiotic relationship between people and technology: the positives and negatives, including how technological developments impact on the environment. They learn that designers need to design for people's differences.
Transferrable skills for personal development (TSkPD)	In D&T, pupils learn transferrable skills that can be used in different school subjects and throughout their lives. They learn how to research and find things out, how to communicate in different ways, to manage and plan their time and how to work as part of a team.

Participants answered each question in terms of its importance for them, using a 5-point (1 = Extremely important; 2 = Very important, 3 = Moderately Important, 4 = Slightly important, 5 = Not at all important) Likert scale. The scores were then reversed and summed, such that a high score represents a value that is high importance, and low score, low importance. Individual subjective-values scores were calculated for each of the 5 dimensions, all the values can be summed for an overall SVA-D&T total score. For the purposes of this research the raw scores were then covered into percentages, to standardise the degree of value expressed for the uneven number of participants in each demographic group (see Table 1). The questionnaire and associated validation data are available on Zenodo (https://bit.ly/ZValueofDaT) to interested researchers upon request.

In addition to the Likert scale questionnaire, the teachers were also asked to respond to three open questions, that asked them to describe what they thought the purpose was of D&T:

1. What is the purpose of D&T?
2. Why should D&T be taught in secondary school?
3. Who benefits from D&T being taught in schools?

Responses were coded (using MAXQDA https://www.maxqda.com/ software) in two ways; either they were inductively coded using the five SVA-D&T dimensions, or deductively coded when the responses did not fit the five dimensions.

Finally, the teachers were also asked if they would like to receive updates about the research and to have access to an anonymised report. For this they had to provide an email address, which was later removed from the raw data and kept separately from their answers.

FINDINGS

We first report on the teachers' responses to the 28 statements of the SVA-D&T, treating the 19 teachers as a homogenous group, before considering the pattern of responses across the sub-groups: (1) By school experience of D&T, (2) by gender and (3) by school role. The aim here to get an objective sense of teachers' values, as captured by the SVA-D&T as whole and by sub-group. Then we compare the inductively coded responses to the 3 open-ended questions to the 5 dimensions of the SVA-D&T questionnaire. Finally, we report on the additional themes identified from the deductive coding.

Findings from the quantitative analysis

Overall, our sample of D&T teachers provided a high level of agreement with all 5 dimensions of the SVA-D&T (Table 3). However, there appears to be less agreement on M&C (*M*=78.25 (17.79)) and TD (*M*=79.74(11.72)) as compared with CLE (*M*=81.35(10.75)), TSkPD (*M*=81.9 (11.34), and C&CT (*M*=85.79, (10.59)), which had the highest level of agreement to overall. This pattern of agreement is reflected in the ALL (mean) total SVA-D&T scores in each table (note owing to the way in which these scores are calculated the specific value varies slightly but the pattern is the same). A one-way repeated measures ANOVA was conducted to compare responses across the five dimensions but did not reveal any significant differences between the values ($F(4,72) = 2.00$; $>0.0.1$; $\eta^2=0.1$).

Table 3 Mean percent agreement (and standard deviation) for each dimension

Dimension	CLE	C&CT	M&C	TD	TSkPD
MEAN (STDEV)	81.35, (10.75)	85.79, (10.59)	78.25, (17.79)	79.74, (11.72)	81.9, (11.34)

Table 4 presents the data for the sub-group school experience of D&T, Table 5 the subgroup data for School Experience, and Table 6 for Gender. Each of these tables present the mean percent agreement for each of the 5 dimensions (C&CT, CLE, M&C, TD, TSkPD) of the scale, along with standard deviation in brackets to give an indication of the variability in the responses for the given item. The *n* value indicates the number of teachers in each sub-component of the total sample (N). For comparison, tables 4, 5 and 6 include an ALL (mean) total SVA-D&T value agreement scores for each of the 5 values, as well an All values score, which represents the mean level of agreement on the SVA-D&T scale for the subset (e.g. role classroom teacher, subject leader, etc). The standard deviations are less helpful for individual experience and school, because the sample size is often very small, but they are useful when considering gender, and ALL, and All Values responses, because the sample size is larger and more representative.

Whilst it was not possible to perform any formal analyses for the data for each of the of the sub-groups, owing to a limited sample size, these data nevertheless offer an instructive picture of the pattern of values and are useful in providing a sense of D&T values when considered with the open-ended questions (see qualitative analysis). School Experience of D&T (Table 4) does not seem to indicate much in the way of variability across the sample, suggesting little impact for the teachers (who are presumably committed to their subject). However, the All values score does suggest that those finishing D&T education aged 16 and 21 had lowest levels of agreement.

Table 4 Mean percent agreement (and standard deviation) for each subjective value by end of school experience of D&T (aged 12, aged 14, aged 16, aged 18, NA (Not applicable)), for each dimension (ALL), and total score across the subsets (All Values)

		Dimension					
	Age	CLE	C&CT	M&C	TD	TSkPD	All values
End Age Formal Ed in D&T	12 (n=1)	77 (0)	93 (0)	87 (0)	80 (0)	84 (0)	84.2 (0)
	14 (n=2)	84.5 (21.92)	73.5 (33.23)	63.5 (33.23)	72.5 (38.89)	80 (28.28)	74.8 (31.11)
	16 (n=2)	92.5 (2.12)	88 (7.07)	83.5 (4.95)	75 (7.07)	84 (5.66)	84.6 (5.37)
	18 (n=7)	77.29 (12.67)	88 (5.89)	75.71 (17.82)	79.29 (7.32)	80 (10.83)	80.06 (10.91)
	21 (n=2)	77 (4.24)	82 (7.07)	71.5 (26.16)	75 (7.07)	70 (8.49)	75.1 (10.61)
	NA (n=5)	84 (4.64)	86.8 (6.02)	86.6 (15.58)	87 (4.47)	88.8 (5.93)	86.64 (7.33)
	ALL	82.05 (9.12)	85.22 (11.86)	77.97 (19.55)	78.13 (12.96)	81.13 (11.84)	

The starkest pattern of different can be found when comparing levels of agreement across the dimensions by school role (see Table 5). Here it is evident that whilst there is generally high agreement in most cases, and over all agreement is lowest for M&C, and TD, there is markedly low levels of agreement in the student teacher roles for all but CLE. Although you would expect a high level of variability in such a small sample (n=2) when you compare the variability (as indicated by the Standard deviations) with the senior leaders (n=2), there are large differences of opinion amongst the student teachers in all the dimensions.

Table 5 Mean percent agreement (and standard deviation) for each subjective value by school role, for each dimension (ALL), and total score across the subsets (All Values)

		Dimension					
		CLE	C&CT	M&C	TD	TSkPD	All values
School Role	Student Teacher (n= 2)	80 (15.56)	71.5 (30.41)	60 (28.28)	57.5 (17.68)	70 (14.14)	67.8 (21.21)
	Class Teacher (n= 8)	83.5 (6.55)	85.88 (4.88)	87.13 (11.84)	82.5 (7.56)	85 (8.21)	84.8 (7.81)
	Subject Leader (n= 7)	76.86 (12.62)	87.14 (7.06)	73.71 (19.65)	80 (7.07)	77.71 (11.04)	79.09 (11.49)
	Senior Leader (n= 2)	90 (14.14)	95 (2.83)	77 (14.14)	90 (14.14)	96 (5.66)	89.6 (10.18)

ALL (N= 19)	82.59 (12.22)	84.88 (11.29)	74.46 (18.48)	77.5 (11.61)	82.18 (9.76)	

Finally, although the value scores for the females are generally lower than for the males (Table 6), over all there is very little difference between them. This suggests that gender had little influence in terms of agreement with the SVA-D&T.

Table 6 Mean percent agreement (and standard deviation) for each subjective value by gender (Female, Male) for each dimension (ALL), and total score across the subsets (All Values)

		Dimension					
		CLE	C&CT	M&C	TD	TSkPD	All Values
Gender	Females (n=5)	79.6 (6.43)	82 (18.01)	79.2 (26.72)	77 (18.91)	82.4 (12.84)	80.04 (16.58)
	Males (n=14)	82 (11.9)	87.143 (6.76)	77.929 (14.89)	80.714 (8.74)	81.714 (11.28)	81.9 (10.71)
	ALL (N=19)	80.8 (9.17)	84.57 (12.39)	78.56 (20.81)	78.86 (13.83)	82.06 (12.06)	

Findings from the written responses

All 19 teachers provided written responses to the three questions posed at the end of the survey. In total 115 statements were coded (Table 7). CLE was mentioned by most participants (n=17) and M&C by the fewest (n=3).

Table 7 Inductive coding frequency for each dimension and number of participants mentioning a dimension

	Dimension				
	CLE	C&CT	M&C	TD	TSkPD
Frequency	36	21	3	22	17
Number of participants mentioning this dimension	17	14	3	9	10

No link can be made between the frequency of a dimension with the importance this indicates. Participants may have repeated a value but used different words to describe the same value, they may have wanted to provide a response to each question and so repeated a value, or it may be repeated because it is significant to them.

By school experience

None of the dimensions were mentioned by at least one participant in each sub-group. Of the five participants who did not study D&T at school none mentioned M&C in their written responses but all mentioned CLE.

Table 8 Number of participants mentioning a dimension categorised by school experience

		Dimension				
		CLE	C&CT	M&C	TD	TSkPD
End Age Formal Ed in D&T	12 (n=1)	0	0	0	0	0
	14 (n=2)	2	1	0	1	0
	16 (n=2)	2	2	1	0	2
	18 (n=7)	7	7	2	4	4
	21 (n=2)	1	1	0	0	1
	Subtotal (n=14)	12	11	3	5	7

	NA (n=5)	5	3	0	4	3

By School role
Except for the Subject Leaders, all participants wrote about the value D&T made to careers, life and the economy.

Table 9 Number of participants mentioning a dimension categorised by school role

		Dimension				
		CLE	C&CT	M&C	TD	TSkPD
School Role	Student Teacher (n= 2)	2	1	1	0	1
	Class Teacher (n= 8)	8	6	1	5	5
	Subject Leader (n= 7)	5	5	1	2	3
	Senior Leader (n= 2)	2	2	0	2	1

By gender
Analysis by gender shows a similar pattern to the other variables in terms of ranking, however none of the female teachers wrote about making and creating.

Table 10 Number of participants mentioning a dimension categorised by gender

		Dimension				
		CLE	C&CT	M&C	TD	TSkPD
Gender	Female (n=5)	5	3	0	3	3
	Male (n=14)	12	11	3	6	7

Summary of the deductive coding

Sixteen statements could not be coded with the five dimensions and were inductively coded into four additional dimensions: (1) Broad and balanced curriculum, (2) Independent, (3) Tradition and (4) Well-being. These 16 statements featured in 10 of the 19 datasets. Of the 10 participants who mentioned these four new additional dimensions none were student teachers, nine had studied D&T at school and of these nine, seven had studied up to the age of 18 (highest school leaving age in England).

Table 11 Four additional dimensions from deductive coding

Additional dimensions	*Number of participants mentioning this dimension*
Broad and balanced curriculum	7
Independent	4
Tradition	1
Well-being	4

ANALYSIS

Analysis of the survey showed a high level of consensus across all five dimensions, with some minor variations in rank order in each category. There are small margins within and between each category, but it is difficult to draw any major conclusions because of the small sample size. We focussed on the three categories (school

experience, school role and gender) because each has been identified as a factor in explaining value consensus and dissonance.

The Creative and Critical Thinking dimension was the most highly rated, with Making and Creating having the lowest average rating. Preliminary comparative analysis by school role, gender and whether they studied D&T at school shows that teachers attribute different values to D&T dependent on their school experience, school role, and gender. For example, whilst both gender groups identify with the Creative and Critical Thinking dimension of D&T, the female teachers value this dimension less than the male teachers. There was also difference for this dimension when we compared by school role (such as student teacher and senior leader) and school experience (stopped studying D&T at 12 compared with 21 years old). However, none of the participants who had not studied D&T at school or had not studied D&T after the age of 12 valued Making and Creating, whilst a small number of those who had studied D&T between the ages of 13 and 21 did attribute the value M&C to D&T.

Validity of the SVA-D&T

All five dimensions were mentioned in the written responses. This suggests that the SVA-D&T is valid. In both parts of the survey (Likert and written responses), M&C had the least agreement (78.25% and n=3), with TD the next lowest (79.74% and n= 9). However, the rank order for C&CT, CLE and TSkPD is different for the two parts: CLE, C&CT and TSkPD for the written responses and C&CT, TSkPD and CLE for the SVA-D&T responses. As the sample size is small it is difficult to infer that this is significant, but it is something to be considered with a larger dataset.

The four additional dimensions show that there are values not included within the SVA-D&T that are important to some teachers. These values and dimensions have appeared in earlier iterations of the survey (Hardy et al., 2021) and our qualitative studies (Hardy, Gykye and Wainwwright, 2015), but were not significant enough to be included in this version.

NEXT STEPS

At the PATT39 conference and in a future publication we will share our interpretation of the differences in relation to these factors. The next steps for our study are first to complete the validation of the SVA-D&T and then to analyse the pupils' responses from step 3 in a similar way to the teachers' responses.

ETHICS STATEMENT

The research was reviewed and given a favourable ethics opinion (approved) by the Business Law and Social Sciences Ethics Committee at Nottingham Trent University, on 01/09/2020.

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