

# A Modular O Level/CSE Course in Technology

## Introduction

Much has been said and written recently about increasing the technological awareness and literacy of the children leaving our secondary schools and Mr. Callaghan's Ruskin Speech about the core curriculum and the comments made by Sir Alex Smith, Chairman of the Schools Council at the launching of the Industry Project are but two examples. Several attempts have been made to remedy this apparent deficiency through such curriculum developments as Project Technology and the work of such agencies as the North West Technology group and the Engineering Science Development Unit at Loughborough. These developments have usually used one of the following patterns of introducing technology into the school curriculum.

1. Offering technology as a structured course as a choice subject in its own right, based in either the science, technical or craft departments (or a combination of these) and frequently taught on a team basis.
2. As part of a general studies programme.
3. As an enrichment of existing curriculum subjects, in particular science and craft.
4. As a unifying factor throughout the curriculum by several departments contributing to the development of a technological topic.
5. By introducing extensive project work.

The need for these different strategies is inherent in the nature of technological activity which is not a defined area of knowledge but rather a process drawing on man's knowledge and resources to improve the quality of human life. It is important therefore, that teachers who want to introduce technological activities into their schools' curriculum choose the right strategy. However, a wrong decision in this respect is not the only cause for the failure of technological resource material to have an impact on the school curriculum. Another cause is undoubtedly the fact that many resources have tended to be produced by national rather than local agencies and, as a consequence, teachers expected to use the material have not been involved in its production so that they tend to play a passive role in using the materials. Also local resources and community needs get largely if not entirely ignored.

Bearing these two factors in mind, meetings of Bath, Wiltshire, Somerset and Bristol teachers were called by Dr. Ray Page and Mr. John Poole, Liaison Officer of Avon's Science and Technology Centre early in 1974 to explore the role of technology in the school curriculum for schools in these areas. As a result of these meetings and a national conference held at Trent Polytechnic on October 26th 1974 entitled 'Courses in Technology to Age 16+' which was convened by the School Technology Forum's Working Party on Curriculum and Examinations, it was decided that if an impact was to be made on schools in the Bath, Bristol and surrounding areas, efforts must be concentrated on producing a structured CSE/'O' Level course on a modular basis

which viewed technology as a problem-solving process drawing on existing knowledge and resources rather than applied science or craft design (although these aspects would have a part to play). It was also decided that a major project should be included at the end of such a course.

Such a decision was not based on pragmatic reasons alone. Although it was argued strongly that the attraction of a structured modular CSE course was that it:

- (a) offered technology as an examinable subject, giving it status in the sight of headteachers, parents, local industry as well as with the pupils themselves,
- (b) made less demands on schools' resources and space than extended open-ended investigational and constructional project work,
- (c) did not demand teachers highly expert in anticipating problems and dealing with unpredictable problems at short notice.
- (d) worked within a framework in which difficult behaviour was more easy to control and was easy to timetable,
- (e) allows individual modules to be used in existing science, craft or design courses to give them a technological flavour,

it was also argued that:

- (a) it is important for pupils to learn about technology rather than just behaving as technologists.
- (b) for many pupils the demands of project work are beyond them in terms of self confidence and the necessary craft and self-study skills,
- (c) structured courses can help those pupils progress that in more open-ended situations see themselves as failures,
- (d) placed in both the 'science' and 'craft' option bands at 'O' level and CSE, it can enrich the studies of pupils taking the separate sciences and keep a relevant design/craft element in their curriculum, while for those pupils tending to opt out of pure science courses, it can keep an element of science in their curriculum relevant to their technical/craft/design studies.

With a major project included at the end of the course most of the gains argued for constructional and investigational projects are accrued as well, namely:



- (a) teachers and pupils working alongside one another as co-learners,
- (b) pupils experience the technological process for themselves,
- (c) decision making skills are developed and the use of knowledge rather than its acquisition is emphasised,
- (d) cognitive, affective and psychomotor skills are integrated in the problem solving process,
- (e) pupils work at their own pace and within their abilities and are more intrinsically motivated.

#### Structure, organisation and development of the modular course

Obviously there are several ways of designing a five-term modular course in technology at CSE/'O' level and the first problem the group of teachers in the Bath, Bristol and surrounding areas had to solve, who had committed themselves to development work as a result of the 1974 meeting, was how they were going to put the package together. The final decision was that examples of the knowledge, resources and process of technology must be specifically taught as three central modules (the common core) backed up in the second year by two optional modules and a major but well-defined project. The common core modules chosen for development were Energy; Material Science; and Problem-solving, Communication and Society. With each module

lasting approximately ten weeks the overall pattern is diagrammatically represented in Figure 1.

The decision was also taken that since technology does not have a natural base in the school curriculum that science, craft or technical departments (or any combination of these) should be able to offer the course and that the modules should be developed by curriculum groups of teachers from such departments led by a group leader with additional help provided by interested parties from FE and Industry. From mid 1974 working groups have been meeting fortnightly to develop the necessary modules and some 60 teachers have been involved.

Apart from establishing the groups, it was quickly realised by the co-ordinators of the development that there were other matters that needed attention. For example, money would be needed to develop resources and technical/secretarial assistance to produce necessary resources. Also the co-ordinators did not want the group leaders to go on working on the development of resources and the editing of worksheets and teachers guides as a 'spare time' activity. As a consequence an approach was made to the Schools Council in 1975 for financial support to develop resources and to second the group leaders half a day a week or a day a fortnight to the project.

Through the co-ordinators involvement at national level with others working in this field, contact was established with a similar development

### AVON/BATH MODULAR COURSE SYSTEM

#### YEAR ONE: 4th FORM

#### Project titles decided

ENERGY MODULE	MATERIAL SCIENCE MODULE	PROBLEM SOLVING & COMMUNICATIONS MODULE	6/10 FIRST OPTIONAL MODULE
CHRISTMAS TERM 15 weeks	EASTER TERM 12 weeks	SUMMER TERM 11 weeks	
38 WEEKS			

#### YEAR TWO: 5th FORM

5/10 FIRST OPTIONAL MODULE	SECOND OPTIONAL MODULE	MAJOR PROJECT	R E V I S I O N	E X A M S
CHRISTMAS TERM 15 weeks	SPRING TERM 12 weeks	SUM. CSE TERM 11 weeks		
38 WEEKS				



in Hertfordshire/West of London led by Mr. Roy Pickup and Mr. Michael Ives as well as with the School Technology Forum's Working Party on Curriculum and Examinations. At the Round I stage therefore three linked proposals were considered by the Schools Council Programme committee at its meeting on March 25th 1975, which involved all three parties — Avon/Bath University, Hertfordshire/West of London and the School Technology Forum through the National Centre for School Technology. The committee decided that the Hertfordshire/West of London and Avon/Bath University Projects should go forward for consideration at Round II after further development had taken place. When considering this further development the CAST committee of the Schools Council became aware of a certain amount of overlap and at its meeting on May 6th 1975 suggested that the two projects should seek ways of reducing this overlap so that the Round II proposal would constitute a combined scheme rather than two separate developments. The ensuing collaboration bore fruit and the joint proposal cleared Steering Committee B, Steering Committee C and the Programme Committee during the month of March 1976.

The joint proposal allowed the Avon/Bath University and the Hertfordshire/West of London developments to adhere to their original frameworks while at the same time allowing the modules produced by the two developments to be interchangeable. The Hertfordshire framework had been developed using three one term teaching units as a foundation for a 2½ term project in which *each* teaching unit endeavoured to give equal weighting to the knowledge, resources and process of technology as opposed to the common core approach of Avon/Bath University development.

Subsequently the two developments have worked together to produce modules which will complement but not overlap each other and common aims and format have been agreed and regular meetings of the four co-ordinators organised. Only in one area has overlap been necessary — that of electronics. However this has come about for practical reasons in the trial situation, although the approach is different in each case. Individual modules and courses based on the modules will be evaluated in local schools and this collaboration has meant that Avon/Bath University trial schools carrying out a full course have been able to select their optional modules from either the three being produced by Avon/Bath University groups or the eight being produced by Hertfordshire/West of London authors. Hertfordshire/West of London trial schools on the other hand will be able to select three modules from any of the thirteen modules being produced by the two developments with certain exclusions. For example, not all of the six Avon/Bath University Modules can be profitably extended from ten weeks to a term, and some of the Hertfordshire/West of London modules cannot be reduced to a ten week programme.

Although the work of co-ordinating the two developments has not been an easy task, it has been greatly helped by the early contact established by the co-ordinators of the two developments through the School Technology Forum's Working Party on Curriculum and Examinations. Thus the aims and objectives originally drawn up by Dr. Page and Mr. Poole for the Avon/Bath University development were accepted by the School Technology Conference held on October 26th 1974 with only minor alterations and they subsequently appeared in the Conference Report (STF Working Party No. 2: Exam material at 16+). As the Hertfordshire/West of London team was represented at that Conference and gave their endorsement to the papers presented it hasn't been difficult for these aims and objectives to become the common aims and objectives of the joint project.

During the period from when we made our first submission to the Schools Council in 1975 to September 1st 1976, when the Schools Council funding began, the Avon/Bath University curriculum groups continued to develop their modules, the common core groups to the point of producing the teaching framework for each of their modules. Courses were also started in schools based on this pilot work. In September 1975 one Avon school started a CSE Technology course which presented candidates for examination in June 1977 when 5 out of the 15 candidates, gained Grade I CSE. This was followed by 8 Avon and 1 Somerset school offering both an 'O' level and CSE course in 1976, and 12 Avon schools, 4 Wiltshire schools, 1 Gloucestershire, 1 Somerset and 1 Dorset school in 1977. The 1977 schools represent the full course 'trial' schools that are taking part in the summative evaluation discussed later.

### Aims and Objectives

It was realised very early on that it was necessary to establish the goals the development was going to try to achieve, and out of the discussions with the teachers who had expressed interest and commitment to the development, a framework of aims and objectives were drawn up. In this context, an aim was seen as a useful statement of overall intent, and the ensuing objectives as an attempt to define the aim in more specific terms with respect to the course content, the teaching approach, and the expected outcome as far as pupils' gain in knowledge, change in attitude, and skill development is concerned.

The technological process is in itself neither good nor bad, it is the use to which it is put that decides it. If our society is to develop humanely then we need to ensure that the technological process is put to good use. This argues a greater public awareness and literacy in technological matters.

Also to meet this country's and the world's need, the present manpower input into technological orientated careers must be improved in quality and quantity. This does not mean producing 'factory fodder' or a public willing to accept a 'high'



technology approach, but rather a public prepared to be concerned and involved in technological debate and young people willing to put their skills and abilities to use in a technological context, to develop and reform industrial progress. In the school context, it was felt that pupils should be made aware of the major technological problems that face mankind, that through technology they can serve mankind as fully as through any other avenues, and that technology can be as intellectually and emotionally satisfying as any other activity (providing it affects people of the right calibre). To achieve these ends the following aims were agreed:

#### Aims

##### Cognitive Aims

to develop intellectual ability in a technological context

##### Affective Aim

to create individual interest in, and awareness of the technological influence on society

##### Psychomotor Aim

to develop practical technological skills

It was then agreed that the following objectives would help achieve these goals.

#### General Objectives

##### Cognitive Objective

C1 to develop an understanding of a range of basic scientific principles related to

- (a) the structure and use of materials
- (b) the availability and use of energy resources

C2 to familiarise pupils with machines, instruments and processes

C3 to develop an adequate technological vocabulary and the ability to use it

C4. to develop practical ability and understanding of problem solving, design line and cost effectiveness (cost economically and cost sociologically)

C5 to develop an understanding of the culture of technology by understanding

- (a) its multi-disciplinary nature
- (b) how it differs from scientific investigation/craft work

##### Affective Objectives

A1 to stimulate and motivate pupils by creating an attitude of inquiry into aspects of technology

A2 to develop individual co-operation through team work

- (a) between pupils
- (b) between the school and the community

A3 to develop an awareness of the impact of technology at

- (a) a local level, by assessing the benefits and drawbacks of a 'local problem'

(b) a world-wide level by the use of TV programmes, films, tapes, etc.

A4 to develop an awareness of safety factors

A5 to appreciate that technology and industry are poverty reducing agents that provide the wealth, that *if used properly*, provide food, clothing, heat and shelter on a world basis

#### Psychomotor Objectives

P1 to develop the ability to use hand tools and efficiently perform associated operations

P2 to develop the ability to use machines properly for their various functions

P3 to develop the ability to use simple instrumentation.

Group leaders were then given the task of using these general objectives (or intermediate aims) to define specific objectives for their modules. Obviously the common core modules together had to cover all the objectives, whereas the optional modules had only to cover some of them (see Figure 2). The project is seen as consolidating the work of all the modules.

Also as Figure 3 tries to illustrate, we would not see the module objectives as fully fledged behavioural objectives, defining the exact behavioural outcome in terms of performance and conditions.

#### Content and Teaching Approach

Each module lasts 10 weeks with four 35 minute periods per week, giving a total time of 24 hours. The modules available are listed in Figure 4.

A structured course automatically defines a less open-ended teaching approach than say extended project work does. However, we would hope that a variety of teaching styles will be used depending on a particular teacher's experience and preference. Certainly the technological process has convergent and divergent elements in it and this in itself suggests that a didactic teaching style alone will not achieve the aims of the course. The teaching of 'very basic elementary knowledge' followed by problem-solving briefs and mini-projects will form the typical structure of the teaching programmes of each module.

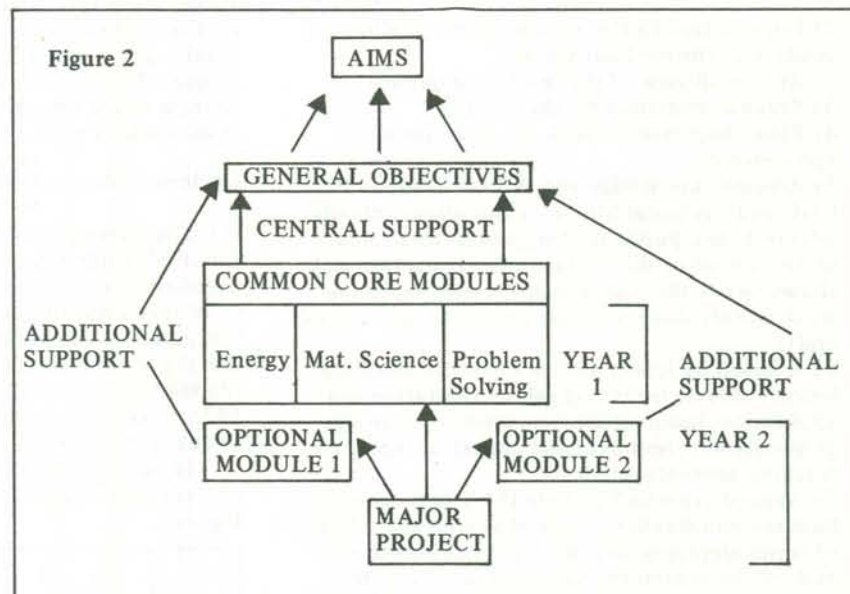
The modular approach also lends itself to team teaching but does not demand it and although the course will probably be taught to limited mixed ability groups (i.e. CSE Grade III and above and 'O' level pupils) it does not have to be and separate CSE and 'O' level groups can be run provided numbers justify two groups. As the development groups contain science and craft teachers we hope that no undue bias will be detected in the resource materials either. Certainly there are almost equal numbers of science, craft and joint science/craft departments teaching the course at present and if any bias exists it is towards craft (5 science, 9 craft/design/technical, 5 joint ventures). The modular approach also allows individual modules to be used in existing courses and some 8 schools in Avon, Wiltshire and Somerset are doing this.

Each module is supported by:  
 a pupil's reader (school would buy these in sets, i.e. one per pupil),  
 a pupil's activity package (bought in sets, i.e. one per pupil),  
 and a teacher's guide and resource book (for teachers' use, i.e. one copy only bought).

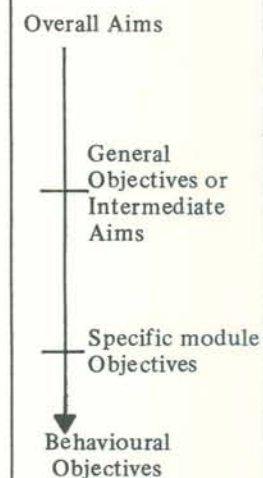
(a) *The Pupil's Reader*

This will be a supporting and background reader for pupil use, although it could be used by a teacher wishing to refresh his knowledge or even read round

the subject having limited previous knowledge. The text will be accompanied by diagrams, graphs, cartoons and photographs as appropriate. The group leaders are largely responsible for developing these readers. Certain sections will be written for only the able pupils to read and these will be suitably flagged. Key terms and definitions will be highlighted and home-based activities suggested. Self-assessment questions will also be included. We are being helped in keeping the reading level correct by Dr. Armitage, Senior Adviser for Science and Technology in Avon, who is spot checking the average reading age of these texts.

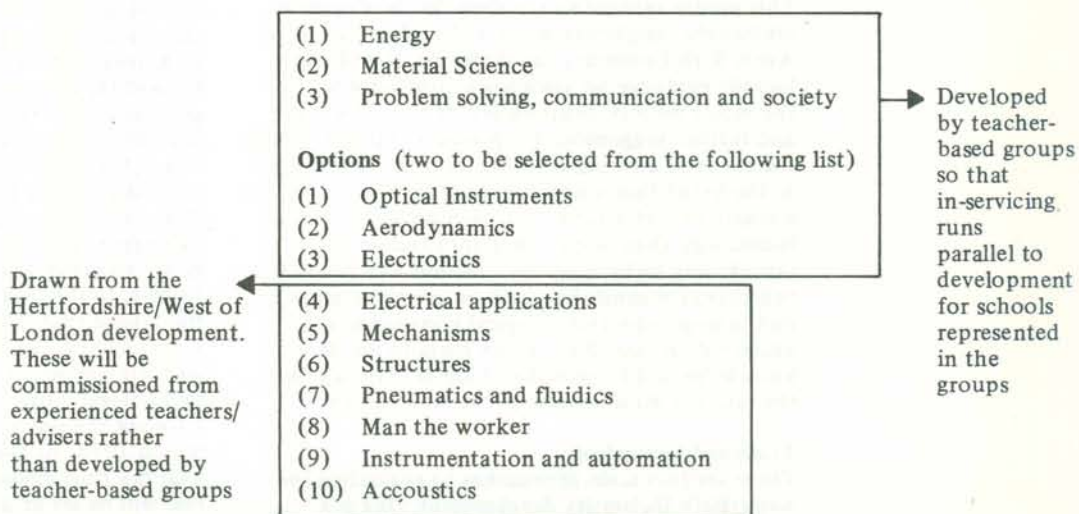


**Figure 3**



**Figure 4**

**Common Core (to be taken by all pupils)**





(b) *The Pupil Activity Package*

These packages will include practical activity cards which will be programmed sheets giving pupils' practical activities such as circuits to build, mini projects and small practical assignments for use in class as well as think-and-find-out cards for homework. They will also include project brief cards for use in the 5th year to motivate pupils who are choosing a final project to construct. These cards will give ideas for possible projects similar to Project Technology Briefs.

(c) *The Teacher's Handbook*

The teachers' handbook takes the following format:

- 1) Introduction to the module giving its ethos and position in the modular scheme
- 2) An overall view of the teaching approach
- 3) Specific objectives for the module
- 4) Flow chart inter-relating the principle ideas and concepts
- 5) Assumed knowledge and skills in Science, Maths, Craft and Technical Studies. (This allows schools who feel their pupils are deficient in some areas of knowledge or skill to take remedial action and shows clearly the course is not merely repeating work already done on other courses in science and craft).
- 6) A lesson by lesson outline under the headings: lesson content, technological interpretation and application, lesson objectives, teacher's activity, pupils activity, resources and apparatus, notes on teaching approach and level.
- 7) Appendices which include D-I-Y instructions for building non-standard items of equipment, addresses of firms supplying kits and other equipment (the bulk of the equipment used should already be available in schools), useful visual aids and films, diagrams for OHP reproduction, pupil and teacher reference books.

(d) *Teacher's manual*

This master manual will outline the development, philosophy, implementation and evaluation of the Avon/Bath University development. It will also include guidance on assessing course work with the major project, organisation of project work and further suggestions for projects that fall outside the scope of existing modules. A firm commitment to the belief that a structured course which includes a major project affords a more rounded view of technology than many other approaches to introducing technology into schools will pervade this master manual. For such an approach allows pupils to acquire technological knowledge and project skills, and then allows them to put this knowledge and these skills to use in experiencing the technological process in the major project.

**Trials and Evaluation**

There are two main approaches to evaluating the Avon/Bath University development. One is a consumer or formative evaluation and the other a summative evaluation backed up by some case

studies. In this sense the project is breaking new ground in that the production of resources and the evaluation of the development are running concurrently rather than consequently.

(a) *The formulative evaluation*

From the outset, teachers in the curriculum groups producing the modules, have tried out the resources and teaching outlines in their own schools.

In the first year of the School Council's funding (i.e. 1976-77) this practice was extended and consumer reports were sent in to module group leaders on a fortnightly basis. This year, schools not represented on the curriculum group have been added to the list of schools trialling individual modules. These are being used in a variety of ways within existing science, craft, design or technology courses. The report forms have also been streamlined for ease of use by asking for a structured response from teachers using the material.

e.g. lesson content

Difficult	About right	Easy
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(b) *The Summative Evaluation*

This evaluation will cover the two-year period necessary for a full modular 'O'/CSE level course to be taken and the 21 trials schools involved in this aspect of the evaluation began their course this September. As the Schools Council has only funded the project for the period September 1976-1978, it is hoped funds will be made available to complete the work.

The full trial schools will be involved in the experimental evaluation programme outlined in Figure 5.

E	O <sub>1</sub>	T	O <sub>2</sub>
C	O <sub>3</sub>	—	O <sub>4</sub>

Figure 5

where E represents the group receiving treatment (i.e. being taught the technology course), C represents the control group (i.e. pupils not being taught the technology course), O<sub>1</sub> and O<sub>3</sub> the same pre-tests, O<sub>2</sub> and O<sub>4</sub> the same post-tests and T the treatment given (i.e. the technology course). The gain of the experimental group (O<sub>2</sub> - O<sub>1</sub>) has its counterpart (O<sub>4</sub> - O<sub>3</sub>) in the control group, and if these gains are compared by their difference (O<sub>2</sub> - O<sub>1</sub>) - (O<sub>4</sub> - O<sub>3</sub>) it is reasonable to attribute the difference to the treatment the experimental group received which the control group did not receive. In the analysis of data collected from full course trial schools, any difference in pre-test scores will be examined to see if pupils' attitude and attainment influenced the decision to take the technology course. It is hoped an initial report covering the pre-testing will be available by March 1978. As the post-test period needs to be near the final examinations, the post cognitive test will be set at the end of the 2nd option in the traditional 'mock' period so that schools can use the results diagnostically. The post attitude test will



be set at the very beginning of the summer term, 3 to 4 weeks before CSE and 'O' level begin.

The control group in most cases will be the rest-of-the-year group, but in two cases schools have selected a similar size trial group to be the experimental group, matched for achievement using standard tests, and for socio-economic background.

Each full trial school has been provided with a teacher's handbook and a pupils' activity pack for each teacher involved in teaching the course. Readers are provided for all the pupils taking the course. Equipment can also be loaned from either Bath University Science and Technology Education Centre or Avon Science and Technology Centre, to supplement existing resources. This in part off-sets the inconvenience that schools are put to during the pre- and post-testing periods.

At present we are able to put the following equipment and resources on loan:

1. Energy Houses (5 held at each Centre)
2. Set of Energy Slides (3 sets available from each Centre)
3. Set of Materials Science Slides (3 sets held in each Centre)
4. Materials Science Hardness Testers (5 held in each Centre)
5. Materials Science Bubble Rafts (4 held in each Centre)
6. Electronics Analogues (4 held in each Centre)
7. Fischer-Technik Kits

This equipment has been developed and built in the required quantities by Mr. G. Carter, the technician attached to the project, in consultation with the group leader, with the exception of item 7. Additionally, trial schools may purchase at a discount price, a Materials Science kit (one pack per two pupils) at £1 an item from the Surplus Buying Agency, Richmond College Annexe, Station Road, Woodhouse, Sheffield, S13 7RD, together with five Electronics circuits which can be obtained from ESL Electronics Limited, Stover Road Trading Estate, Yate, Gloucestershire. Three sets of the five circuits cost £146.64.

#### **The Cognitive Test**

The cognitive test is divided into six sections and covers all the Avon/Bath University modules. Each section of the test is devoted to one module and contains about eight multiple choice items which have been selected to cover the content and objectives of the module concerned. Although the validated test has some 50 items, about 130 items were originally written so that a sufficient bank of items with acceptable discrimination and facility indices would be available for the final test.

Five schools were used to obtain the test statistics involving some 100 pupils. These pupils were all in pre-trial schools, i.e. schools taking the Avon/Bath University course from September 1976, and so they had completed the Common Core and one option in the majority of cases. This was felt to be the best point at which to validate the test, as in the evaluation programme it was going to be used

as a pre-test as well as a post-test for the whole modular course of five modules plus a major project.

This test will only be used with full course trial schools and therefore each school will only answer five of the six sections, namely, the Common Core sections and the options the school is taking. Some of our trial schools however are taking one Hertfordshire module as an option, and these schools will only answer four sections as it has not been possible to develop multiple choice items for the Hertfordshire modules to include in the cognitive test.

#### **The Attitude Test**

This test is being used by the Science and Technology Education Centre of Bath University in a wider context than just the evaluation programme of the Avon/Bath University Modular Courses in Technology development and space does not permit detailed discussion of it. Suffice it to say that the test has a satisfactory reliability (a necessary requisite for validity) and some construct validity. Factor analysis has indicated that the four sections of the test selected at face value by judges on a statistical basis for discrimination, have loaded separately without significant cross-reference on four factors. On top of this, a significant correlation has been found between the scores on this test and the 'technology component' of the option choices of some 100 fourteen-year-old pupils.

As this was not an enforced choice situation, it seems reasonable to suppose that the attitude towards technology of a pupil would influence the amount of technology he chooses to have in his curriculum. This again gives the test some construct validity, and even if the same result had been found for a more forced choice system it would not be unreasonable to suppose that a teacher's selection of the technological component in a pupil's programme would in some measure be influenced by the teacher's assessment of the pupil's attitude towards technology.

The four facets of an attitude towards technology that the test purports to assess are:

- (a) attitude to technology
- (b) attitude to technologists and their work
- (c) attitude towards a technical/technological job or career in industry
- (d) attitude towards technology in the school curriculum

#### **CSE/'O' Level Examinations**

The SUJB has accepted the course as a Mode I 'O' level while the SW CSE Board has for the time being accepted a Mode III group submission. The following assessment pattern has been adopted in both cases.

- (a) Main Project ... 20%
- (b) Course Work ... 40%
- (c) Examination ... 40%



(a) *Main Project:* 20 marks

This will be a vetted design and construction project of the student's own choice. A record in diary form clearly indicating the planning, diagrams, drawings, and the reasoning behind decisions taken together with self assessment of the project's success.

The award of marks will be:

Planning	2
Communication	4
Reasoning	4
Quality of solution	8
Evaluation	2
	20

with suitable criteria on which to award marks on a five point scale:

i.e. 8,6,4,2,0,: 4,3,2,1,0,: 2,1,5,1,0,5,0.

(b) *Course Work:* 40 marks

Allocation of 8 marks for each of five modules. Within each module candidates will be assessed as follows using a 5 point scale as in the project assessment.

Planning and Research	2
Communication	2
Reasoning and Evaluation	2
Quality of Solutions	2
Total/Module	8

(c) *Examination:* 40 marks

There will be two papers:

Paper 1, 24 marks – 2 hours duration based on the common core modules

Paper 2, 16 marks – 1½ hours duration based on the two optional modules

Paper 1 will consist of

- Compulsory short answer questions based on the need for simple recall, deduction, and elementary calculation,
- Longer structured questions with an either/or choice for each of the common core modules.

Paper 2 will consist of:

separate papers on each of the two selected modules; each paper will consist of compulsory short answer questions and longer structured questions containing an either/or choice.

**Dissemination and Future Developments**

Any success achieved by the Avon/Bath University development will be to a large extent due to the back-up facilities and help that the two Science and Technology Centres have been able to provide beyond that of merely producing the curriculum resources. If the development is extended by the Schools Council to a national programme, emphasis must be placed on the dissemination of the resources through similar Centres so that the same process which has seen the development of the existing resources may be repeated at those Centres. In other words, using the material that has been produced by

this development, these Centres collect groups of teachers together interested in developing a structured course in technology at 'O' level/CSE, with the object that these groups will alter and develop the material to suit their own local needs. Thus the pattern of parallel development and in-servicing is repeated and spread.

The development of resources alongside in-service training, which has been the modus operandi of the module groups, has proved to be very effective in getting the ethos of the development into the classroom.

The development is firmly teacher-based, with specialist expertise being brought in where necessary by the co-ordinators or the group leaders from industry and further education establishments. We are convinced that this regionally-based approach, which trains teachers as it develops materials, overcomes many of the barriers to curriculum change and dissemination that have been identified by such bodies as the Schools Council and the NFER. For example Shipman has identified five factors that influence the implementation of innovations. These are:

1. Clarity of an innovation to teachers.
2. Capability of teachers to implement innovations
3. Willingness of teachers to invest appropriate effort
4. The availability of necessary materials and equipment
5. Compatibility of organisation of school system

**Awareness of need for change**

Obviously in a local curriculum development based on teachers' workshops the need must have been expressed by the teachers that such a development was necessary. In the case of the Avon/Bath University technology department, this arose from the series of meetings that were held in 1974, which resulted in the formation of the module groups.

**Capability and willingness of teachers to promote change**

Using the development as an example of a local curriculum development, the workshop groups gave the necessary impetus to science and craft teachers to explore the 'technology needs' as far as their teaching was concerned which, supported by the input of advice from the co-ordinators, FE and HE, and industry, helped them over difficult periods to the point where they were willing to try out the ideas they had had in the school scene. In fact one school started a structured course in technology almost as soon as the first meetings had been held. This was followed by 9 schools a year later, and 21 schools at the beginning of this year.

**Resources to teach innovation**

On a local basis, it cannot be expected that schools can provide all the resources necessary, and at the present time Local Authorities also find themselves



rather hard-pushed on this score. Therefore it is essential to have additional funding to provide these resources and Centres from which these resources can be channelled into schools. With the current development, comment has already been made about the role played by the two Science and Technology Centres in this respect.

#### Compatibility with school system

Using the development again as an example, the need with respect to introducing technology into the school curriculum was assessed from the teachers' meetings that were held in 1974. From these meetings it emerged that the greatest need was for an 'O' level/CSE structured course in technology. By the time the project was funded in 1976, the co-ordinators had established that the SUJB Board would be prepared to examine at 'O' level and had had a Mode III CSE accepted by the South-West CSE Board. A slot had also been found for the course in the option choices as mentioned earlier.

Although the above comments suggest that the type of curriculum development described has several advantages over centralised national developments, this is not to argue that no central developments are needed. Certainly the evaluation programme would have been easier to develop if the test instruments had not had to be designed within the project, and it was fortuitous that the skills and expertise existed for this to take place. Here is a very necessary area for central development.

At several points in the development of material we have been concerned about the ability of pupils to understand the concepts involved, and it is unfortunate that the CSMS (Concept in Secondary Mathematics and Science) Project has only just begun its work. Nonetheless, this indicates another area in which only a centralised development is likely to succeed.

Therefore, from the experience of this particular development, it would seem that the best pattern of curriculum development is one in which central and local developments work together to enhance the advantages which they each separately possess.

Further details about this project may be obtained from either of the two co-ordinators at the following addresses:

Dr. R.L. Page, London Borough of Bromley,  
Education Department, Sunnymead, Bromley  
Lane, Chislehurst, Kent.

Mr. J.T. Poole, Liaison Officer, Avon Science and  
Technology Centre, New Kingsley Road,  
St. Philips, Bristol, BS2 0LT.

## LOUGHBOROUGH University of Technology

### DEPARTMENT OF CREATIVE DESIGN

Summer Exhibition      Thursday, June 8th  
   – Sunday June 11th

Craft, Design &      Saturday, June 10th  
Technology in      10.15 am – 4.15 pm  
Education

#### Speakers:

Victor Margrie      Secretary,  
                                 Crafts Advisory Service

Benedict Austen      Industrial Design  
                                 Education Officer,  
                                 Design Council

Professor M.J. French      Department of  
                                 Engineering,  
                                 Lancaster University

This day seminar will consider relationships between Craft, Design & Technology in Education. Each speaker has been associated with one of the recent publications 'New Directions in the Craft': 'Industrial Design Education in the United Kingdom'; 'Engineering Design Education'.

Exhibition invitations and seminar details from:

R.W. Millard,  
Department of Creative Design,  
Loughborough University of Technology,  
Loughborough, Leics., LE11 4YU.