Teacher education for technological literacy: a Scottish perspective

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CURRICULUM DEVELOPMENT

Introduction
Two cohorts have completed the first two years of a new four-year degree course, B.Ed Design and Technology, at the University of Strathclyde. As the third cohort progresses, we consider progress to date and ask the question: does the course educate for technological literacy and provide our students with the capability to educate for technological literacy with

- perspective
- sensitivity
- creativity and
- confidence?

Scottish Consultative Council on the Curriculum, 1994, p.5,6)

When Jordanhill College of Education merged with University of Strathclyde in 1993, there was a timely opportunity to create a new degree in accordance with the 'Guidelines for Initial Teacher Training' issued by the Scottish Office Education Department (1993). National development and deliberations, together with feedback from schools and students, made it clear that certain changes were necessary in order to meet the needs of teachers who would be preparing our young people for the next millennium. This resulted in the B.Ed (Hons) Design and Technology.

Teacher education for a changing school curriculum
The most recent Scottish Office Education Department initiatives to affect technology teaching in Scotland are the National Guidelines for 5-14 Environmental Studies, 1993 and Higher Still: Opportunity for All, 1995. With 5-14 the umbrella title of Environmental Studies Framework Document brings together science, technology, information technology, health education and social subjects. The Higher Still programme, within technology departments, will have the collective title of Design, Engineering and Technology. This proposes changes to the upper secondary school with the merging of Craft and Design with Graphic Communication into Design Communication, offering an Advanced Higher level design-based subject with which pupils can access university. Thus

Technological Studies remains in a revised and extended form.

These initiatives serve to create a cohesive, progressive continuum for technology education as underpinned by the rationale developed by the Scottish Consultative Council on the Curriculum (SCCC) entitled 'A Framework for Technology Education in Scottish Schools: A paper for Consultation and Discussion' (1994). The framework discussed in the SCCC paper attempts to identify characteristics of appropriate and effective technology education, and encapsulate its overall aims, nature and value.

Implementation model
Addressing these issues and others, the B.Ed Design and Technology course capitalises on the resources of two nationally renowned centres of education by utilising the resources and teaching modules from the engineering, business and science faculties in addition to the more specific education studies. Although B.Ed Design and Technology students attend lectures along with other students, e.g. product design engineering, the course is mainly based in a purpose-built, self-contained unit within the Faculty of Education at the University of Strathclyde. The Division of Technology, Department of Maths, Science and Technological Education is equipped with workshop facilities similar to school, with manufacturing processes possible in wood, plastic, and metal; CNC lathes and milling machines; computer suites for CAD and CAG; literature, magazines and Internet resource base; design studios and graphics; computer control; and pneumatic, electronic and mechanical labs in addition to classroom accommodation.

Design permeates throughout. The engineering and technology classes provide knowledge and understanding which create a firm foundation of specific fundamental concepts which the students can transfer and apply to any design situation or context to enable a detailed analysis, a critical evaluation or the generation of design ideas. These inputs on engineering technologies are included in the initial two years of the degree programme.

The students' understanding of design is developed through a range of project-based design assignments supported by design tutors. These involve many practical modelling techniques for a wide variety of media, kits and materials, with processes and equipment which enable design ideas to be explored and communicated with increasing confidence.

In addition, each student will complete two industrial placements totalling six weeks over the third and fourth years. These placements will enhance the students' understanding of the made world and encourage them to make connections between design and technology in school and the world of work. A wide range of technologies and applications of a design philosophy must be evident and placements range from manufacturing to service industries. For example, students may be placed in Barr soft drinks, a fish farm in Skye or Highland Radio Scotland.

Balance and integration
The design and technology aspect of the course is balanced with education studies, through Managing and Teaching Learning & Assessment modules (MaTLA) and school placements of an increasing duration and intensity towards the final years. Over the four-year programme students will experience three schools and one associate primary school (for observation and teaching). Initially there is a series of one day visits to school, with the student returning for a four-week block in that school at the beginning of second year. In third and fourth year there are extended placements of 10-12 weeks, during which time they are responsible for devising, teaching and evaluating a 7-9 week programme of work in its entirety, in line with the school scheme of work. Most students and schools recognise the need for awareness and understanding of the primary sector and place the increased importance of the primary visits in direct relation to progression of the 5-14 National Guidelines.

Recruitment
Entry to B.Ed Design and Technology requires Scottish Highers, or equivalent, in English, Mathematics and Technological Studies or Physics.

The ages of the students on the course currently range from 18 to 50 years, with the average age currently at 29. Recruitment has brought together students from a diverse range of backgrounds – outdoor education, submariner, fire fighter and those direct from school.

Each applicant with appropriate qualifications is invited to interview. This permits an assessment to be made by a panel comprising the course lecturer and a practising teacher. The panel considers each interviewee on individual merit in relation to commitment, motivation and suitability for teaching design and technology.

Transferability: a way in
The course accommodates students who bring with them prior learning and industrial experience by permitting entry to second year and third year to those holding appropriate certificates. Students from other courses, e.g. electrical and electronic engineering and naval architecture, have also transferred successfully.

Direct entrants are required to attend a three-week bridging course in order to satisfy the legislative requirements of the General Teaching Council for Scotland and MaTLA1 (including school observation and teaching days), and introduce the aspects of the course which their prior learning has not adequately covered.

This has proved to be a popular route into the B.Ed Design and Technology. Each cohort to date has been supplemented by six direct entrants to second year, bringing with them experiences including the telecommunication industry, CNC operations and drawing offices.

Transferability: a way out
Recognising that students sometimes make inappropriate judgements regarding their personal compatibility with teaching, the experiences provided by modules from both engineering and education permit a greater degree of flexibility than could otherwise have been afforded. Therefore, transfer from B.Ed Design and Technology to certain engineering courses, e.g. B.Eng. (Product

CURRICULUM DEVELOPMENT

Design), with appropriate credit accumulation, is possible at the end of the first year and vice versa.

Gender issues

The new course also aims to encourage a greater recruitment of women into the teaching of technology – at present in Scotland 3.8% of the registered technology teaching force is female. Although statistics show an improvement in the gender imbalance, there is still much to be done to encourage more women to pursue a career in technology teaching.

Learning approaches: responsibilities

While technical, engineering problem-solving remains an integral aspect of the approach, the B.Ed Design and Technology involves a broader perspective of design centred activity. It is a course which emphasises that design and technology activity is an active study which encourages the application of knowledge, skills and understanding already acquired, whilst pushing the learner/designer to acquire the further knowledge, skills and understanding which a particular context and design problem demand.

To increase breadth, the students choose two electives each year. These are selected from a menu including, for example, forensic science, environmental awareness through photography, European studies, video production, animation, improve powers of communication, tourism, children in care, etc.

Technology education must have significant learning value. We must go beyond a checklist of skills and competences. This is a concept which often causes a great deal of concern in many teachers and students of technology. Although guidance is required to provide a cohesive scheme and a direction, it is not a subject that one can define and provide a definitive list of what must be learned or taught.

For each design project there is a range of solutions rather than one right answer. Students, therefore, are responsible for their own learning and professional development, through the application of skills and knowledge, reflection and exploration of issues. They must develop confidence in their own quality of thought and proposals.

Evaluation

At present we are using a range of evaluation mechanisms with students and schools which accommodate the students on teaching placements to identify the strengths and weaknesses of the course structure, content and approach. There are a number of 'teething' problems with all new initiatives and the B.Ed Design and Technology acknowledges it has had its share. We also recognise the qualitative nature of the evaluation exercise and this has revealed to us the varying student and school perceptions of what a course on design and technology education should entail.

Greater public awareness of the B.Ed Design and Technology programme would enable the public in general to have an increased understanding of the technological literacy that we are striving to provide for our schoolchildren, future teachers and future citizens. This may, in turn, help to attract applications from a broad range of appropriately qualified candidates who are committed to the development of others in a rapidly changing society.

The University of Strathclyde B.Ed Design and Technology course strives to prepare newly qualified design and technology teachers who have a firm grasp of the basic concepts and principles and have experienced a broad range of learning activities which has deepened their understanding of a technological society in the broadest educational sense. Technology education is an attitude not a checklist of competences!