

Setting the Scene

Towards the end of the 19th century technical subjects were introduced in a number of secondary schools in Scotland. Initially studies were confined to woodwork but by the 1930s many technical departments were also offering courses in technical drawing, applied mechanics and metalwork. Study of the philosophy behind these courses reveals some fluctuations in emphasis; in some periods stress was placed on activity, exploration and discovery. At other times the teaching of skills and craft processes were considered to be more important. Generally, though, there were long spells of stability and change, if any, was gradual.

In more recent times the accelerating rate of change of technological innovation appears to have made continuous change become the order of the day.

Curriculum Development in Scotland

In 1965 the Secretary of State for Scotland set up the Consultative Committee on the Curriculum (CCC) to provide him with specialist advice on all aspects of the primary and secondary school curriculum. The CCC in turn relies on a network of committees and curriculum development centres to advise it on specific subjects and to promote developments in particular subjects and areas of school education.

One of these specialist committees is the Scottish Central Committee on Technical Education which first met towards the end of 1973. Its remit is 'to keep under review all aspects of Curriculum in Technical Education, to indicate lines along which future developments should take place and, with the approval of the CCC to encourage, support and where necessary initiate developments in co-operation with other agencies'.

The Committee is serviced and all its development programmes administered by the Dundee Centre of the Scottish Curriculum Development Service.

Scotland with a population of less than 6 million and about 430 secondary schools appears to be a reasonable size for national (central) curriculum development initiatives.

Need for Change

In the late sixties Scotland was in the midst of a re-organisation of its secondary schools to a comprehensive system. This was not such a traumatic experience as it appears to have been south of the border because many Scottish schools had already been comprehensive for a long time. What was new was the introduction of mixed ability classes in S1 and S2, that is the first two years of secondary education. This meant that all boys, irrespective of ability, and, occasionally, girls too were entering Technical Education departments for the first time.

Most readers will appreciate that the handling and management of groups of pupils of a wide range of practical aptitude were always within the remit of technical department staff but seldom before were the staff asked to deal with pupils of such a

Technical Education in Scotland: A Course for Mixed Ability Pupils in the First Two Years of Secondary Schools

wide range of intellectual ability within the one class.

Thus there was a need for new teaching strategies linked to content which would provide challenging material for the gifted as well as interesting and demanding work which would give the less able child an opportunity to succeed. The Central Committee was conscious that any course which was to be provided must not only be a means to an end but also an end in itself because many children would end their connection with Technical Education at the end of S2. Content and activity provided would have to contribute to making the pupil acquire confidence in a technological environment.

National Working Party

The Central Committee set up a National Working Party (NWP) composed of some of its own members and a number of practising teachers, to promote the development of a new course for S1, S2 together with pupils' materials and teachers' guides.

During 1974 a questionnaire was sent to a stratified random sample of technical teachers throughout Scotland in an attempt to find out if there was a consensus about the need for change and the direction such change should take. The response was excellent and enabled the NWP:

- a) to develop a statement of the course objectives.
- b) to determine the variety of materials then in use in Scottish schools.
- c) to identify areas of work which needed stimulation
- d) to pinpoint attitudes which might signify a reluctance to change.

Analysis of the returns revealed that whatever course structure was adopted it would have to have the flexibility required to allow for environment, accommodation and time-tabling variations. It was also apparent that the consensus of informed opinion was in favour of a blend of practical skills with an imaginative, decision-making approach. The general objectives which the NWP developed for the course are set out in Appendix 1.

Presentation

The need for flexibility led the NWP to decide that the course should be in modular form. They were somewhat influenced in this decision by the success of the Australian Scientific Education Project (ASEP) materials and, perhaps more so, by the Scottish Integrated Science Project.

Module

The NWP defined a module as a package of learning material dealing with an identifiable area of work within the technical field (e.g. Technical Drawing or Craft and Design or Technology) and intended to be completed within sixteen to twenty hours.

Each module contains some, and sometimes all, of the following components: teachers' guide, work books, reference sheets, worksheets, assessment sheets, filmstrips, slides, OHP transparencies and audio tapes.

Each module is designed to contribute to a number of relevant course objectives and contains a statement of specific objectives, core learning material, extension learning material, suggestions for appropriate teaching methods and, usually, some form of assessment material.

The core material is designed for all pupils. It is intended to introduce pupils to learning experiences which will give them an opportunity to move towards achieving some of general course objectives. (Figure 1).

The extension material consists of activities which involve the manufacture of artefacts or provide opportunity for further experience. These activities are intended to:

- i) consolidate what has been learned in the core.
- ii) provide a variety of related experiences likely to appeal to individual interests.
- iii) develop various practical skills introduced in the core. (Figures 2 & 3).

They also allow teachers to pace the work of the module.

So in any module all pupils work on core material; from this individuals move on to appropriate extension(s) and then the class are brought back together to study further core material. (Figure 4).

In this example the extensions increase in difficulty from A to C but in some modules there are many more extensions which may be used, although extension A is always used with lower ability or poorer aptitude pupils.

The Course

Having agreed on the course objectives and the method of presentation the NWP conscious that the majority of teachers were seeking for a course which would blend the acquisition of skills with a decision-making or design approach, decided that the modules should be written on the following topics:

1. *Craft (Wood)*; *Craft (Metal)* and *Craft (Synthetics)*. These were to be subject-centred and the teacher would play the role of demonstrator/instructor showing and explaining how skills should be carried out. The pupil would have a say in the selection of the artefacts to be made.
2. *Integrated Craft*¹ (1 and 2); *Technical Drawing*¹ (1 and 2). These modules would encourage a blend of subject and child-centred approaches and a shift of the emphasis of the teaching from 'how' to 'why'.
3. *Technology* (1 and 2) and *Craft and Design*¹ (1 and 2). These adopt essentially a child-centred approach with the teacher involved as an initiator or in an advisory capacity and the pupils gain 'controlled' freedom.

Writers

The pattern of modules to be developed was established. In the belief that innovations are more likely to be implemented if teachers themselves played a part in the development it was decided that the writing should be done by teams of practising teachers. Four Regional Working Parties, each of about ten teachers, were set up and the various modules were allocated to them. This meant that more than fifty teachers were directly involved in writing and editing the materials.

Trials

The modules are being piloted in two first-year classes and two second-year classes in each of twenty schools throughout Scotland; schools from inner city areas and from island and rural communities; large schools and small schools; old schools and new schools. Thus a further fifty to sixty teachers are participating in the project. The twenty schools were selected by the NWP in consultation with the Local Authority Advisers.

Evaluation

At the time the first editions of some of the modules went into the trial schools a part-time evaluator was appointed and, later, as a consequence of an award of a research grant by the Scottish Education Department, a full-time research assistant was recruited.

As work on the project progressed, pre- and post-tests were devised for each module to assess the effectiveness of the learning material in helping pupils to achieve the cognitive objectives. The same

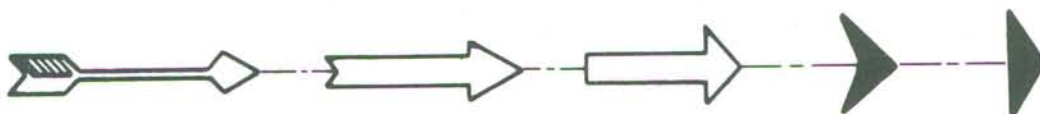
Figure 1

To be effective we should only include information which is necessary: the message may be lost if too much information is given.



What happens in class if everyone answers at once?

Simple pictures and shapes are recognised quickly and easily: - in fact, we learn to recognise the meaning of very simple shapes once we know about them.



Graphic Symbols and Signs

Graphic symbols and signs are used to form visual languages for all to understand. Wherever groups of people with different speaking and written languages meet communication can be assisted by use of symbols.

e.g. Chemist



Graphic formula

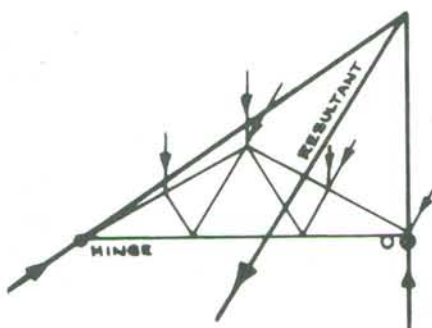


Pictorial diagram of the formula

Musician



Engineer



Tourist



studied the module and the results are analysed by computer. These tests are for purposes of evaluation only and are not, nor were they ever, intended to assess individuals or schools. The results, along with all the rest of the feedback, are used when writing the second editions of the module. If time and resources permit the intention is eventually to produce third editions of each.

To assess attitudes, and more important, to detect changes in the pupils' attitude, rating scales are used. These scales, a small portion is shown in Fig 5, are completed by the class teacher on a

number of occasions throughout the year and the changes they record are noted by Centre Staff. Criterion referenced tests, essentially check-lists, have also been drawn up and are being used to assess whether the relevant practical skills are being achieved. These involve observations of the pupil at work by either the class teacher or the evaluator who checks off on a list whether or not the pupil is demonstrating satisfactorily his mastery of the necessary sub-skills.

In addition to the evaluation instruments just mentioned a very large amount of information is

Figure 2

NAME	EVERYDAY MATERIALS	TECHNOLOGY 1	5
CLASS		C6 E.A. 1:1	

The articles shown below may be made up in part from stone, glass, ceramics or rubber or sometimes a combination of these.

Underneath each article write the name of the material or materials listed above which are used in the making of the articles.

CAR TYRE



Material:-

CUP AND SAUCER



Material:-

HOUSE WALLS



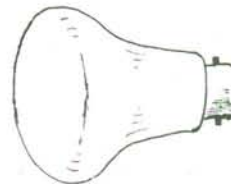
Material:-

SPECTACLES



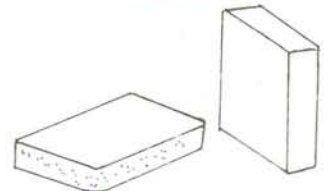
Material:-

ELECTRIC LIGHT BULB



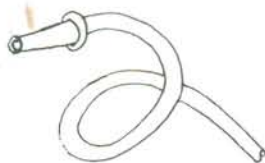
Material:-

FIRE BRICKS



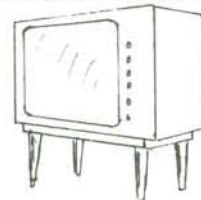
Material:-

GARDEN HOSE



Material:-

TELEVISION SET



Material:-

ROADS



Material:-

WINDOWS



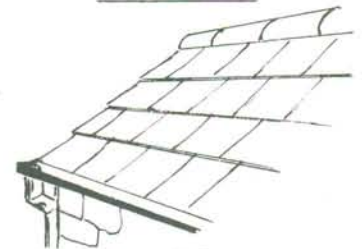
Material:-

ELASTIC BANDS



Material:-

ROOF SLATES



Material:-

collected by the Research Assistant through observation of classes at work, discussions with both pupils and staff and from the analysis of questionnaires which are filled in by pupils after they have completed the work on each module.

Cautious Optimism

Any truly innovatory project is likely to stimulate conflicts and, ultimately, its successful implementation depends on the strategy employed to overcome them. Once the original decisions had

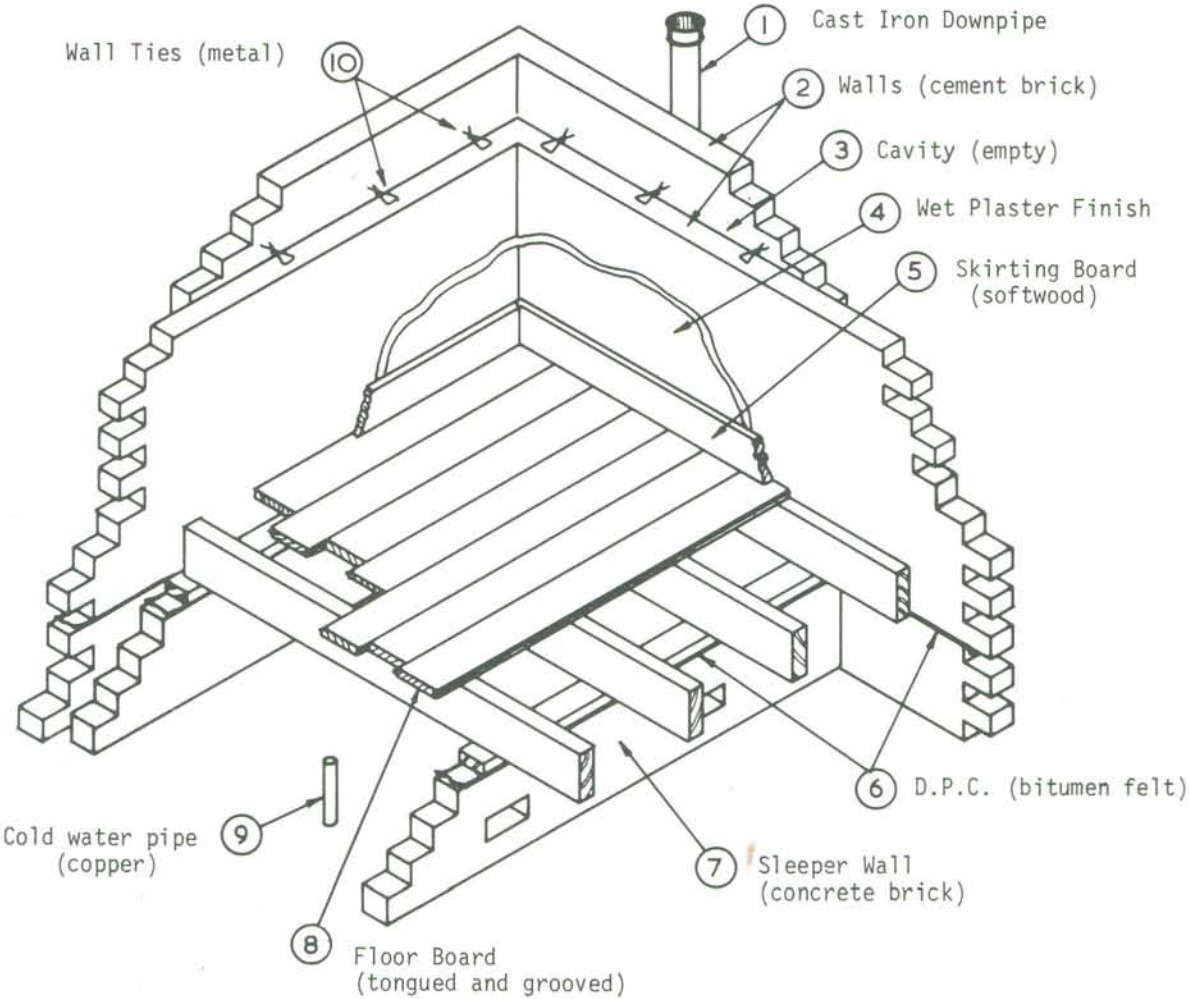
been taken by the Scottish Central Committee on Technical Education (on which teachers have the majority membership) the strategy employed had, and has, the following in-built features.

- The material is written and edited by teachers (approximately 50 are involved).
- The evaluation is formative with the views of staffs in the trial schools carefully considered at each stage and action taken (another 50+ teachers are thus involved).
- Technical Education Advisers to Regional

Figure 3

NAME	BUILDING ALTERNATIVES	TECHNOLOGY 1	5.
CLASS		C2 E.C. 1:1	

The drawing below shows the construction of a corner of a house. For each part numbered and named, suggest suitable alternative materials or processes. Write your answers in the table given.



ALTERNATIVE MATERIALS	
1.	6.
2.	7.
3.	8.
4.	9.
5.	10.

Education Authorities are holding local meetings to discuss features of the project.

d) Each college of education in Scotland which trains Technical Education teachers has a liaison lecturer who is kept fully briefed on developments so that he may acquaint his colleagues and pass information on to students.

e) There is an HMI on the National Working Party. His colleagues receive all material and keep a watching brief.

f) Details of developments are published in the Bulletin of the Dundee Centre each term and are therefore, at least in theory, available to every member of technical staff in the country.

g) To date the Assistant Director of the Centre has

addressed meetings of teachers and discussed the development in every Region in Scotland.

h) The course is in modular form so that it can be introduced in part.

i) The materials are designed so that elements of them can be combined with established practice.

j) The course can be adapted and the structure modified to suit individual environments.

k) As material is rewritten copies are sent to every secondary school in Scotland for information.

These tactics lead all those concerned to be cautiously optimistic at this stage.

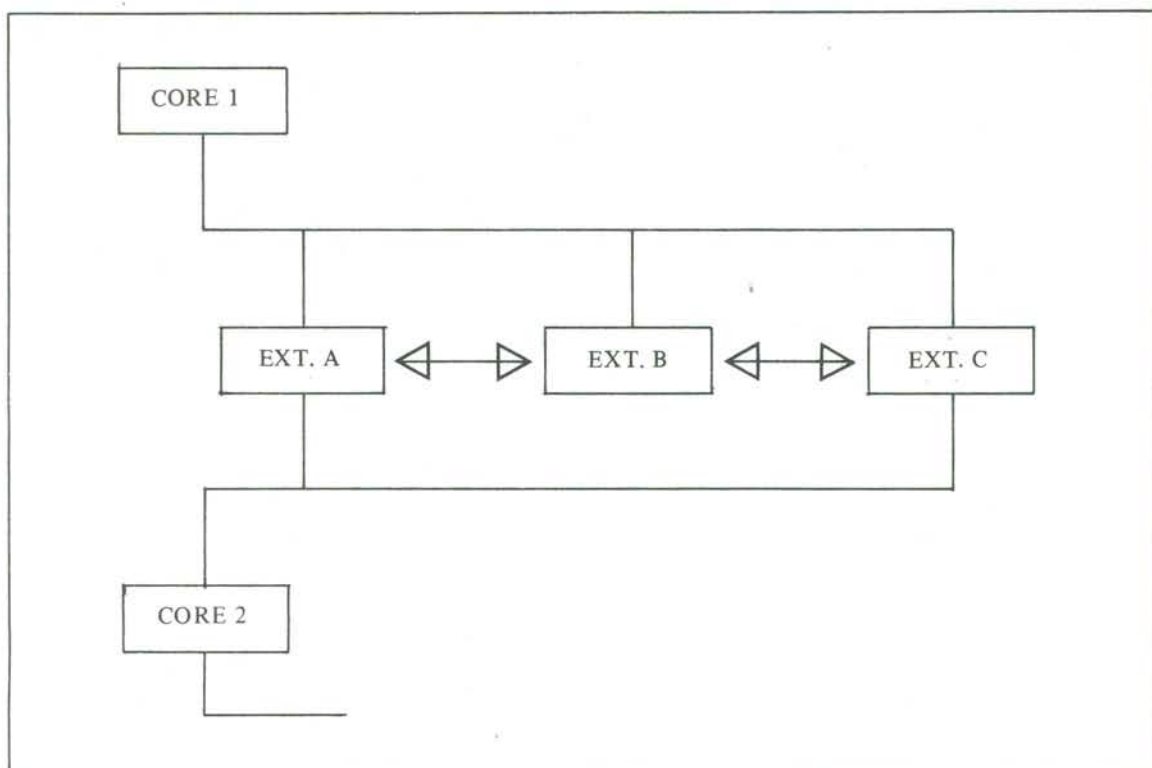
As has been implied earlier none of the material has yet reached the final stage of development and

Figure 5

[illegible]

as it has been printed in limited quantities, for use in the pilot schools only, copies of the modules are, unfortunately, not available for distribution. The project is due to be completed by June 1980.

Figure 4



Appendix 1

General Course Objectives

After exposure to a complete diet² of the modules the pupils should acquire:—

- 1) 'in knowledge and understanding'
 - a) a knowledge of the use of appropriate tools and instruments
 - b) an adequate technical vocabulary
 - c) an ability to communicate using this vocabulary
 - d) a comprehension of basic concepts of mechanics and mechanism.
 - e) an ability to select relevant knowledge and apply it to new situations
 - f) an ability to solve practical problems
 - g) a knowledge of materials; their use, suitability, cost, etc.
- 2) 'in attitudes'
 - h) and maintain, an interest in Technical Education
 - i) willingness to co-operate with others in the effective use of shared facilities
 - j) enjoyment in working with tools and materials
 - k) confidence and adaptability in a practical situation
 - l) an awareness of the inter-relationship of the different disciplines of technical education
 - m) an awareness of the relationship of technical education to other aspects of the curriculum
 - n) an awareness of the contribution of technical education to the economic, social and leisure life of the community
 - o) an appreciation of and respect for skill in self and others
 - p) an appreciation of the need for pre planning
 - q) in his work, and as a potential consumer, an appreciation of good design, sound construction and appropriate use of materials
 - r) a commitment to safety.
- 3) 'in practical skills'
 - s) some skills with hand and machine tools
 - t) an ability to handle tools, machines and materials safely.

References

1. The second of each of these modules are at present being written.
2. This means that the pupils have worked on at least eight modules over the two years.