The personal response to designing and making: investigating PGCE students’ feelings as they move through a designing and making assignment

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The Personal Response to Designing and Making: Investigating PGCE students’ feelings as they move through a designing and making assignment
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Abstract
The purpose of the study reported in this paper was to investigate the way in which feelings of trainee teachers on a one year post graduate certificate of education (PGCE) initial teacher education (ITE) design and technology (D&T) course changed as they moved through a designing and making assignment.

This paper is in four parts. The introduction presents a brief overview of the literature reporting pupils’ emotional response to the secondary school curriculum in science and attitudes toward technology. Second, it describes a pilot study in which a cohort of secondary design and technology PGCE trainee teachers were required to record their feelings in response to a designing and making assignment. Third, the paper presents a preliminary analysis of the data, commenting in some depth on the response of four purposefully sampled trainees. Finally, it considers the possibility of this approach being used with pupils in schools.

Key words
design and technology, designing and making, emotional responses, feelings, initial teacher education

Introduction
Although the way we feel about what we are doing is important and can enhance or detract considerably from our performance, effectiveness and enjoyment of the task in hand there is little in the way of empirical studies of pupils’ affective response to subjects in the school curriculum. In the case of science education John Head wrote The Personal Response to Science in 1985 but since then, and despite periodic attempts at monitoring students’ attitudes-towards-science, the ‘effect of affect’ in science education has been largely ignored. The recent publication of Beyond Cartesian Dualisms Encountering Affect in the Teaching and Learning of Science (Alsop, 2005) has reawakened interest. The recent Twenty First Century Science Curriculum Development Project (see www.twentyfirstcenturyscience.org), developed in response to the report Beyond 2000 (Millar & Osborne, 1998) places personal use of science at the core of the science curriculum, ahead of additional qualifications necessary to continue to study science beyond 16+. Patricia Murphy evaluated the Energy Foresight pilot programme which utilised the Twenty First Century Science approach, (Murphy, Lunn & Jones, 2005). In this pilot, 15 year old students were taught about radioactivity and radioactive materials by means of contextualising the scientific content in the working practice of those in health care, energy production and nuclear waste management. Murphy reported that for girls this approach was highly successful.

‘…it wasn’t like a textbook, it showed that these things actually happened and it made it seem more real, you were able to comprehend it better and understand it more because of that, …it was more about the world around you, and I think that’s more interesting, you know, better in terms of the future really.’

‘It was actually quite different because we didn’t used to look at something related to the real world, whereas now we’re actually looking at things that might involve us.’

‘I always thought it [radioactivity] was bad, but from watching the programmes and talking about it I know that it can help. I found how radioactivity can help the medical profession. I found that really interesting.’

Overall, Murphy reports that this approach to science teaching enabled the girls to appreciate the relevance of physics to their lives. Girls made significant increases in both their understanding and interest. For boys, the increase in learning centred on an enhanced awareness of the complexity surrounding the use of radioactive materials in society.
This change of attitude indicates that the students felt differently about the science they were studying because of the pedagogy used. However, this approach to pedagogy is new for the science curriculum.

Michael Reis, (in Alsop, 2005) notes that while relatively little work until recently has explicitly addressed feelings or emotions in science education, there is a large literature on attitudes to school science. The general consensus makes sorry reading. For example, Reis found that:

- during their school careers, most students lose interest in chemistry and physics;
- the more technologically advanced a society the lower the interest of its students in school science;
- school science is particularly criticised for its lack of relevance;
- students desire more opportunities in school science lessons for the exercise of personal autonomy.

The last point is particularly pertinent to teachers of design and technology. For example, one of the defining features of technology education in England is that it both requires and develops the exercise of personal autonomy as indicated by this extract from the Importance Statement for design and technology in the National Curriculum in England: “The subject calls for pupils to become autonomous and creative problem solvers, as individuals and members of a team.” (Department for Education and Employment and Qualifications and Curriculum Authority, 1999:15).

While there is little empirical research about pupils’ feelings in design and technology, there have been attempts to investigate students’ attitudes to technology. Notable amongst these is the PATT Survey Instrument (available at www.iteaconnect.org/D4c.html). However, this does not probe how students feel when they are doing technology in school and for the purposes of this paper ‘doing technology’ equates with ‘designing and making a product’. There is some evidence that there are aspects of ‘doing technology’ with which students are disenchanted. Welch, Barlex and Taylor (2005) reported that producing a portfolio to accompany designing and making was regarded by some students ‘as “boring” and a burden that detracts from the enjoyment of designing and making’.

Given the apparent lack of studies about how students feel when they are designing and making I decided to probe the feelings of a group of trainees in the middle of a one-year postgraduate certificate of education (PGCE) initial teacher education (ITE) design and technology (D&T) course whilst they were tackling a designing and making assignment.

**Method**

This pilot study took place throughout a one-day workshop (professional development experience) in which the group of 18 trainees designed and made a toy which had to be powered by a battery and use a variety of electrical and mechanical components to provide play value. Their progress through this task was orchestrated by means of booklet that guided them through a series of activities and enabled them to reflect on their own feelings about the activities. The activities are summarised in Table 1. The design briefs which they could use as the basis for the task are shown in Table 2. Note that one option allowed them to develop their own brief.
<table>
<thead>
<tr>
<th>Section</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section 1</strong></td>
<td><strong>Feelings before beginning the task</strong> Trainees were asked to consider their feelings and those of pupils when faced with a task that involved working with resistant materials, associated tools and technical components.</td>
</tr>
<tr>
<td><strong>Section 2</strong></td>
<td><strong>Considering my technical understanding</strong> Trainees answered a series of structured questions concerning mechanisms and electrical circuits.</td>
</tr>
<tr>
<td><strong>Section 3</strong></td>
<td><strong>Feelings about the task after some technical thinking</strong> Trainees were asked to consider their feelings now that they had had the chance to think about some of the technical aspects of the task.</td>
</tr>
<tr>
<td><strong>Section 4</strong></td>
<td><strong>The stimulus</strong> Trainees looked at images and artefacts that can be used to stimulate a creative response to the task e.g. an image of a toy buggy made by a secondary school pupil and a toy 'Batmobile', a fantastic vehicle from the recent comic book hero science fiction film 'Batman begins'. They were asked to considered their feelings and those of pupils in response to this stimulus.</td>
</tr>
<tr>
<td><strong>Section 5</strong></td>
<td><strong>The context</strong> Trainees were asked to consider the play value of toys with electric motors and prompted with examples such as Scalextric, radio control toy cars, and toy robots with limited intelligence.</td>
</tr>
<tr>
<td><strong>Section 6</strong></td>
<td><strong>Knowledge skill and understanding</strong> Trainees received a demonstration concerning the construction of a chassis, a body shell construction and a control unit and asked to consider their feelings in response to the demonstration.</td>
</tr>
<tr>
<td><strong>Section 7</strong></td>
<td><strong>Possible briefs</strong> Trainees were introduced to two briefs and asked to consider their feelings in response to these briefs. They also had the option of developing their own brief.</td>
</tr>
<tr>
<td><strong>Section 8</strong></td>
<td><strong>Possible support tasks</strong> A range of short tasks to teach knowledge, understanding and skills likely to be useful in the task were available but no trainees used them.</td>
</tr>
<tr>
<td><strong>Section 9</strong></td>
<td><strong>Feelings during the designing and making</strong> Trainees were asked to consider their feelings at the beginning, middle and end of the designing and making assignment.</td>
</tr>
<tr>
<td><strong>Section 10</strong></td>
<td><strong>Sketches of my finished product</strong> Trainees were asked to make sketches showing what their product looked like on the outside and on the inside and to consider their feelings about being asked to sketch.</td>
</tr>
<tr>
<td><strong>Section 11</strong></td>
<td><strong>How my product works</strong> Trainees were asked to use sketches and notes to describe how their product worked.</td>
</tr>
<tr>
<td><strong>Section 12</strong></td>
<td><strong>My thoughts about teaching this task</strong> Trainees were asked to consider pupil learning, organisation and management, contribution of the task to D&amp;T learning and how to present the task so that it has wide appeal.</td>
</tr>
</tbody>
</table>

*Table 1: Activities in booklet*
Design Brief 1
Imagine that you work for a toy manufacturer who has already developed a wide and successful range of products that use battery powered electric motors and other technical components: individual toy vehicles, sets of toy vehicles, vehicles with tracks for racing, stunt vehicles. The manufacturer realises that these sorts of toys appeal mainly to boys and he wishes to extend his sales by developing toys that will appeal to girls. His only condition is that the toys you design must use electrical motors and the other technical components used in the products he already manufactures. Your task is to develop a range of electromechanical toys which will appeal to girls and to design and make a typical example.

Design Brief 2
Imagine that you work in the special effects department of a small independent film studio that specialises in low budget productions with very little if any computer animation effects. The director of the current film, a science fiction movie, needs small model vehicles that can move under their own power across a miniature set. The vehicles are search and rescue vehicles, can carry three crew with room for four more passengers and have to look both futuristic and battered. The set will feature several different sorts of terrain – sandy desert, swamp, rough rocks. Your task is to develop outline designs for three vehicles, one for each sort of terrain, and to design and make a working model of one them.

Design Brief 3
Write your own brief that meets the following criteria:
• It is concerned with designing a toy.
• The toy must use a battery powered electric motor and associated technical components.
• The brief should have wide appeal for pupils at Key Stage 3.

Table 2: Design briefs
Trainees could indicate their own feelings by circling adjectives describing feelings in a given list. They were also able to suggest other words for feelings not described by the words on the list. These are listed in Table 3.
<table>
<thead>
<tr>
<th>Section</th>
<th>Topic</th>
<th>Word list</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Feelings before beginning the task</td>
<td>Calm, Apprehensive, Dreading it, Panicky, Unsure, Up for it</td>
</tr>
<tr>
<td>3</td>
<td>Feelings about the task after some technical thinking</td>
<td>Calm, Apprehensive, Dreading it, Panicky, Unsure, Up for it</td>
</tr>
<tr>
<td></td>
<td>Feelings after the stimulus</td>
<td>Amused, Apathetic, Bored, Indifferent</td>
</tr>
<tr>
<td>5</td>
<td>Feelings about the context</td>
<td>Amused, Apathetic, Bored, Indifferent</td>
</tr>
<tr>
<td></td>
<td>Feelings about knowledge, skill and understanding</td>
<td>Confident, Dreading it, Insecure, Vexed, Worried, Impatient to start</td>
</tr>
<tr>
<td></td>
<td>Feelings about possible briefs</td>
<td>Appropriate, Contrived, Foolish, Silly</td>
</tr>
<tr>
<td>8</td>
<td>Feelings about possible support tasks</td>
<td>Calm, Apprehensive, Confident, Relaxed</td>
</tr>
<tr>
<td>9</td>
<td>Feelings during designing and making</td>
<td>Alienated, Calm, Elated, Frustrated, Miserable, Relieved, Scared</td>
</tr>
</tbody>
</table>
For Section 2 (Considering my technical understanding) trainees could respond using a five-point Likert scale with these end categories:

- I felt very confident – Not at all confident
- I felt very anxious – Not at all anxious
- I felt very relaxed – Not at all relaxed

For Section 10 (Sketches of my finished product) trainees could respond using a five point Likert scale with these end categories:

- I felt able to do this – I felt incompetent

The participants

The sample consisted of 18 trainees (11 male and 7 female). Fourteen trainees had materials technology as their first specialism and of these the second specialisms were electronics and communication technology (11 trainees), food technology (2 trainees) and textiles technology (1 trainee). Two trainees had electronics and communication technology as their first specialism and both of these had materials technology as their second specialism. Two trainees had textiles technology as their first specialism and both of these had materials technology as their second specialism.

The first degree qualifications of the sample are typical of those pursuing a PGCE in design and technology and are listed below:

- BA 3D Design (3 trainees)
- BA 3D Furniture Design
- BA Architecture
- BA Design & Technology Management
- BA Fashion
- BA Furniture Design & Manufacture
- BA Graphic Design
- BA Industrial Design
- BA Industrial Design & Technology
- BA Product & Furniture Design
- BA Textiles Design
- BA Theatre Design
- BEng Civil Engineering
- BEng Manufacturing Engineering
- BSc Industrial Design
- BSc Product Design, Innovation & Marketing

Results

This paper will comment on the responses of all the trainees to sections 1, 3, 4, 6, and 7 of the Activities Booklet. It will describe in detail the response of four purposefully sampled trainees to Section 9. These trainees were chosen because they represented a range of relevant experience in their first degree. This range encompassed highly relevant to little relevance.

Trainees’ response to Section 1 of the booklet when first faced with a designing and making assignment that involved working with resistant materials, electrical components and appropriate tools was more positive than negative. Sixty one words concerned with positive feelings were chosen compared with 21 words concerned with negative feelings.

After answering technical questions (Section 2 of the activities booklet) concerned with simple mechanisms and electrical circuits trainees indicated the intensity of their feelings with regard to confidence, anxiousness and relaxation on a five-point Likert scale in Section 3. The results are summarised in Table 4.

<table>
<thead>
<tr>
<th>Very confident (5) – Not at all confident (1)</th>
<th>Very Anxious (5) – Not at all anxious (1)</th>
<th>Very relaxed (5) – Not at all relaxed (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5  4  3  2  1</td>
<td>5  4  3  2  1</td>
<td>5  4  3  2  1</td>
</tr>
<tr>
<td>-  8  5  5  -</td>
<td>-  1  1  6  9</td>
<td>-  1  4  8  5  -</td>
</tr>
</tbody>
</table>

Table 4: Intensity of feelings after answering technical questions
Inspection of this data shows that the majority of trainees were not anxious but confident and relaxed.

The impact of having done some technical thinking on trainee’s response to the task (revealed in Section 3) is minimal. It is still positive with 57 words concerned with positive feelings being chosen compared to 17 words concerned with negative feelings.

The feelings evoked by the stimulus (revealed in Section 4) appear to be overwhelming positive with 67 words concerned with positive feelings being chosen compared to 4 words concerned with negative feelings. It is important to note however that two trainees recorded no positive words and 1 negative word each indicating that for them the stimulus was not motivating.

The feelings evoked by the demonstration of control systems and constructional techniques (revealed in Section 6) appear to be overwhelming positive with 75 words concerned with positive feelings being chosen compared to 4 words concerned with negative feelings. It is important to note however that one trainee recorded no positive words and 2 negative words and two other trainees recorded only 1 positive word each, one recording 2 negative words and one no negative words indicating that for them the demonstration was perhaps not helpful.

The feelings evoked by the two given briefs (revealed in Section 7 of the activities booklet) appear to be overwhelmingly positive with Brief 1 gathering 39 words concerned with positive feelings compared to 3 words concerned with negative feelings and Brief 2 gathering 41 words concerned with positive feelings compared to 5 words concerned with negative feelings.

The briefs written by the trainees fall into a wide range of categories summarised in Table 5.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Number of trainees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small vehicle with a particular purpose – object collector, racers</td>
<td>3</td>
</tr>
<tr>
<td>Small vehicle or artefact with particular play value</td>
<td>2</td>
</tr>
<tr>
<td>Construction kit for school</td>
<td>1</td>
</tr>
<tr>
<td>Themed vehicles</td>
<td>3</td>
</tr>
<tr>
<td>Seasonal toy</td>
<td>1</td>
</tr>
<tr>
<td>Unusual moving items – insect, robot, animal puppet</td>
<td>3</td>
</tr>
<tr>
<td>Game with appeal to boys and girls</td>
<td>1</td>
</tr>
<tr>
<td>Linear travelling toy with appeal to boys and girls</td>
<td>1</td>
</tr>
<tr>
<td>Advertising device</td>
<td>1</td>
</tr>
<tr>
<td>Scale model of existing artefact</td>
<td>1</td>
</tr>
<tr>
<td>Nil response</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5: Briefs written by trainees organised into themes
The feelings of four purposefully sampled trainees as they moved through the designing and making assignment are summarised in Table 6.

<table>
<thead>
<tr>
<th>Trainee</th>
<th>Feelings at the beginning</th>
<th>Feelings in the middle</th>
<th>Feelings at the end</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Male) First degree B Eng Civil Engineering, First Specialism Electronics and Communication Technology, Second Specialism Materials Technology.</td>
<td>confident, excited, intrigued</td>
<td>confident, excited, frustrated, happy</td>
<td>excited, happy, pleased, satisfied</td>
</tr>
<tr>
<td>2 (Male) First degree BA 3D Design, Art &amp; Design Foundation, First Specialism Materials Technology, Second Specialism Electronics and Communication Technology.</td>
<td>calm, excited, intrigued but worried</td>
<td>annoyed, frustrated</td>
<td>angry, annoyed disappointed</td>
</tr>
<tr>
<td>3 (Female) First degree BA 3D Furniture Design, MA Furniture Design, First Specialism Materials Technology, Second Specialism Food Technology.</td>
<td>confident excited</td>
<td>confident excited but worried</td>
<td>confident, pleased satisfied</td>
</tr>
<tr>
<td>4 (Female) First degree BA Textiles Design, First Specialism Textiles Technology, Second Specialism Materials Technology.</td>
<td>alienated, angry, frustrated, miserable tense</td>
<td>excited, happy, pleased relieved</td>
<td>elated, fascinated, happy, satisfied</td>
</tr>
</tbody>
</table>

| Table 6: Feelings of four trainees as they moved through the designing and making assignment |

**Discussion**

The personal autonomy considered so important in design and technology can be related to the design decisions made by pupils. These have been categorised as conceptual (overall purpose of the design, the sort of product that it will be), technical (how the design will work), aesthetic (what the design will look like), constructional (how the design will be put together) and marketing (who the design is for, where it will be used, how it will be sold) (Barlex, 2004). In the designing and making assignment tackled by the PGCE trainees the conceptual design was to a large extent made by the course tutor, although the trainees did have the option of developing their own brief in which the concept could be radically different to that in the set briefs. Notwithstanding this the trainees had plenty of opportunities to make design decisions in the other areas. Hence they were able to exercise considerable personal autonomy.

In the build up to the designing and making assignment the majority of trainees expressed positive feelings towards their experience and for most of the time it could be said that most of them were looking forward to the designing and making assignment. The few negative feelings expressed were in most cases balanced by positive feelings. So it can be reasonably argued that the emotional disposition of the group towards the task was affirmative.

It is therefore intriguing to note the way emotions changed for individual trainees over the course of the assignment.

Trainee 1 has a first degree and course specialisms that match well with the requirements of the assignment and are reflected in his feelings before beginning the task: positive, excited, unruffled, up for it. He answered the technical questions correctly and fluently and these did
not deter him from the task. He recorded the feelings calm, excited, confident, up for it. The stimulus was positive for him – amused, interested, attracted, pleased, engaged. The demonstration of relevant knowledge skill and understanding also provoked positive feelings: confident, excited, engaged, up for it, composed, eager, impatient to start. His feelings stay positive throughout the professional development.

Trainee 2 has a first degree that matches moderately with the requirements of the assignment, plus appropriate course specialisms. This is reflected in the mixture of emotions he experiences before beginning of the task: calm, positive, anxious, excited, relaxed, confident, unruffled, apprehensive, composed, up for it. He answered the technical questions well but this did not allay his fears as he records his feelings now as anxious, apprehensive although still up for it. Although amused, interested and engaged by the stimulus he wonders if it might be ‘over-awing’. After the demonstration his feelings are all positive: engaged, up for it, composed, eager. However his feelings through the task change considerably. The feelings move from positive to negative. He notes that the reason for this is that he didn’t finish in the time available. But on completing his product and getting it to move satisfactorily he reports feeling happy, pleased and satisfied.

Trainee 3 has first and second degrees that match moderately with the requirements of the tasks. Her first specialism is relevant but not her second specialism. Her feelings before beginning the task are mainly positive with some concerns: positive, excited, confident, up for it yet unsure and apprehensive. Her responses to the technical questions indicate some limitations in being able to explain technical systems but this does not deter her from the task as she reports the feelings positive, excited, composed, up for it. The stimulus engaged her as she reports the feelings amused, interested, attracted and pleased but also annoyed noting that the ‘Batmobile’ was very ‘male’. After the demonstration her feelings are all positive: excited, up for it, fascinated, eager. Her feelings throughout the task remain positive, although she admits to feeling worried during the middle of the task. Interestingly this trainee was the only one to depart from designing and making a moving toy ‘car’. She designed and made a display system that used a compound pulley drive to reveal a sequence of photos through a rotating circular disc.

Trainee 4 has a first degree that does not appear to match the requirements of the task. Only her second specialism appears relevant. Her feelings before beginning the task are mainly positive with some concerns: relaxed, up for it but unsure. Her responses to the technical questions indicate considerable limitations in understanding technical systems and this moves her feelings towards the negative: unsure, insecure, apprehensive. However her response to the stimulus was positive: amused, interested, fascinated, attracted, pleased and engaged but she has some reservations about being overwhelmed or even frightened. The demonstration did nothing to allay her worries as she reports feeling insecure and unsure noting that ‘not really looking forward to doing it as my skills and knowledge are very limited. Worried that I will not achieve a finished product’. Her feelings change radically across the course of the task. The feelings move from negative to positive. Interestingly her moving toy was in the form of a cat and she used her textile skills to achieve a very professional finish for the ‘body shell’.

Conclusion
The response of the four purposefully sampled trainees indicates that designing and making is accompanied by feelings that vary according to the competences possessed by the designer maker, the amount of progress being made and any particular difficulty being encountered. This should not surprise us. As Caine and Caine (1991) write:

We do not simply learn. What we learn is influenced and organised by emotions and mind sets based on expectancy, personal biases and prejudices, degrees of self esteem, and the need for social interaction. Emotions operate on many levels, somewhat like the weather. They are ongoing, and the emotional impact of any lesson may continue to reverberate long after the specific event. (82)

If PGCE trainees who are well disposed to a designing and making assignment experience changes in the way they feel about what they are doing as they move through the task what is the likelihood that pupils in
school will experience changes in feelings? For some, these changes may reduce their confidence and be de-motivating.

These results of this preliminary analysis of data give rise to a number of questions. To what extent would it be possible or desirable to include reflections about feelings as part of initial teacher training and professional development programmes? To what extent would this enable teachers to understand the feelings of their pupils? Would this help them in their teaching?

The results also raise the intriguing possibility of using a similar but simpler device to enable pupils in school to record their emotions as they work through a designing and making assignment. The reaction of trainees to being asked to consider their feelings was positive and welcomed, particularly by those who felt least able to cope with the demands of the task. This perhaps indicates that pupils might like the opportunity to reveal their feelings, particularly if teachers were then able to take this into account when providing support and guidance. There is also the possibility that once pupils become adept at considering their feelings and there is an atmosphere of trust in a classroom they might be able to help one another in dealing with conflicting or negative emotions towards the subject matter being learned.

References
Alsop, S. (2005), Beyond Cartesian Dualisms Encountering Affect in the Teaching and Learning of Science, The Netherlands, Springer