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Design and Technology Teacher Training at Loughborough University: Principles and Practice

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Abstract

The Department of Design and Technology at Loughborough University has been a centre for training teachers in technological subjects from 1930. During that time it has developed a reputation as the premier institution in the field within the United Kingdom, a position it retains today according to inspection reports from the Office for Standards in Education (Ofsted).

The paper briefly describes the routes for training teachers of Design and Technology at Loughborough:

a. the three-year programme in Industrial Design and Technology with Education leading to the one-year Post Graduate Certificate in Education (PGCE) course (total 4 years).

b. direct entry to the PGCE course with appropriate degree qualifications and experience from other degree programmes or, for mature graduate entrants, from industry.

This paper focuses on the PGCE year and sets down the principles which underpin training at Loughborough. Recruitment and selection procedures are described. The training process at both University and practice schools and the relationship between the two is shown. Methods for supporting and extending trainees are described together with methods for assessment and evaluation.

The paper shows the emphasis made on teaching excellence based on thorough long-term planning, good classroom management and continual self-analysis to produce a reflective practitioner. In addition, thorough analysis enables graduates to maintain a lead in the development of design and technology in society as a whole and to be able to incorporate this into subject teaching so ‘future proofing’ their work with children.
Design and Technology Teacher Training at Loughborough University: Principles and Practice

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Introduction

Loughborough has been a centre for training teachers in design and technological subjects in secondary schools (ages 11-18) from 1930. During that time it has developed a reputation as the premier institution in the field within the United Kingdom. This was confirmed by a national survey by the Office for Standards in Education (Ofsted 1997, http://www.ofsted.gov.uk/inspect/index.htm) in which Design and Technology teacher training at Loughborough gained the highest grades in the country.

The Department of Design and Technology at Loughborough has two main undergraduate programmes, both use the title Industrial Design and Technology, that is industrial design with a technological bias. One programme is aimed at industry; the other adds with Education to the title and is aimed at those students who are considering the teaching profession. Both programmes shares most modules and student groups are mixed meaning that graduates from the ‘with education’ programme have a good grasp of industrial design. In addition these students take a small number of ‘taster modules’ on teaching design and technology. Those graduates wishing to teach must then follow the one-year Post Graduate Certificate in Education (PGCE), as a ‘professional year’. It should be noted that the Department considers it important that future teachers of design and technology study a recognised degree in the field of design rather than a degree which focuses only on design at school level as has traditionally been the case in teacher training in the UK.

The Department also offers a direct entry to PGCE via an appropriate degree and experience from other courses or universities. Graduates from the Department and those from outside are mixed to form a group with a good range of experience and expertise in design and technological fields.

This paper examines the ‘professional year’ at Loughborough. The methods of recruitment and selection are examined. The training process is described, looking at the general principles applied, the two phases of the year and the relationship between University based work and that in teaching practice schools. Issues of assessment, including assignments used and evaluation are discussed and a summary made.

Recruitment and Selection to the PGCE year

The matching of applicants’ qualifications and experience to meet the National Curriculum for Design and Technology (1999) is problematic. This is because there is no individual degree which suits the wide demands placed on a teacher of Design and Technology, though Industrial Design is possibly the closest. During their teaching practice all trainees gain experience, at Key Stage 3 (ages 11-14), in teaching pupils to design and make artefacts using resistant materials (wood, metal and plastics), food, and textiles. This requires a considerable skills base and thorough knowledge of the materials, tools and processes needed to work with this wide range of materials. Trainees are also required to teach graphics and Information and
Communication Technology (ICT). Furthermore, many school projects, especially in resistant materials are based around mechanics, structures, electronics and pneumatics. At post 14 (General Certificate of Secondary Education, Key Stage 4) a good trainee is expected to be able to teach two of the main strands of design and technology from electronics, food technology, graphics products, resistant materials, systems and control, and textiles. They are also required to teach a post 16 syllabus, for example an Advanced level or an Advanced General National Vocational Qualification (GNVQ) syllabus in a Design and Technology related field.

Such demands on a trainee teacher require that they have qualifications and experience that indicates competence in both a design and a technology-related field. To acquire competence in fields in which they are unfamiliar they must be willing, through self-directed endeavour, to identify and address gaps in their skills and knowledge. Apart from their Degree qualification some of this experience may have arisen from their own schooling (for example post 14 and post 16 qualifications) or from relevant industrial experience acquired from a design or manufacturing industry. All candidates must have the equivalent of a GCSE grade C or above in English language and mathematics. Graduates of the Department’s degree programmes in Industrial Design and Technology follow the selection process outlined below in parallel with external applicants, entry is not automatic.

If an individual possesses all these qualifications and experiences it is unlikely that they are going to present themselves for selection for teacher training. This is because teaching as a vocation is currently seen as of a lower status in the UK. Good Honours graduates are more likely to be eagerly received into a design related profession because of a national shortage. Consequently the number of candidates training to teach Design and Technology has consistently fallen dramatically short of national initial teacher training targets. For example, for the 1999/00 target of 1430 places 379 were filled (26%); for the 2000/01 target of 948 places 435 were filled by June 2000 (46%). This small rise in recruitment proportion can be explained by:

a. reduced numbers required (1430 to 948) because of the removal of National Curriculum Design and Technology as a statutory requirement at Key Stage 4 (ie post 14) in Wales,

b. the incentive of a £6000 training salary and £4000 payment at the end of their first year of teaching. But there is still a large shortfall.

The match of qualifications/experience to meet National Curriculum requirements has considerable implications for the selection process. Consequently the interview needs to be especially rigorous to ensure candidates are fully aware of what they will be required to teach, to what extent their education and experience fits, and the need for self-directed endeavour to acquire additional skills and knowledge. Applications are received from a wide range of degree background. The most common are Architecture, Art and Design, Design Studies, all fields of Engineering, Food Technology, Furniture Design, Graphic Design, Industrial Design, Multimedia Studies, Product Design, Textiles.

Applications are processed through the Graduate Teacher Training Registry (GTTR). Apart from essential details (name, address, age, gender, etc) applicants provide information about their qualifications and experience and a personal statement indicating why they wish to be considered for teacher training. The applicant then sends their completed form to their first (of two) referees with the registration fee (£10). The referee then provides a reference and sends the form and the registration fee to GTTR who, after processing forward it to the first choice training institution.
Prior to interview candidates are asked, by the University, to visit a design department in a secondary school for at least one-day. They must also prepare a portfolio of selected work which shows their designing and making skills, and prepare a three minute presentation on how they would introduce a topic to a class of pupils. The topics are specified – a choice of: two-point perspective, mechanical advantage, why two resistors in series work differently to two in parallel, or product disassembly. This range covers applicants from all backgrounds.

The interview follows the welcome, acquisition, supplying information and parting model (WASP) recommended by the Institution of Personnel Management (cited in Zanker 1993)

Welcome: Setting the applicant at ease, establishing rapport, explaining what will happen.

Acquisition: Collecting the information relevant to the profile to teach design and technology in the 11-18 age range. [Check details on application form, applicant talks interviewer through the portfolio; topic presentation]. During this phase of the interview the interviewer asks questions to probe areas of strength, areas requiring development, and how candidates will address areas of concern.

Supplying Information: Answering applicant's questions about the course [FAQ include school placements, course structure, accommodation, finance].

Parting: Letting the applicant know what is going to happen next [letter from University followed by letter from GTTR].

In practice this model works well. The Ofsted Report (1997) awarded Grade 1 to the quality of the admissions policy and the selection procedures:

The design and technology (D&T) course recruits good quality graduates of both sexes, the majority possessing the breadth of personal designing and making skills required to meet the demands of teaching the National Curriculum in D&T. The training needs of the small number of students without the appropriate skills and range of subject knowledge are clarified during the selection procedure to make them fully aware of the demands of the course.

Students find the selection procedure both rigorous and challenging; it helps them focus clearly from the outset on the profession they are intending to follow and on the personal demand it will make.

No candidates have left or failed the course because of incapability in subject knowledge or skills. The reason for this retention rate is because checks are made on each student throughout the course that they are addressing their individual skill deficits. The 5% of those who have left in the last five years have done so because of either financial reasons or an inability to cope with the demands of pupils. Of the 95% completion rate 90% of them enter their first teaching post from the PGCE/One Year Special Programme.

The training Process

General principles

The professional year (PGCE) is a partnership between the teaching practice schools and the University. Within the University students study the nature and pedagogy of Design and Technology and follow a course in further professional studies, which covers those aspects of
the role of the teacher, which apply to all subjects. The year is 36 weeks long and starts with a two week placement in a primary school (ages 5-11). This gives the trainee a perspective on practice at that level so that they are better able to manage pupil transition to design and technology within a secondary school.

After the primary placement the year is split into two phases. Each has an associated teaching practice. The first part of each phase involves a period of ‘serial practice’ during which trainees attend the University for three days per week and the school two. This enables basic teaching skills and knowledge worked gained in the University to be practised in the schools. Each phase is completed by a full time ‘block practice’ as a continuation of the serial practice. This part of the phase simulates full professional practice and enables the student to focus fully on the role of the teacher. These phases are described in more detail below.

Trainees are guided by three main documents. In subject (design and technology) study they work to a Course Guide giving details of each week’s activities, all assignments, assessment and feedback procedures and various appendices including a glossary of terms. In order to support trainees on teaching practice a Teaching Support Guide (TSG) is used. This focuses on design and technology in the practice school and establishes an interactive structure for students to explore the workings of a design and technology department and develop their own experience of teaching the subject. This guide also includes examples and notes on how to use a range of planning proforma including examples for demonstrations, lessons, long-term schemes of work etc. All are also available on a CD issued to students and the University Learn Server intra-net. These proforma have been worked up over years and give students a structure for both long and short term planning which has been shown to work effectively. The final guide is Further Professional Studies (FPS) which guides students through issues of the broader role of the teacher. This includes pastoral work and the workings of the school as a whole.

An important principle of teaching trainee teachers is to provide a model: staff must lead by example. The professional year is taught by the two authors as Design and Technology specialists. Again, the OFSTED report gives the highest rating for the standard of staff planning and teaching. All work is thoroughly prepared and appropriately supported by visual aids, examples etc. Both staff use teaching files which are deliberately left out so that students may, if they wish, look at the folder and lesson plans during breaks. A number of important principles are followed:

- Students are quickly got into active learning sessions rather than being lectured to. Again this is a model of working with children.

- These active learning sessions are based on well-tested design and technological subject material building a portfolio of ideas for students to use iteratively on teaching practice.

- The portfolio of staff generated activities are, effectively, recipes which ‘work’. The students are shown that one approach to design and technological activity is one of analysis of existing solutions (the recipe) and then making it work better – often a better model than firstly identify a problem which is so often used in schools. Once the objective of the practical activity is achieved all students share a common experience. This can then be analysed in depth and the teaching and learning principles and subject knowledge identified. The group can then brainstorm out new ways of exploring the same points so helping prevent the techniques becoming fossilised.
• Showing students is not enough; they must actually put principles into practice if they are going to have the confidence to use them in schools. In practice this means that approaches to teaching design and technology are physically worked up (the ‘portfolio’), for example exemplar circuits for electronics.

• Information and Communications Technology (ICT) is used as an integral part of the year. All students selected are basically ICT literate but they need help to see how ICT can be employed within their teaching and, particularly, the subject of design and technology. Examples are used frequently within teaching by staff and specialist sessions also focus on this important area. Student assignments and teaching practice folios must show evidence of appropriate use of ICT.

Phase 1
After the two-week primary placement Phase 1 starts with two University-based induction weeks. Then, for four weeks, students attend their first school, in pairs, for two days per week and the University for three (serial practice). They then enter eight weeks of ‘block practice’ full time in the phase one school.

In the University Design and Technology work there are two main foci:

1. Teaching the principles and practice of planning, delivering, assessing and evaluating teaching and learning. Initially students are introduced to short term planning by delivering a series of five-minute demonstrations to peers. They are taught to analyse their own and other’s performance and iteratively improve: to develop the self-reflective practitioner. Eventually they move onto long term planning and, with the support of the first practice school, work up a scheme of work for a period of seven weeks for pupils in KS3. University based work is extended and developed, in parallel, in the serial school practice.

2. Approaches to teaching design and technology. A series of activities explore the nature of Design and Technology in schools. They, in conjunction with experience in the practice school, help the student to conduct an audit of their own skills and knowledge. The activities are ‘hands on’. This give students confidence and builds a portfolio of ideas to work with pupils. Students also learn to analyse these activities as learning experiences and practice extending and developing them to prevent fossilisation.

Students are placed in schools in pairs. Their timetable is about 60% is teaching and, of that 50% is in classes with the other student and a teacher/mentor, the other classes ‘solo’, but with the teacher. This is done to help them observe and analyse their own teaching as well as that of experienced practitioners. By having a colleague in the practice trainee’s get frequent and appropriate feedback while developing their own skills of self analysis.

The key focus for the first practice is KS3 (ages 11-14). Students are encouraged to have most, though not all, of their timetable within this stage and to practice basic procedures such as starting a lesson off, packing up, ‘stop and gather’ routines, giving short demonstrations etc. Emphasis is made on ensuring students can manage these procedures crisply. Students may base much of their work on the school’s schemes of work but must translate this into their own lesson and demonstration plans. Similarly they may use some of the school’s teaching materials and visual aids but must also work up exemplars of their own.

Students keep a detailed practice file in which all teaching planning and evaluation is logged. The file acts as a focussing instrument for the student and a point of reference for the school.
based mentor and the University staff when visiting. The file itself builds into a very valuable resource for the student in their subsequent teaching.

As indicated above, after four weeks of serial practice, working iteratively with the University, students start a block practice of eight weeks in that school. This enables them to focus on the full role of the teacher including supporting pastoral work, attending meeting, extra curricular work etc. By the end of this practice it is expected that students are able to handle whole classes on their own, though the majority of their work will still be with a teacher/mentor and fellow student. They will have mastered basic teaching and planning skills and have interpreted long term plans.

**Phase 2**
After successful completion of phase one there is one week within the University full time before the start of the second phase. Students are placed in a different school, ensuring the experiences are complementary. As before there is a four week serial practice, in this case followed by an eleven-week block practice. The serial days enable students to acclimatise and organise an appropriate timetable. The objective of this practice is to extend experience from phase 1. Sessions in the University take students further in terms of long term planning and approaches to teaching Design and Technology.

Within the second practice timetables have less paired and more ‘solo’ teaching where students work on their own with a teacher aiming to quickly take over those classes. Teachers are encouraged to offer feedback and steadily relinquish control to the student. Once confident the teacher usually withdraws for varying lengths of time so the student gains experience of whole-class management on their own. Nevertheless students are expected to do some paired teaching, continuing to develop skills of analysing each other’s work and offering feedback.

The focus of this phase and practice becomes GCSE, A level and GNVQ, ie ages 14-18, though students should also have some teaching with classes from 11-14. It is expected that students will mainly teach lessons in areas where their expertise is greatest, but they should also take some teaching in areas in which they need to develop expertise. For example a student may teach primarily resistant materials and graphics as their specialism, but they would be expected to do some technology work with younger pupils. It is also expected that students will spend some time on a planned series of lessons taking them into other areas of design and technology such as food or fabrics. Here the objective is to experience activity in these areas so they are better able to appreciate the contribution of these areas to design and technology as a whole. It is not to train them to teach these areas as specialists.

During this phase, like the first, students follow a teaching support guide for further professional studies work where they gain experience of pastoral work, staff meeting, parents evenings, planning and running school trips etc.

**Assessment**

The government, through its Teacher Training Agency (TTA) has laid down standards in Circular 04/98, which must be met by every trainee by the end of their course. The standards are set out, as competencies, under the four following headings:

A  Knowledge and understanding
B  Planning, teaching and class management
It is beyond the scope of this paper to describe the competence model because it is overly complex in that it contains over 60 competence statements. The full version may be found on the TTA's website (www.tta-teach.gov.uk). Evidence that the trainee has reached the required standards is by assessment of:

**Teaching Practice:** a. Observation of lessons undertaken by school mentors and University tutors. Each trainee is formally observed at least four times in the phase 1 school and 6 times in the phase 2 school. A proforma is used to make comments on quality of teaching and pupil response, attainment and progress. Strengths and targets are identified and, through written and verbal feedback, trainees are appraised of their progress.

b. An end of phase school report. Mentors and school co-ordinators comment on the trainee's progress for the four standards in Circular 04/98. Targets are identified for phase 2 or for the trainee's first year of teaching. The report also indicates the year groups taught and, for phase 1, a good/satisfactory/unsatisfactory grading, for phase 2 a pass/fail grade. An unsatisfactory grade for phase 1 results in the trainee being recommended not to continue with their training. A fail for phase 2 results in failure of the course.

**Main Method Assignments:** There are four assignments within the design and technology subject work. For the first, a diagnostic design brief, trainees design and make a hand-held puzzle using whatever materials they wish. They are required to produce a prototype and two A3 sheets showing their process of designing. These outcomes are shared with the group. The aim is to show that there is more than one method to realising a design. For example, trainees from an engineering background tend to use an approach that is very different from a textiles background. The pooled results act as an excellent focus for de-briefing the group on many issues relating to design and technology teaching.

For the second assignment, trainees produce a scheme of work with supporting lesson plans, assessment scheme and teaching materials for a Key Stage 3 design and technology project. The assignment is undertaken in collaboration with the school mentor using planning pro-forma provided by the University. The choice of topic is agreed between the mentor, the trainee and the University Tutor. The topic may be taught by the trainee during their phase 1 practice. The submission is assessed against a series of performance indicators (PIs) to produce a mark out of 100 (less than 40 indicates a fail mark). The assessment serves as an illustrative example to trainees of the use of PIs.

For the third assignment, which is University based, trainees work in teams to produce a scheme of work, supporting lesson plans and teaching materials to meet the requirements of a GCSE project (KS4). The assignment is done in teams because staff consider there are benefits when this is done in schools:
- improved cohesion of approach to the subject within a school department
- teachers learning from each other in terms of both pedagogy and subject knowledge
- more efficient in use of staff time and resources
This exercise is completed in four weeks, the output consisting of a scheme of work, exemplar output form pupils, visual aids, assessment and feedback schemes.

The final assignment is a personal development project (PDP), in the last four weeks of the course, allows trainees to address an area of the subject in which they still lack confidence.
By now most trainees have obtained their first appointment, and so they may use this time to produce teaching resources for an area which they will be teaching.

**Further Professional Studies (FPS)**
This strand of the course covers whole-school issues, such as Equal Opportunities and Personal Social and Health Education. Students are assessed on the quality and content of their FPS file, a report on two of the issues covered and a report of their two-week experience in a primary school (which they completed prior to starting University).

**Evaluation**

The trainees' response to all aspects of the course is continually monitored through a range of techniques, which includes:

- Questionnaires about their school placements. Their comments are used to monitor the quality of school support. Weak aspects of mentoring are identified as issues to be addressed for mentor development session, of which there are two a year. In extreme cases schools are 'rested'.
- Verbal feedback. Trainees are encouraged to provide feedback about the taught sessions. Suggestions for areas to be covered are incorporated to provide alternate sessions or discuss issues with individuals or small groups.

The course is evaluated by an External Examiner who meets all students and provides an annual report and by Ofsted as part of the three-year inspection cycle. Both have reported that the course has the highest standards nationally in the quality of its management and leadership, the training provided and the educational standards achieved.

**Summary**

The professional year at Loughborough is rigorous and has been shown to be the national leader in training teachers of Design and Technology. Key to this is careful selection, thorough teaching, a good relationship with partner schools and staff and trainees who are prepared to work very hard. The year produces good teachers for whom promotion has been shown to be rapid. The year has taken high calibre entrants and shown them how to analyse their work and to constantly review and re-new it. It is important that newly qualified teachers can ‘future proof’ the subject: we cannot afford to train teachers who can only handle one, externally imposed, model of teaching which becomes fossilised as has tended to happen in the past. The Design and Technology this year’s graduates teach in schools will not be same in five years time: Loughborough trained teachers of Design and Technology will be able to stay ‘on the edge’.

**References**

http://www.ofsted.gov.uk/inspect/index.htm