Partnership Schools, Universities and the Shortage of D&T Skills

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Successive revisions of the Technology curriculum have placed more and more demands on the subject skills of the D&T teacher, but how well do newly qualified teachers measure up to the requirements? Here Tim Lewis provides evidence that shows that this is an area for concern.

Design and Technology teachers who have links with universities providing teaching practice placements will be aware of the changes in the training of teachers, particularly the development of partnerships, with teachers taking responsibility for certain aspects of training. Partnerships between schools and Higher Education Institutions (HEIs) have been established in the last three years with schools being far more involved in course design and implementation. Many D&T teachers have taken an active role in these developments including being involved in new course design and delivery as well as taking the opportunity to be trained as mentors in preparation for the supervision of students on teaching practice placements in their schools.

The majority of initial teacher education (ITE) courses have included school experience or teaching practice after students have received some teaching in the HEI, so the new recruit to the profession has had an opportunity to become more aware of the skills and knowledge required by the D&T teacher. New recruits to D&T teaching come with a wide variety of qualifications and experience, which can be seen as an advantage or as a problem for the teacher educator. While four-year degrees continue to attract the 18-year-old student into the profession there is no doubt that the postgraduate certificate in education (PGCE) for students with a degree and two-year BEd. courses for people with Higher National Diplomas/Certificates (HND/C) are a main source of supply of new D&T teachers. Many readers will have entered the profession by one of these two routes. While the supply of students has been adequate, training via these routes poses many problems. Staff in HEIs will be familiar with these, but now that partnerships are established, teachers in schools need to be aware of the problems too, and be involved in developing strategies to overcome them.

The problem this article addresses is the suitability of qualifications for entry to a D&T teacher education course with particular reference to skills. At Sheffield Hallam University the word *alignment* has been used to describe the appropriateness of a prospective student's qualifications and experience for teaching D&T. A PGCE student with a degree in D&T is said to be *in alignment* (at present there are few D&T first degree courses), a product design student *in reasonable alignment* but a fine art degree would be *out of alignment.* Similarly, an HND/C qualification in engineering is *in reasonable alignment* but one in computer science is *out of alignment.* (It is recognised that qualifications can only be used as a starting point in the selection process as some applicants *out of alignment* may have other experience which brings them more into alignment.)

Knowing that students are entering training with different levels of alignment, it follows that we need to design courses which can bring them *into alignment,* that is, fill in the gaps in their D&T knowledge, skills and understanding, as well as train them to teach. An in-house study at Sheffield Hallam University has provided data about the extent of mis-alignment in two-year BEd. and PGCE students as well as focusing on those aspects of D&T which need to be taught to ensure that the student leaving the courses will be adequately prepared to teach the D&T National Curriculum.

Before teacher education courses can deal with this situation, however, it is necessary to have a clear picture of the core skills required by a D&T teacher. This can be difficult as the D&T profession has not always been in agreement about this, so the Technology National Curriculum documentation has been used for guidance. In the first instance, *Technology for Ages 5 to 16*, (1992) and subsequently *Design and Technology in the National Curriculum, Draft proposals: May 1994.* Interim documents such as *Technology: Programmes of Study and Attainment Targets: Recommendations of the National Curriculum Council* (Sept. 1993) have provided guidance. The data used in this article has been collected from three cohorts of students entering D&T PGCE and two-year BEd. courses at Sheffield Hallam University, the number involved being 124 (four-year BEd. students have not been included as their course is designed to cover most aspects of D&T and is sequential to A level).

All students taking part in the study completed a questionnaire which asked them to state their previous course and qualification used as the basis for entry to teacher training. This was followed by a list of key skills and areas of knowledge associated with D&T. Respondents were asked to indicate the extent of coverage of each skill or area of knowledge in their previous course or employment using a three-point scale of *none, limited coverage* and

covered in detail. As stated earlier, the key areas of D&T were derived from drafts of the emerging D&T National Curriculum which seems to progressively identify D&T skills, knowledge and understanding more concisely. The questionnaires were issued early in courses but after students had made visits to schools so they were more aware of the skills and knowledge required by the D&T teacher. A considerable amount of data has been collected and used as guidance in the development of new initial teacher education courses at the university. For the purposes of this article, five key aspects of D&T are analysed and comparisons made between the D&T capabilities and shortfalls in expertise of the two student groups.

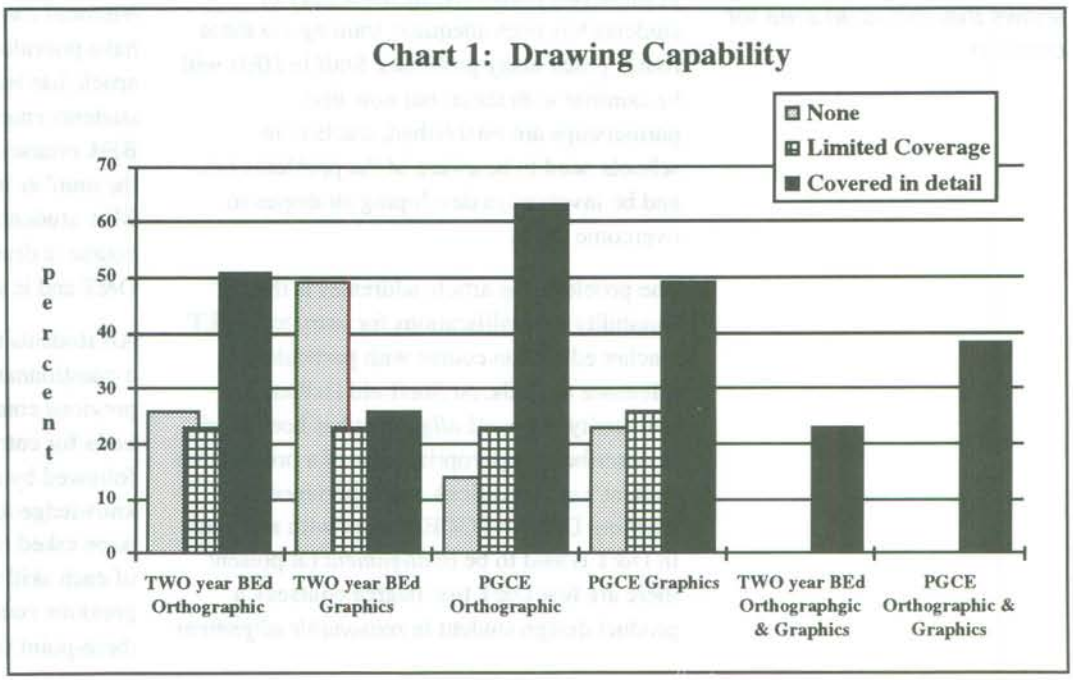
Design processes

As design processes are a fundamental aspect of D&T teaching it seems reasonable that students should have an understanding and working knowledge before they can be effective in the D&T teaching environment. Students entering the two-year BEd. degree were weak in this aspect, with only 26 percent having covered this in detail in previous courses; this compares with 74 percent of PGCE students with only 9 percent having not covered this topic at all. The PGCE students without knowledge of designing usually come from backgrounds similar to the two-year BEd. students, that is mechanical engineering with industrial experience. A more detailed analysis shows that 84 percent of students with an HND/C or a degree in a design-based subject were fully aware of design processes whereas only 25 percent of engineering HND/C and degree students had a sound working knowledge. Students with technological backgrounds such HND/Cs or degrees in electronics or computer studies fare no better, with only 23 percent having covered designing in detail. It is reasonable to expect that any higher-level design course would cover this in detail, so it is surprising that few technological or engineering courses have provided even limited coverage. Discussion with students with engineering backgrounds revealed that while they did units or modules called 'design', the tasks set were usually very restricted with little or no teaching about design processes. In many cases they had been asked to complete half-finished solutions to engineering problems. Some had completed projects based on a manufacturing process which were usually descriptive.

Drawing Capability

The ability to represent ideas by drawing is one of the fundamental skills required by the D&T teacher yet this study shows that there is a considerable variation in students' expertise (and even understanding) of terminology associated with drawing. Some students have an excellent understanding of orthographic projection whilst others are fluent in representing ideas using a range of 3-D presentation techniques; however, the D&T teaching profession requires expertise in both these areas. The questionnaire separated these two aspects of drawing so it was possible to

Chart 1



see which students need teaching orthographic skills and which require the numerous skills of representing ideas in a 3-D form, such as perspective.

Chart 1 shows that more than half the two-year BEd. students have covered orthographic drawing and for PGCE students this is significantly higher, at two thirds. This seems to indicate that degree course content includes more teaching of this topic than HND courses. For 3-D graphics the two-year BEd. picture is weak, with only 26 percent of students adequately covering the topic. However, PGCE students are in a much stronger position with virtually 50 percent having covered the use of 3-D graphics. The two columns to the right of the chart show that over a third of PGCE students have studied both these aspects of drawing and should be able to cope well in school. For two-year BEd. students this is less than one quarter.

There are many intermediate situations where students will have some knowledge of orthographic drawing yet be well versed in 3-D graphics work. It is possible to analyse the data by qualification which shows that 70 percent of students with an HND or a degree in engineering will be able to deal with orthographic drawing but only 10 percent have had the opportunity to do 3-D drawing work in their previous course or employment. Clearly teacher education courses need to provide appropriate teaching for both categories of students so they can build expertise in those aspects of drawing where their previous experience is limited.

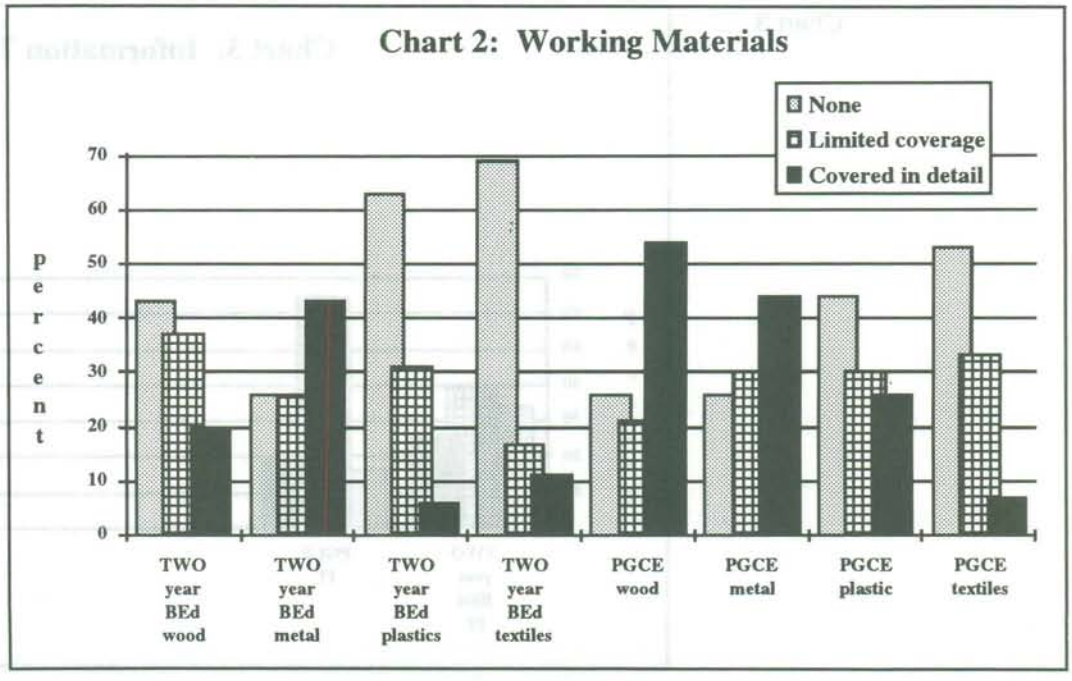
For the teacher in school planning a student's timetable it would be unrealistic to ask the majority of students with an engineering background to teach 3-D drawing work in the early stages of their training course, yet many would be able to cope satisfactorily with orthographic work. The problem is that in most schools it is not always possible or desirable to separate the two.

Working with materials

Design and Technology in the National Curriculum, Draft proposals: May 1994 sets out under the heading Knowledge and Understanding the requirement that pupils should be taught how to work with a range of materials. For the purposes of this study the questionnaire dealt with wood, plastic, metal and textiles.

One regular point of discussion between teachers in schools and university staff in recent years has been the issue of skills, usually centred around the lack of a student's practical skills when working with materials, tools and machinery. The chart below shows a varied picture regarding practical capability. It would appear that PGCE students have, as a group, the best capability with wood, metal and plastic with slightly more than half the students having covered working with wood in detail in their previous course. (Wood is a popular

Chart 2



DIY material therefore it is possible that some students have gained expertise in this way.) Just over 40 percent of both the two-year BEd. and PGCE students have dealt with metal in any depth with similar numbers, 25 and 30 percent respectively, having a limited experience. It is interesting to note that as a group the two-year BEd. students have a stronger 'metal' profile (43 percent) than 'wood' (20 percent); more detailed analysis shows that this is because the course regularly recruits students with an industrial background, particularly engineering.

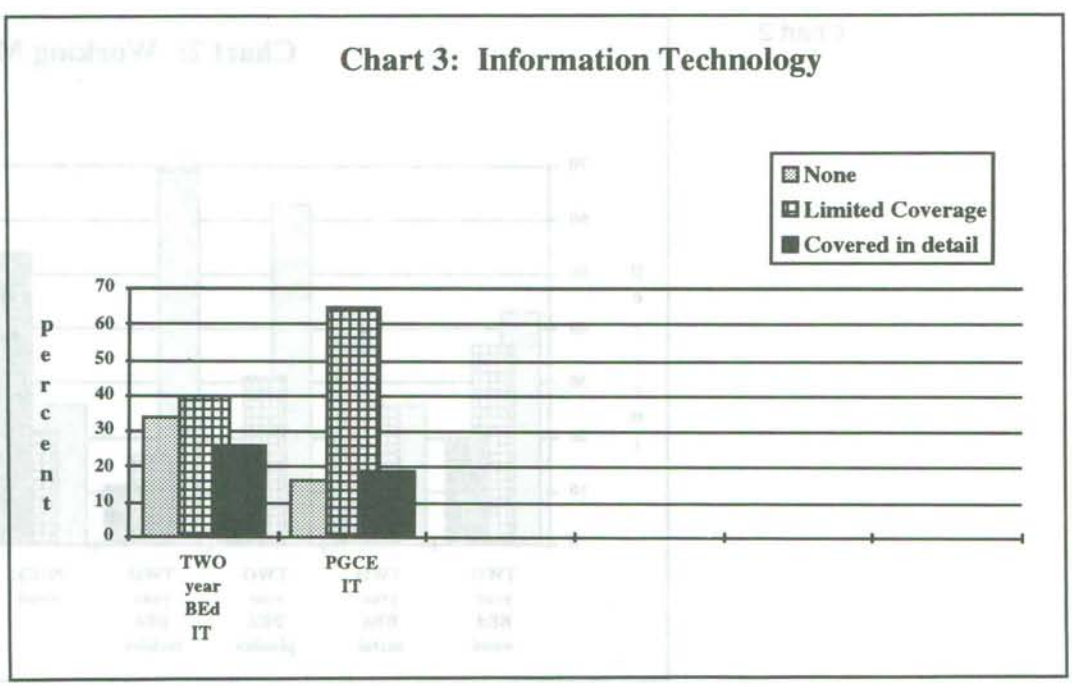
A worrying aspect is that very few students entering a two-year BEd. degree have any experience in working with plastics (6 percent) with the PGCE course better, but still a weak 26 percent. This is a popular material in schools so initial teacher education courses need to provide the necessary teaching so all students can become proficient in the use of this material. There is no doubt that textiles is under-represented as a material (*covered in detail* two-year BEd. 11 percent, with a rather weaker figure of 7 percent for PGCE), although some 33 percent of PGCE students had *limited coverage* of this material in their previous course. Students following two-year BEd. courses are in the worst position for dealing with textiles with the majority (69 percent) having no experience of using this material. This is understandable because, as stated earlier, most cohorts of students for this course have an industrial background which rarely includes textiles.

Assuming therefore that wood, metal and plastic are the most common materials used in D&T project work in schools, it is significant to record that by combining the data for these materials, the PGCE courses can boast 43 percent of students with good skills in all three materials but for two-year BEd. courses this is only 3 percent. This means that at least half the PGCE students and the majority of the two-year BEd. students need substantial teaching inputs covering working with materials. There could be problems here for PGCE courses as there is now a minimal amount of time available in the taught component of a PGCE course to cover the important health and safety (H&S) aspects of D&T. Two-year BEd. students, although weak when starting their course, do have a reasonable length of time to cover working with materials and H&S adequately.

Information Technology

Chart 3 shows a rather disappointing situation, with only a small number of students entering D&T teacher education courses with previous experience which can be described as competent in IT; however, the majority of PGCE students will have had some teaching input on their previous course. The small number (16 percent) of PGCE students with no previous IT coverage are probably mature students who completed degrees some years ago. The picture for the two-year BEd. courses is rather different in that while more students (26 percent) are likely to have had IT *covered in detail*, 40 percent will have had *limited*

Chart 3



coverage and as many as one third no experience of using IT at all; again, these may be students who completed their HND/C several years ago. What is clear is that the majority of PGCE students need some 'top-up' IT teaching and a considerable number of two-year BEd. students need some basic IT skills teaching. Discussions with students revealed that many IT-literate students still face the problem of converting to a different computer system during their course of teacher training, and this can take time before they are confident to teach IT in school. Again, this could be a problem for the PGCE student with very limited time to give to learning to use new systems and software.

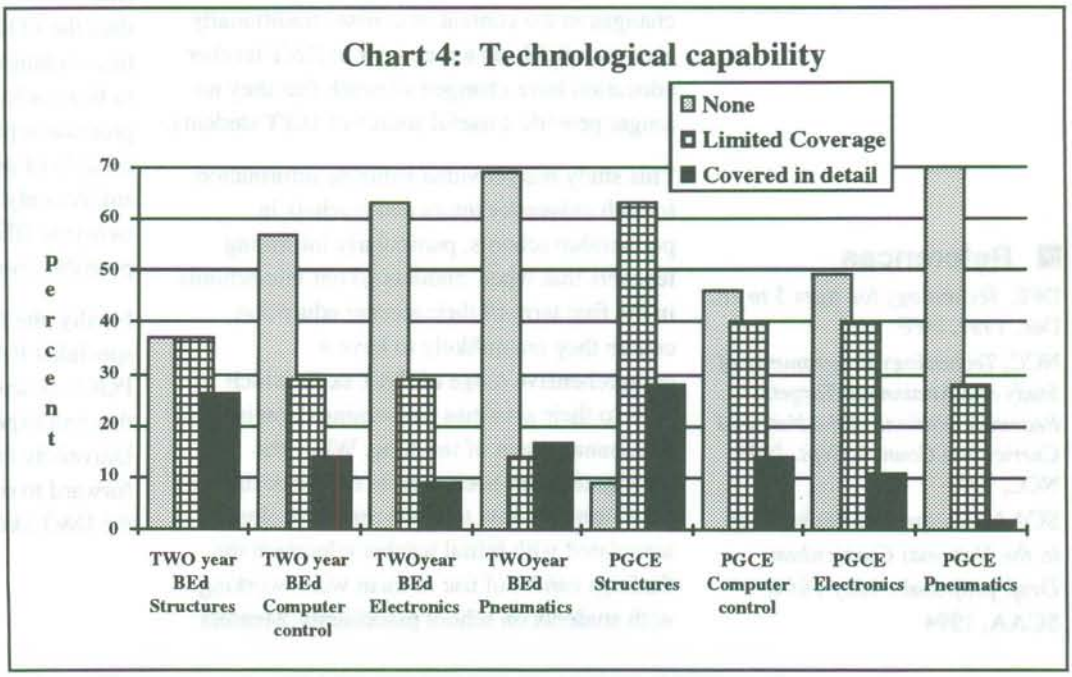
Technological capability

The picture for technological capability looks rather bleak. Compare Chart 4: Technological capability with Chart 2: Working materials and it can be seen that the *covered in detail* columns are all short on Chart 4, with the *none* columns predominating, whereas on Chart 2 the *covered in detail* columns are more in evidence. It would appear therefore that students have a greater 'working with materials' capability than technological. There are clear similarities in the coverage of technology in the different types of previous course (HND/C or degree). The *covered in detail* for structures, computer control and electronics are virtually identical for each type of course. Surprisingly, structures appears to have been covered by some students, but even this is around 25 percent only.

Computer control fares less well with only 14 percent of students having covered the topic *in detail,* and electronics is in a very poor position with a minimal 9 to 11 percent of students having had good coverage in their previous course. It would appear that degree level students have had little teaching about pneumatics (2 percent), with the HND students marginally better (17 percent), still a dismal picture. Pneumatics seems to be a technological poor relation. A rather surprising result is that many degree level students have received some *limited coverage* of structures work putting them in a reasonable position to deal with this topic in school provided they can adapt their knowledge and work at a level appropriate to schools, similarly about 40 percent of PGCE students had *limited coverage* of both electronics and computer control.

Chart 4 shows that while there are weaknesses in the PGCE students' technological profile, particularly electronics, they would appear to have had more technological teaching than the HND/C student. In the discussion about drawing capability, two methods of drawing were put together to get an overview picture; using the same analysis for technological capability the results give a dismal picture of only 3 percent of students being capable in two aspects of technology (electronics and computer control) with most combinations producing a figure of 1 percent or less.

Chart 4



Conclusions

The majority of D&T teachers would no doubt agree that it is impossible to be proficient in *all* aspects of the discipline and that an initial teacher education course should provide the student with a generalist capability plus some specialism. The newly qualified teacher would then be able to join a team of teachers and make a particular contribution to the work of a department.

The study shows that very few students entering D&T teacher training are *in alignment* with the D&T subject, most having gaps in their expertise and knowledge, and many without some of the basic skills. This puts into question the notion that such a wide range of HND/C and degree courses at present acceptable as entry qualifications form a reasonable basis for D&T teacher training. A comprehensive national study could establish the most suitable entry qualifications and provide clear recommendations on the routes into the profession. While it can be argued that diversity in the D&T teaching profession is a direct result of the numerous routes and that it has produced a creative teaching force, it has also produced a lack of agreement about the nature of D&T which people outside the profession have difficulty in understanding.

It is possible to analyse the data to obtain specific D&T weaknesses or strengths in students with certain qualifications; it is possible, for example, to see those aspects of D&T which the degree level 'product design' or HND/C engineering student needs to study on a teacher education course. It may be that changes in the content of courses traditionally seen as suitable as a precursor to D&T teacher education have changed so much that they no longer provide a useful source of D&T students.

This study has provided valuable information to both university tutors and teachers in partnership schools, particularly informing teachers that when students go out into schools in the first term of their teacher education course they are unlikely to have a comprehensive range of D&T skills which adds to their anxieties concerning organisation and management of teaching. While the information has been used in course design and development, now teachers are more closely associated with initial teacher education the findings can be of use to them when working with students on school placements. Mentors and heads of department may find the information useful when organising timetables and other tasks such as pupil shadowing. PGCE and two-year BEd. students usually have placements early in their teacher education programme but, as this study shows that the two-year BEd. students in particular have considerable gaps in their D&T expertise, negotiations between mentor and student are required to ensure that students are not expected to teach an aspect of D&T of which they have little or no knowledge. While the evidence shows that PGCE students are more capable designers and makers there are weaknesses in their technological profile and they need similar consideration, particularly during the early stages of their school experience.

As this study establishes that students entering teacher education with a degree or an HND/C have considerable gaps in their D&T skills, the time taken to plug these gaps needs to be considered. A student following a two-year BEd. course can be provided with appropriate study, and the time, to do this. PGCE students, however, have little opportunity to do this as they are now required to do 24 weeks' teaching practice during a 36-week course, leaving 12 weeks for studying both D&T *and* education. This problem must be shared between the HEIs and the partnership schools. Are teachers going to have time to teach PGCE students technological topics such as computer control, as well as dealing with the professional aspects of lesson preparation and class management? It may be that in the future two-year BEd. students will be better trained to teach D&T than the PGCE student because they have had time to build up D&T expertise. An alternative to this could be that the PGCE route into the profession produces very specialist teachers capable of delivering specific aspects of the subject only, whereas teachers trained through two-year BEd. routes are more generalist and probably more employable.

Finally, the future may be in HEIs providing specialist BA/BSc. D&T degrees followed by PGCE courses. Several institutions have done this and experience at Sheffield Hallam University indicates that this may be one way forward to overcome some of the problems of the D&T skill shortage.

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