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The skills and qualities of students entering design and technology initial teacher education

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Abstract
Typically, until recently, Initial Teacher Education (ITE) providers have provided design and technology (D&T) courses for mature and post graduate certificate students based on an understanding that the students’ previous qualifications provided a sound basis on which to build D&T subject expertise to enable them to teach in schools. This research was prompted by the perception that a change was taking place in the skills and knowledge students bring to their D&T ITE course from previous courses.

To ascertain the nature of change this study involved 27 Higher Education institutions and over 600 mature trainee D&T teachers. Research instruments included questionnaires and structured interviews. Additionally, recent course documents of both HND and degree courses were scrutinised to gain insight into the course content and how this related to the knowledge and skills required by the D&T teacher.

Analysis of the data indicates that many students lack practical skills and their designing expertise is variable. The majority do not have strong technological profiles. Students are concerned about their shortfall in D&T expertise. The research quantifies the extent of these difficulties related to the qualifications students have on entry to ITE. ITE lecturers have reservations about these qualifications and use additional indicators related to personal qualities to help determine suitability for entry to ITE courses.

Introduction
The subject of design and technology and its predecessor Craft, Design and Technology have recruited considerable numbers of potential teachers from a range of industrial sources, with a variety of previous qualifications. Several institutions have developed D&T strands of their one year Post Graduate Certificate in Education (PGCE) courses recruiting from degrees ranging from engineering to product design. Initial teacher education (ITE) providers acquired an understanding of the knowledge and skills required by these students based on an awareness of the students’ previous qualifications and experience and how they related to the fore-runner of D&T in schools. The implementation of Technology in the National Curriculum¹ in 1990 resulted in changes to the subject expertise needed by teachers of this curriculum area. Further change has taken place with the implementation of the revised and renamed Design & Technology in the National Curriculum² in 1995.

This research was prompted by an impression of a widening gap between the subject skills and knowledge students have on entry to courses and the requirements of teaching D&T in schools. Students appeared to be having difficulty dealing with aspects of designing and their practical capability and technological understanding seemed more varied. Heads of Department in schools were aware of these difficulties and regularly expressed concern. These impressions were confirmed by a local study published in Design and Technology Teaching³. Since this study the new version of D&T in the National Curriculum² has been published with concise programmes of study, giving a clearer picture of the skills and knowledge the D&T teacher is required to deal with. This research has been conducted in order to obtain an accurate picture of the D&T skills mature students have at the point of entry to D&T ITE specifically referenced to the requirements of teaching D&T in the National Curriculum. The qualities considered are those which indicate a
prospective student has potential to develop D&T knowledge, understanding and skills. The objective is to assist institutions develop training programmes which more closely match the requirements of D&T ITE students.

Research method
There were four elements in the research:
• questionnaires used to assess the D&T skills and knowledge mature students have from their previous courses;
• interviews with students about previous courses and experience referenced to their understanding of D&T in schools;
• analysis of several current HND and degree course documents;
• interviews with staff involved in the selection of students for ITE courses, aimed at gaining insight into specific personal qualities desirable in students entering D&T teacher education.

The Questionnaire
Percentage enrolment figures for students starting D&T courses show the following share of students registered on each type of course:
• 36.5% - one-year Post Graduate Certificate in Education (PGCE) courses;
• 34.5% - two-year courses for mature students consisting of PGCE, BEd, BA/BSc with qualified teacher status (QTS);
• 29% - 3-or-4 year courses consisting of BEd or BA/BSc with QTS courses designed for students with A level qualifications.
(Figures supplied by ITE providers: 1994)

This research concentrated on students enrolled on PGCE courses and courses for mature students, as they represent the majority (71%) of students entering D&T ITE. An important aspect of recruitment is that applicants' previous qualifications provide a sound basis for training as a specialist D&T teacher, although ITE providers have recognised for some time that the majority require further subject study to equip them for teaching in schools. As one-year PGCE courses are focused on developing professional teaching competences there is little time for the student to enhance their prior knowledge. It is, therefore, particularly important that ITE providers have a clear understanding of a student's skills and knowledge gained from previous courses. This was established using a questionnaire which included the following sections:
• qualifications used as the basis for entry to ITE;
• teaching and learning methods used during the previous course for D&T related skills and knowledge.

Questions were in the following categories:
• designing skills;
• making skills using hand tools;
• making skills using machines;
• technology, particularly electronics, mechanisms and structures;
• communication skills, particularly drawing.

Respondents used the following scale to indicate teaching and learning method used to cover aspects of D&T on their previous courses.
• None = Not covered by any formal teaching during your previous course.
• Limited coverage = Taught by some form of lecture or demonstration as part of your previous course, but with minimal practical follow up.
• Covered in detail = Taught by lecture or demonstration as part of your previous course, plus extensive practical follow up.

These definitions were established by discussion with students and a pilot questionnaire. Students emphasised the need to focus on the practical follow up, as they viewed hands-on experience as an essential part of the learning process if they were to be competent and confident D&T teachers.

Table 1 and 2 show the results of the questionnaire; entries in bold are significant and referred to in this text. For this analysis the students' previous qualifications are grouped into engineering, design, D&T and other. The number of D&T respondents was small as these are relatively new courses. University and College Entrance 1995 lists
All have profiles weak in different aspects of D&T, a consistent feature being minimal practical capability. Fine Artists and Architects indicate good designing and drawing capability, whereas the Computer Technologists have received minimal drawing or design work during their degree courses. As one-year PGCE courses provide professional training with about two thirds of the time spent in schools the graduate has little time to acquire D&T skills, yet the data show that the majority of one-year PGCE eleven degree and four HND D&T courses. The other category is significant as it represents 29% of one-year PGCE students and most of two-year PGCE students.

### One-year PGCE courses

First degree subjects represented in one-year PGCE courses include engineering, design, D&T and other. The range of degree subjects in the other category varies from Fine Art, Sculpture and Architecture to Computer Technology, Consumer Services and Sciences.

<table>
<thead>
<tr>
<th>Degree</th>
<th>Designing</th>
<th>Using hand tools</th>
<th>Using machines</th>
<th>Technology</th>
<th>Drawing</th>
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<td>35 37 28</td>
<td>38 29 33</td>
<td>10 37 53</td>
<td>18 41 41</td>
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<td>14 33 53</td>
<td>17 27 56</td>
<td>49 36 15</td>
<td>3 29 68</td>
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<td>D&amp;T</td>
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<td>15 30 55</td>
<td>20 25 55</td>
<td>30 50 20</td>
<td>10 30 60</td>
</tr>
<tr>
<td>Other</td>
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<td>46 36 18</td>
<td>60 24 16</td>
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<td>Other</td>
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<td>19 39 42 64 25 11 71 18 11 60 25 15 36 28 36</td>
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</table>

Table 1: One and two year PGCE courses: questionnaire data
Figures in bold are referred to in the text
Figures are percentages of students: n=none  l=limited coverage  d=covered in detail

<table>
<thead>
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<th>HNC/HND</th>
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<td>Designing</td>
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<td>Engineering</td>
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<td>Design</td>
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<tr>
<td>D&amp;T</td>
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<tr>
<td>Other</td>
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</tbody>
</table>

Table 2: Undergraduate students following two year courses: questionnaire data
Figures in bold are referred to in the text
students do not have an adequate D&T skill base. As expected, the majority of design students have a sound basis for teaching designing in schools, but graduates of the D&T degrees appear less well equipped. The others fair better than expected with 49% well equipped, but over half (58%) of the engineers have not had follow-up design activity in their previous course. Design students are well equipped to teach drawing but most other students have minimal practical drawing during their course, yet this is an essential skill for the D&T teacher.

Design and Technology in the National Curriculum (1995)2 has clear statements in the knowledge and understanding programmes of study about the technology to be covered at each key stage. For KS3 and 4 technologies are listed as part of the knowledge and understanding, yet data collected shows that graduates entering ITE courses do not have strong technological profiles. Surprisingly, about half the engineers have not had the opportunity for technological practical work. Design students are the most disadvantaged group technologically with half (49%) not having received technology teaching and more than one third (36%) being taught through a lecture programme. The D&T graduates are only marginally better off than design students.

Using tools and machines shows a more satisfactory picture, with more than half the design and D&T students having good practical profiles. However, the data shows that there are many students ill equipped to deal with practical project work which is central to D&T activity in schools. It is not surprising that the other students are weak in using hand tools and machines, but the engineer has similar weaknesses, although one third have used machinery extensively.

Analysis of degree course documents for engineering and design courses gives an insight into why these courses cannot be relied on to provide a sound basis for D&T ITE. Engineering courses now have:
- minimal practical work, therefore graduate engineers are unlikely to have a range of practical skills unless they followed a sandwich course involving workshop practice;
- a unit structure which enables the undergraduate to tailor a programme of study often with elements of management or business at the expense of practical project work;
- much of the technological teaching delivered by lecture with follow up work confined to computer simulations, particularly in disciplines such as electronics, structures, pneumatics and computer aided manufacture;
- drawing skills taught through computer aided design systems which produce two and three dimensional images quickly without study of the principles involved.

Design degree courses show structures with:
- minimal time allocated to formal teaching of practical skills, typically 30 to 40 hours;
- considerable time devoted to ‘paper design’ exercises;
- minimal clearly defined technological teaching.

The extent of practical project work in design courses seems to depend on projects set by tutors and individual students interests. Many courses have industrial contacts whereby students are able to develop technological capability through project work, but the extent and nature of this is difficult to quantify.

It has not been possible to analyse other degree course documents because of the wide range of subjects. However, the newer D&T degree courses seem to provide a sound basis for D&T teaching with the proviso of an increase in technological content.

Table 1 shows the data returned by students enrolled on two-year PGCE courses which are being run by a small number of institutions. The D&T profile of these students shows limited capability brought from previous courses, with serious weaknesses in using hand tools and machinery but slightly better drawing and design expertise. Overall, the D&T profile of these students is marginally worse than other students following one-year PGCE courses but as they have an extra year to build up their profiles they should become
competent and, therefore, better equipped to teach in schools.

Two-Year degree courses
Two-year BEd degrees for students with qualifications and experience related to industry have been a major source of D&T teachers. However, BEd courses now account for less than half (45%) of students with this background; 55% are enrolled on recently developed BA/BSc with Qualified Teacher Status (QTS) courses. Students with the more craft-focused City & Guilds full technological certificate represent only 11% of two year degree students; 36% have Higher National Certificates (HNC); and 57% the higher level Higher National Diploma (HND). The majority of students following these routes to teaching are, therefore, well qualified at entry. Most students (39%) are drawn from the engineering profession, and there is a significant number with design qualifications (25%), but this figure is exceeded by students drawn from other courses (32%). The range of qualifications in this category is different from those found in the PGCE other category with 25% of students having building qualifications and 14% with catering/food technology qualifications. The remainder is made up of students with various technological qualifications (53%), plus a further 8% with business and finance qualifications and a virtually non-existent D&T profile.

When compared with the graduate engineer the HNC/HND engineer is likely to be considerably weaker at designing and drawing, slightly better at using tools and machinery but with even less-hands on experience of using technology. The HNC/HND designer shows a strong profile in designing and drawing but, as in the case of graduate design students, a weak technological profile. Disappointing is the profile of the D&T specialist in this group who appears to have had a theoretical course at HND level.

Their profile is similar to that of students in the other category with marginally greater expertise in using machines, technology and drawing.

The conclusion drawn from analysis of HNC/HND course documents is that changes in content and structure are broadly similar to those of degree courses. Practical work does not appear to be a strong feature.

Student Interviews
Structured interviews were used to gain insight into students’ views about D&T ITE. The majority of students indicated that they had based their decision to move into the teaching profession on a desire to work with young people and had chosen D&T as they considered their qualifications and experience provided them with appropriate skills, or, they had enjoyed practical work when pupils at school. Most had visited schools prior to applying and experienced a positive reaction to the D&T seen. Of the twenty-five students interviewed, two considered their previous course had provided a sound basis for D&T ITE and thirteen felt they were ill equipped in several aspects of D&T. The remaining ten considered they had some specific skills related to D&T but their previous course had been too narrowly focused to cope with the breadth of D&T. Eighteen interviewees expected their ITE course would address their shortfall in D&T. Eighteen interviewees expected their ITE course would address their shortfall in D&T expertise. Fourteen students found designing difficult, particularly engineers and others. Ten students expressed doubts about its feasibility in school, although they did acknowledge they had not been able to observe pupils involved in designing activity. Five design students were concerned about the differences between designing in school and their previous experience. Reservations were expressed about technology, with design students saying the knowledge was outside their scope and engineers stating doubts about their ability to cope with the diversity expected in D&T. An almost universal concern voiced by students was their lack of, or inadequate practical skills (twenty-two students). In several cases this worry had been exacerbated during the first school experience when students found they could not cope with the range of skills required. Two thirds of students commented that they had experienced negative comments from D&T teachers regarding their practical capability and this had affected their confidence. All one-year PGCE students (twelve) interviewed considered that
insufficient time was given to practical skills during their course.

Interviewees were unanimous in their view that qualities such as patience, ability to get on with people and organisation skills were important to the teacher, twenty students commenting that these are inherent personal qualities whereas D&T skills could be acquired.

University staff interviews

D&T staff in training institutions are aware that previous qualifications could be used only as an initial guide of an applicant’s D&T capability. In addition to looking for qualities applicable to all applicants for ITE, such as an ability to get on with children, they emphasised the importance of searching out evidence of enthusiasm for practical activity and willingness to develop new skills and knowledge. Several institutions ask applicants to bring examples of D&T related work to interview and use this as the basis for a discussion about D&T skills. One institution sent applicants a questionnaire about their D&T capability and used responses as a basis for an interview. Most had come to the conclusion that assessing an applicant’s D&T capability at interview had become more difficult. A particular quality looked for in applicants is flexibility of thinking and a willingness to embrace technology even though it may not have been a significant part of a previous course. Staff in several institutions use science qualifications gained at school as an indicator of potential technological capability as in many cases they have no better gauge. All were concerned about applicants having an open minded approach to D&T, using answers to esoteric design questions as an indicator of the applicant’s flexibility when approaching new learning situations. Several commented that they seemed to be interviewing students who had not had the opportunity to do practical and/or technological work in their previous course or employment and were seeing a D&T ITE course as opportunity for this.

Conclusion

The DFE circular Initial Teacher Training (Secondary Phase)\(^5\) states that for one year PGCE courses ‘Institutions should satisfy themselves that: the content of an entrants’ initial degree is appropriate to the secondary school curriculum’ and ‘newly qualified teachers should be able to demonstrate a breadth and depth of subject knowledge extending beyond the Programmes of Study and examination syllabuses in school.’ The recently published ‘Minimum competencies for students to teach Design and Technology in Secondary Schools\(^6\)’ outlines a further view of core requirements. The evidence of this research highlights that many one year PGCE students have difficulty in meeting these requirements, yet the profession would face problems in teacher supply without these recruits. Pre-course extensions aimed at building up the students’ D&T profile could address these difficulties. Graduates in the other category should be advised to do a two year PGCE. Students enrolled on two year undergraduate courses have clearly defined weaknesses which could be dealt with by scrutiny of individual profiles followed by study tailored to address specific weaknesses.

References


5 Department of Education, *Initial Teacher Training (Secondary Phase)*. Circular 9/92, September 1992, 4.4.2 and 2.2.3.