ADVANCED LEVEL IN CRAFT, DESIGN AND TECHNOLOGY

The Movement towards Acceptability

BY

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ABSTRACT

ADVANCED LEVEL IN CRAFT, DESIGN AND TECHNOLOGY
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Craft, Design and Technology (CDT) is a relatively new curriculum area, which is emerging based on a sound educational philosophy and considerable political and industrial support. Its origins lie firmly in practical, craft-based work, but the new courses are based on designing and making with a notable technological component and have been accepted by educationalists as having undoubted value in educating children. As this new subject is emerging, its acceptance by Higher Education is frequently questioned. This study places the subject in context within the school curriculum, looking at its origins and the reason for its low social and academic status and discusses how the subject has emerged through curriculum development to a position of considerable support from politicians, educationalists and industrialists.

Following this analysis, the study looks closely at 'A' level CDT. There is an evaluation of the current position of numbers and syllabuses offered, which concludes that there is an urgent need for rationalisation of syllabuses, which could be created through agreement on criteria and a common core. Existing criteria for current Design 'A' levels are closely analysed and developed into new proposed criteria for the subject at 'A' level. The validity of the new criteria is tested against existing syllabuses with the conclusion that the changes required are less than might have been envisaged. A comparison is made of the proposed criteria for CDT with the criteria for other subjects, which clearly shows CDT compares most favourably. The final aspect of the study is a survey of offers from Higher Education which, despite its size, clearly shows the subject's acceptance as an entry requirement by Universities, Polytechnics and other Institutions of Higher Education. The survey shows that a CDT 'A' level provides opportunities for a wide range of careers and enhances the possibility of obtaining industrial sponsorship in Higher Education. The study concludes that 'A' level Design and Technology is now an acceptable subject for entry to Higher Education.

CHAPTER 1

INTRODUCTION

Craft, Design and Technology (CDT) is an area of the school curriculum which has grown rapidly during the last decade. Its success is a result of the development of new courses which are intellectually demanding, relevant and applied through designing and making. These courses create active learning situations and integrate knowledge and skills from a range of disciplines. However, the subject's origins and its association with low esteem subjects have tended to lower its status and hinder its acceptance by Higher education. Sir Alex Smith, former Chairman of Schools Council and Director of Manchester Polytechnic stated in his Stanley Lecture 1980 called 'A Coherent Set of Decisions':-

> 'The activities of designing and making should be regarded as being, at the fundamental stage, every bit as important as reading, writing and arithmetic, and at the more advanced stages, as important as literature, science and history. Every child in every school, every year should be involved in designing and making activity, on the grounds that, in its own right, it is a very valuable educational approach.'

Sir Alex's concern to express the need for recognition of the importance of designing and making to young people epitomises the problem confronting the acceptability of Craft, Design and Technology in the school curriculum. The secondary school curriculum is built upon a pyramid structure with 'A' levels at the peak influencing the remainder of the curriculum, especially for the more able children. The respectability of a subject greatly influences those who take part in such studies and by implication, the social status of not only that subject but also work outside school which may be associated with it. In the case of CDT, this can affect the manufacturing industry's recruitment upon which our society depends. This study has several purposes:- to understand the reasons for the social status, to identify the current position of 'A' levels, to provide a strategy to gain increased acceptability, to give confidence about current levels of actual acceptability and to cast aside several myths which have developed concerning this subject's acceptability at 'A' level. These points should help to show the move towards acceptability.

This introduction seeks briefly to place Craft, Design and Technology in the educational, political and social context, showing the conflicts, dilemma and lack of rationale in the acceptance of 'A' level Craft, Design and Technology (CDT).

The concept of learning by doing and, in particular, designing, making and evaluating artefacts or systems is fundamental to the teaching of CDT. Equally, this concept is fundamental to British Industry because without the flair, inventiveness and application of design activities, manufacturing industry will fail to compete effectively in world markets. An education system concerned with academic and personal development may be sound in a utopian world but one which undervalues or denigrates the introduction to those skills which provide the finance for such an education system, does so at its own peril. The view that applied skills are of less value than pure knowledge for able pupils has been the corner stone of education since the industrial revolution. The self taught inventors and industrialists of the eighteenth and nineteenth centuries eagerly sent their children to public schools where the curriculum bore no relationship to the industrial society in which they themselves earned their living. The class boundaries began to be formed not only on financial grounds but also on whether children had undertaken an academic or practical education. (Hidden Factors in Technological Change - SCSST - 1976). This view still remains today and it is only within the last decade that it has been seriously challenged.

It is important to note that it is not only within the last decade that educationally the problems have been recognised. Many reports and authors have described the problems including A N Whitehead (1917) in his book 'Aim of Education', which stated:-

> 'The life of Man is founded on technology, science, art and religion. All four are interconnected and issue from his total mentality.'

It is sad to reflect that almost seventy years on, in the middle of the technological revolution, the education system still has not fully accepted technology as an integral part of the curriculum in our schools. Professor Stonier and Professor Toffler suggest that we are moving towards the post-industrial society, which maybe known as the communication revolution, based upon a service economy. Such a prognosis could suggest a technological/industrial related curriculum would be irrelevant. However, both Stonier (Education 2000 Lecture 1983) and Toffler (The Ecospasm Report 1975) argue that although designers and makers will be a small part of society, they will undoubtedly need to be some of our most able citizens. Equally in order to live satisfactorily within such a society, knowledge of its basis needs to be understood. Thus it becomes imperative that current social attitudes must be changed if our service society is to be funded adequately. The reversal of current attitudes towards engineering was one of the principal themes of the Finniston Report (1980) entitled 'Engineering our Future':-

> 'Culturally, Britain lacks the "Third Culture" ....' (2.3)
>
> 'Engineering tends to be regarded as a subordinate branch of Science. This misleading tendency must be corrected by the education system.'

To enable changes in attitude within our society to be made, a range of initiatives has been established. The first has been to bring relevance to the school curriculum by involving education and industry in a dialogue; this has had significant influence on CDT. The second has been the development of computer and microelectronics education in schools, again in the application of devices and systems, CDT has a significant role to play. Thirdly, the Technical and Vocational Education Initiative has been established to initiate change in the traditional curriculum in a manner which is interventionist from the centre on a large scale. CDT is one of the subjects playing a significant role in such a development. The reason for this is that as a subject CDT seeks to integrate the practical and academic skills to provide a coherent, relevant learning situation. Thus its success in obtaining acceptability is fundamental to this country's attitude in the twenty-first century.

Having noted the role CDT can play in changing attitudes, it certainly should not be seen as totally the responsibility of CDT. CDT is merely one of the principal markers which may indicate in a subject-orientated secondary school curriculum the success or otherwise of the movement towards a more practical curriculum. This change can be seen with all the new GCSE syllabuses involving more practical coursework assessment.

In looking at CDT's move towards acceptability, several factors cannot be ignored. The subject is new and, as such, its level of attainment is varied throughout the country depending on the in-service teacher training and resources available. The subject's development has been rapid and diverse from the aesthetic to the almost scientific and only now is a consensus beginning to emerge. The consensus has been derived from the centre, based on individual elements of good practice. The common core activity of problem solving through designing and making, although educationally very sound, lacks rigour according to some in higher education (see Chapter 5) or to others it is an activity which cannot be undertaken by pupils in school. This was soundly refuted by Professor Black, School of Engineering, Bath University, in an article published in 'Hidden Factors in Technological Change (1976)', in which he states:-

'The enthusiastic response of, and the immense efforts put into their design work by our students confirms our belief that design is a challenge which is welcomed by the aspiring engineer and technologist, largely because it forces him to use all his knowledge, skill, flair and invention ..... There is no right or wrong answer so that the budding designer can, and often does, produce a better solution than the so called expert - but experience does help, so it is never too early to design, and learn by one's mistakes.'

At this early stage of development of the subject, it is essential that CDT is not caught in a 'Catch 22' situation whereby it cannot develop because it is not accepted by Higher Education and Higher Education will not accept it until it has established a sufficiently large number of entrants. Thus there is an urgent need to provide a clear identity, sound educational philosophy, sufficient reliability and the appropriate level of academic rigour to ensure academics and industry have confidence in its performance.

In carrying out this study, it was important to identify what an 'A' level is and to determine its purpose before looking at its level of acceptance. The Secondary School Examinations Council (1947) stated the following when establishing GCE 'A' levels as a replacement for the Higher School Certificate:-

Para 21(c) 'The Advanced papers shall be designed to provide a reasonable test in the subject for pupils who have taken it as a specialist subject for two years of 'Sixth Form' study .....'

'We recommend that a "Pass" at Advanced Level should approximate closely to what has been the "Pass" standard in the Higher School Certificate examination.'

Looking back at the 1914 Circular 849 'Examinations in Secondary Schools: Proposal of the Board of Education', which defined the standards for the group School Certificate in terms of individual subjects as follows:-

'The standard for a pass will be such as may be expected of pupils of reasonable industry and ordinary intelligence in an efficient secondary school. The form and not the pupil will be the unit for examination, and it is contemplated that a large proportion of the pupils in the form should be able to satisfy the test.'

The conclusion which can be drawn from such definitions is that their vagueness calls into question any statement that a subject is unacceptable. However, for those subjects deemed by tradition or personal prejudice as unacceptable, it is equally difficult to prove the case for CDT with such a loose definition. The concept of acceptance by convention is fine for traditional elements of education, but when a new subject evolves, judgements are often made in light of its origins rather than its content. In attempting to determine the acceptance of 'A' levels it is important to establish the purpose of 'A' levels. Firstly, it is to satisfy the needs of selectors, usually Universities, Polytechnics, Colleges of Higher Education, although employers do also use 'A' levels as a selector. Secondly, they provide a meaningful and worthwhile educational experience for pupils. The use of 'A' levels as a selector is a doubtful activity in its own right. In 1981 Rees, in analysing 'A' level, age and degree performances, concluded:-

> 'The 'A' level grades achieved by students were of little value in predicting degree performance.
>
> The conditional 'A' level method of selection is simply an administrative convenience to obtain the target number of students rather than a scientific method of selecting those students most likely to obtain good degrees.'

However, it is the level of acceptance attributed to a subject by some consensus or otherwise of academics which determines its acceptance. Thus although it is difficult to define an 'A' level and 'A' levels have little reliability in terms of forecasting the level of degrees obtained, acceptance remains a major obstacle in many people's eyes to the development of 'A' levels in CDT. Its educational value to young people appears accepted as relevant, self-motivating, and a means of integrating skills, knowledge and understanding, attitudes and values by Her Majesty's Inspectors of Schools and the Department of Education and Science. The central theme of problem solving according to the Hargreaves Report 1984, 'Improving Secondary Schools' ILEA, 'provides a balanced education in connecting the academic and the practical, the theoretical and applied'. Thus it can be concluded that CDT meets the educational purpose of an 'A' level but is in conflict with the selectorial purpose which in its own right is in something of a dilemma, being an ineffective predictor and basing its judgement on convention rather than on knowledge and understanding.

It is important to define acceptance for Higher Education more closely. There are two levels of acceptance, the first is concerned with general entry requirements and the second level is the course entry requirements. The modern CDT 'A' levels meet the general entry requirements of all Higher Education institutions. However, this is somewhat meaningless because it is the course entry requirements which matter to future students. This study is concerned with the movement towards acceptability of Design and Technology as one of three 'A' levels for Higher Education courses, as well as making the subject itself compatible with the needs of Higher Education. The CNAA policy statement 'Engineering First Degree Courses' states:-

3.4 'Because of the nature of the engineering profession, an engineering degree course should provide a technologically broad education, particularly in the early stages.'

3.6 'Engineering degree courses should give due consideration to the place and importance of design, manufacturing and marketing.'

3.7 'All engineering degree courses should provide an emphasis on engineering applications by, inter alia, covering the applications of engineering principles to the solution of potential problems based on engineering systems and processes (this aspect should be integrated into the academic curriculum) and an introduction to the fabrication and use of materials.'

The latter requirements are also essential requirements for modern CDT courses and this study will show that there is a level of acceptance by Higher Education of this valuable subject despite its origins, because of its sound development, political and educational support, its reliability in meeting a core and its favourable comparison with other acceptable 'A' levels. If this is achieved and the actual offers confirm its level of acceptance then the subject should be in a stronger position to refute press articles which show traditional academic elitism in reports such as the following quotation in the Daily Telegraph, 18 May 1985:-

> Headline 'Blacklist of A-Level for University Entrance'
>
> 'In general, sixthformers who want to get into university should steer clear of "unconventional" A-levels like computer science, electronics, design and technology, ...'
>
> 'Technical and vocational subjects, especially those involving a strong element of practical skill, have been virtually outlawed by the Universities.'

CHAPTER 2

ORIGINS OF CDT

In the introduction, the low social and academic status of this area of the curriculum has been stated as a reason for difficulty in gaining acceptability. Furthermore, as it becomes clear that 'A' level subjects are assessed more by convention than educational objectives, the origins which formulate conventions and attitudes must be understood. In this chapter the origins of the subject will be discussed and show the pressures and difficulties encountered.

As early as 1825, William Allen's School in Sussex offered a proportion of the timetable to manual work. This work was a combination of farmwork and rural crafts but gradually other crafts such as carpentry, blacksmithing, shoemaking and tailoring were introduced. These activities, however, were rare and most resulted from the work of philanthropists and children's societies and were available only to orphans or children who were at odds with the law. In 1837, B F Duppa in 'Industrial Schools for Peasantry' wrote that the objectives of one of these schools were:-

> 'to educate children destined for country pursuits in a manner to make them better workmen, and more intelligent and happier men, than is at present the case.'

This clearly shows at the earliest time the concept of the workmen in country pursuits undertaking such activities, but not for the more able young men. However, it is interesting to see that Duppa also saw the role of increasing the level of intelligence, sadly noting the loss of potential that was obviously taking place.

These activities were further accelerated in the 1840's with the growth of lawlessness. The pressure to increase activities which might be useful to pupils, thus giving relevance and hopefully, helping to control youngsters, clearly arose out of social unrest.

Some parallels can be drawn with the current levels of unemployment and the political pressures for developing more designing and making in our schools and colleges. However, there are today far more sound and fundamental reasons for political support (see Chapter 4) concerned with changing the national attitudes to wealth creation and the status of those involved in such pursuits.

Kay-Shuttleworth was a great believer in industrial training and, as the Secretary of the Committee of Education in 1852, his report by HMI's stated:-

' ... any education of the children of the labouring classes that is not accompanied by industrial training, and their actual employment in manual and useful labour, will entirely fail in checking the growth of crime.'

Thus by the mid 1850's it was becoming clear that education in practical activities was desirable, whether it was to correct moral habits or develop skills for industry can be debated; the value of such activities was beginning to emerge. The association with only the labouring classes was becoming more clearly identified and the distinct class orientation was developing.

The Great Exhibition of 1851 displayed British products in competition with those from the rest of Europe and it became apparent that Britain was losing its leadership in the industrial field. The Paris Exhibition of 1867 increased the pressure and one solution was seen to be the inclusion of more practical work in schools. It was assumed that by increasing the number of skilled workers, the economic performance would be improved. Here, more clearly, the parallels can be drawn with the 1970's and early 1980's, with reduced performance in our manufacturing industry and the political view that something should be done in our schools to improve the situation. However, little was done of real significance and perhaps here the parallels with today cease, because today, certain steps are being taken to redress the educational balance.

Some enlightened educationalists began to see practical activities as providing a liberal education. However, not until 1867 when Edward Thring became Headmaster of Uppingham School did any practical activities enter the education of the upper classes. Thring saw craftwork as recreational and a leisure activity, significantly however, he also saw it as the application and practical aspect of science.

It is interesting that for able youngsters, craftwork, even when taught as a practical aspect of science, was considered to be only a leisure activity. This shows even in the late nineteenth century, curriculum time was not easily available for the serious pursuit of practical activity in schools. Here, parallels with the 1960's and Project Technology can be drawn, when technology was introduced as a general studies activity in some schools; thus, although worthwhile, it was considered to lack the status which examination courses offered, and inadvertently to perpetuate the attitudes of able young people to technological activities.

As the country moved to the end of the nineteenth century the educational merits were slowly emerging with the demise of broad apprenticeship schemes and therefore less vocational pressure, but an increasing need to bridge school and work.

There were several significant stages in this development. One of the most important was when the London School Board, in 1882, reported taking the positive step of setting up a committee to 'consider and advise how far the Board could facilitate technical education or co-operate with those bodies that were carrying it on.' Part of this development saw an experiment at Beethoven Street school, which allowed boys to be given voluntary instruction in woodwork. This was a great success; however, the pressure from organisations such as the City and Guilds of London Institute which was very skills-orientated, tended to over-ride these developments. In 1884 the British Association for the Advancement of Science requested a special committee,

> 'to consider the desirableness of making representation to the Lords of the Committee of Her Majesty's Privy Council on Education in favour of aid being extended towards the fitting up of workshops in connection with elementary day schools or evening classes and the making of grants on the results of practical instruction in such workshops under suitable direction.'

Again this showed growing support, yet action remained limited. The London School Board's Special Committee reported in 1888 that it believed,

> ' ...it possible to improve the school curriculum by bringing manual work to the aid of the intellectual and thus to throw life into the formal and parrot-like instruction which now leaves so little impression on the children's minds.'

The parallels between this period and today can clearly be seen with the introduction of the Technical, Vocational and Educational Initiatives(TVEI) being imposed on the traditional academic curriculum at a time of very high youth unemployment and considerable technological change.

However, the success of such schemes will take time to assess; certainly they show a more constructive attempt to eradicate deep-rooted problems, than was tried in the 1890's. The skills, knowledge, process debate still surrounds educational discussion as it did in the 1890's. Whereas today the CDT area of the curriculum tries to encompass all three, one hundred years ago, the emphasis was merely on practical skills.

In Northern Europe in the late nineteenth century, educational craftwork was introduced and it was compulsory for all boys. The courses were in woodwork owing to the availability of wood and these schools became known as Sloyd. Saloman became inspector for Sloyd schools and in his book 'The Theory of Educational Sloyd' published in 1892 he states the aims of Sloyd to be:-

> 'It gives a taste for rough labour as distinguished from clerkly accomplishments, it cultivates manual dexterity, self-reliance, accuracy, carefulness, patience, perseverance, and especially does it train the faculty of attention and develop the powers of concentration.'

Saloman believed greatly in the work carried out being useful and pupil orientated, thus the use of skill exercises was roundly condemned. This is significantly close to the philosophies of modern CDT, but again the association was with rough labour, a simple way to reduce status and give it a class orientation. There was an attempt to introduce Sloyd into this country. This ranged from modification of existing practice to full implementation of the scheme, however, the conservatism and strength of the establishment lead to little real influence being made by this development and, in fact, Sloyd itself became over-structured eventually leading to little opportunity for any expression by the pupil. This factor is one which should not be lost upon us today, especially in the development of technologically orientated CDT courses, with the sophisticated equipment which could lead to a sterile equipment orientated curriculum, rather than a creative designing and making activity. It will also be interesting to see if the conservatism and strength of the academic establishment will be able to subdue the blossoming CDT development. Certainly, attempts have been made with the Northern Universities letter to all schools and colleges in 1979 (see Chapter 5 for further details). Thankfully, progress has been made since that rather condemning and unhelpful letter.

Thus Britain moved into the twentieth century with a few educationalists recognising the problems of education and the need for craft activities to take place in a child-centred manner, rather than the practice of 'manual training' which was totally skills-orientated. However, this did not run smoothly and, although movements could be identified, the following two quotes from the Board of Education's Memoranda on Teaching and Organisation in Secondary Schools and Manual Instruction in Secondary Schools for Boys, published in 1915 (Circular 891), give an indication of the position.

> Para 14 'Some teachers adopt a rigid scheme of work consisting of 'exercises' and 'models' drawn up on a definite plan with difficulties carefully graded and principles in logical sequence. Clear and definite instructions are provided at every step, and every pupil is required to follow these instructions precisely. In some ways the plan works well. At the end of the course certain definite aims are achieved; the pupil has learnt exactly how to use certain tools and to perform certain operations; all pupils have made the same things, and the periodical comparison of their models leads to healthy competition.'

> Para 19 'The weakness of such a plan lies in the small demand made upon the intellectual and inventive powers of the pupils. Virtually all the thinking is done by the teacher, and the boys do little more than carry out his precise directions. Many teachers, realising this, have adopted the alternative plan of allowing their pupils to suggest the common objectives to be made. They find it quite possible still to retain a satisfactory sequence, while giving freer play to the pupils' individuality. Collective instruction has thus in considerable measure given place to individual effort.'

So change was detected and reported and movement to craft and design, as opposed to pure craft, was beginning. However, many battles remained and still do, but this memorandum had the vision to see the place and relationship of manual instruction in the school curriculum. Para 29 states:-

> 'Manual instruction should not be regarded as an isolated subject of the curriculum, but should aim at definite association with such subjects as Science, Mathematics, Geography and Art. The Workshop should, in fact, be looked upon not only as a place where formal lessons are regularly given, but also as a place where a boy may carry out any constructive ideas in connection with problems arising out of his school or home life ...... The ordinary boy is full of constructive curiosity which only needs to be carefully stimulated, and it is surprising how much knowledge he will acquire if he is intelligently left alone in the workshop.'

Few teachers of CDT today could argue with such views expressed in 1915. Sadly, the last seventy years have not encouraged sufficiently this enlightened view. Even today, cross-curricular links are difficult to achieve owing to the isolated course approach to our curriculum.

As much as the sentiments expressed in Circular 891 may have been accepted, the teaching force remained ill-prepared and unconvinced, furthermore, the First World War had removed many able young teachers. Consequently, the results of this movement were not totally successful. At the beginning of the 1920's the term 'Constructive Handicraft' began to evolve; this included some experimentation with practical skills. Throughout the inter-war period Handicraft developed in a somewhat ad hoc manner. The Hadow Report recommended craftwork as an essential ingredient of the new modern school and the famous 'Millbank Scheme' was well publicised. This involved the interlinking of skills, knowledge and pupil participation. Just before the Second World War the Board of Education published its Handbook of Suggestions which placed emphasis on Design as the link between Art and Craft. This suggested link has merit today; many successful CDT departments have very close associations with Art and Design, although it would be fair to say that in other schools conflict is occurring.

The 1944 Education Act which raised the school leaving age and abolished elementary education, caused a serious re-think regarding what was taught to our children. It attempted to create a tripartite system with Grammar, Technical and Modern schools. This illustrates that significant improvements in status had been achieved as the technical schools were to be selective and provide a sound technical education. Sadly, these schools never made a significant impact, being totally overshadowed by the grammar schools and the social and academic pressure for technical education never materialised. In 1963 some nineteen years after the 1944 Act there were only 204 technical schools in existence and these were seen as second class to the grammar school, although the Act had not envisaged this role.

Some see the TVEI schemes of today as another route to re-establishing technical schools, although currently they are being developed alongside the academic. It is too early to determine whether this is the case, but it is significant that within two years of announcing the establishment of the TVEI schemes, there are more schools involved now than were involved in 1963, nineteen years after the official attempt to establish the technical schools under the 1944 Act.

The 1944 Education Act did, however, help the development of handicraft and significantly placed emphasis on introducing metalwork into schools. Previously, most schools that did craft concentrated purely on woodwork. Industry, however, noted that as a country with a large engineering wealth-creating industry with large labour shortages in technical skills, our schools must do some introductory training and encouragement. It may be significant, however, that the technical schools were given metalwork facilities and then other schools demanded parity. Therefore, the 1944 Act recognised and assisted the development of CDT but, at the same time, the opportunity was lost when the established grammar schools managed to impose their status over the system and consequently technical education failed to achieve parity of status in our society.

In 1951 'A' level examinations were undertaken for the first time. These followed on from the Higher School Certificate and examinations moved on from a certificate resulting from a collection of successfully completed subjects to certificates for each subject taken and passed. This allowed performance in woodwork, metalwork and technical drawing to be assessed individually. However, by 1955 there were only 123 'A' level candidates in woodwork, 17 in metalwork and 215 in engineering drawing compared with approximately 12,400 in mathematics. (Statistics from Examining Boards' data) The position of metalwork reflected both the lack of facilities and status. However, the Ministry of Education in 1952 was aware of the situation and it published a guidance booklet entitled 'Metalwork in the Secondary School'. This offered the following general aim:-

> 'Crafts are taught in schools to stimulate children's intellectual development, to give confidence born of accomplishment, to encourage discernment and promote good taste. Through creative experience in a variety of media a child can be led to distinguish and appreciate quality in craftmanship, and to value and enjoy beauty even in a sombre environment.'

The guidance notes went on to explain the educational value of solving problems through designing and making.

This was a most far-sighted document and in many ways was the start of the CDT movement. It certainly provided a stimulus for thinking handicraft teachers. Although written to support metalwork, when that subject was very much in its infancy, it was able to see the need to combine materials and introduce designing.

In 1959 the Crowther Report suggested Handicraft as an alternative route to knowledge, but indicated that the subject needed to increase its intellectual demands. It also recognised the problems of status of Handicraft and proposed that a new emphasis should be created for the subject in consultation with Examination Boards, employers and universities. The Crowther Report was in many ways the key to the re-thinking of what was taking place in Handicraft. The Report suggested that this area of the curriculum needed to increase its intellectual demands. This could have been devastating in removing handicraft; however, the leaders in the field did respond, although it could be said, rather slowly. During the last twenty years, the lack of intellectual demand has been a frequent accusation, which in some cases has been justified. Sadly, this image has been translated to all the subjects in the area. The recommendation that the subject should determine a new emphasis in consultation with Examination Boards, employers and universities, was well received. The significance of involving the employers was not lost and it is noticeable that these links have grown during the last twenty five years. The Schools Council Occasional Paper 'Craft, Design and Technology Links with Industry' published in 1980 is a good example of this working together and it is not without significance that the Engineering Employers' Federation Policy Statement on Education noted that CDT was the only subject which recorded consultation over the new GCSE 16+ criteria.

Thus after Crowther, Handicraft had to find an intellectual platform and until that was achieved its low status would not significantly improve. The value of creative manual activity was clearly recognised, Newson for instance in his report 'Half Our Future' in 1963 referred to Handicraft as offering, 'creative and civilising experiences beneficial to all pupils.'

The growth of 'A' level candidates continued in 1960 with 272 taking Woodwork, 163 metalwork and 951 Technical Drawing compared with 23,289 in Mathematics and by 1965, 555 were taking Woodwork, 534 Metalwork and 2622 Technical Drawing compared with 35,451 in Mathematics. These figures in percentage terms were large increases but remained insignificant compared with other acceptable 'A' level subjects.

The origins of CDT were clearly formed in the manual trades with the subsequent low social and academic status. The subject's potential was being recognised but up until the mid-sixties there was a lack of leadership and sense of direction. The academic criticism was justifiable, although there is little doubt that it could equally have been applied to other subjects as well. Of the three subject areas in CDT, Technical Drawing was the most acceptable, perhaps because it looked more academic, but none could claim a great deal of support. Thus to meet the needs of employers, universities, teachers and pupils, handicraft embarked upon an exciting and diverse series of curriculum developments to determine the subject's future identity and, hopefully, to improve the level of acceptability and participation. This curriculum development lead to a considerable upheaval for the whole handicraft/practical area of the curriculum, and this is detailed in Chapter 3.

CHAPTER 3

CONTEMPORARY DEVELOPMENTS IN CDT - THE SEARCH FOR IDENTITY AND ACCEPTABILITY

The contemporary developments in CDT over the last fifteen years began with wide ranging pressures from a variety of sources, all concerned with increasing academic acceptability and improving the social status of the subject area and associated areas in society. The educationalists wanted the courses to be more intellectually demanding; the industrialists wanted more relevance in the whole curriculum. The inclusion of technology was considered vital, together with an improved status of all subjects concerned with engineering. The progressive Handicraft teacher became dissatisfied with what he was offering pupils and his lowly status in the school common room as the comprehensive schools developed.

Up to the mid-sixties the subject area had developed with slight swings in direction, either to the 'free expression' or the pure skills approach. However, the emphasis was placed principally on high quality craftmanship. Educational philosophers had seen potential in this area of the curriculum, but very few had the insight on how to translate it into an educational experience for all pupils. The advent of the comprehensive school undoubtedly provided an awakening experience for handicraft teachers but the excellent new facilities that were provided did not result in the expected growth in pupil participation in the subject. From Table 1 it can be seen that the combined Woodwork, Metalwork and Technical Drawing 'A' level passes did not significantly increase over the six-year period whereas Mathematics did.

Table 1 GCE 'A' Level Passes (Source: Exam Board Statistics)

Year	Metal/Wood Passes	Engineering Drawing	Mathematics
1965	1089	2622	35451
1966	1161	2775	40772
1967	1174	2781	41412
1968	1287	2885	41005
1969	1304	2660	40724
1970	1184	2713	43469

This led teachers to recognise they could not attract 'A' level students owing to the outdated curriculum and syllabuses which lacked status. The introduction of the comprehensive school had raised considerable curriculum debate and teachers were being asked to justify their subject which many found difficult with the pure skill-based approach. However, the comprehensive school itself did not help. It had to fight for acceptance in society and to achieve this, it chose to reproduce a grammar school curriculum for as many pupils as it possibly could. Handicrafts and technical subjects were given lower status in these schools, in the attempt to prove that the comprehensive school was as good as the grammar had been. New developments at sixth form level were principally through general studies and from this, some token of respectability was achieved, but no national movement to develop new 'A' levels was taking place. However, the enlightened teachers and administrators began to react and as they did so, several other initiatives arose.

G T Page in his report commissioned by the Institute of Mechanical Engineers 'Engineering Among the Schools' (1965) discovered many interesting facets, several of which are sadly still true today. Page observed schools carefully place subjects in compartments and the amount of interdisciplinary work was very small, thus subjects which integrated fields were at a disadvantage. The report found teachers turning towards Technology for good educational reasons and to increase the relevance of the changing society to pupils. Although a significant number of teachers believed in this appropriate strategy, few of the brightest pupils undertook such work. The Page report also condemned the Examination Boards for political wrangling over developing new syllabuses, but recognised there had been insufficient research carried out to determine relevant strategies for the future. However, it is significant that Page found a range of design and technology in schools, but it had no structure and there was a clear need for more technology. At that time, D. I. R. Porter HMI was carrying out research into technology in schools and in Curriculum Bulletin 2, entitled 'A School Approach to Technology' he published arguments supporting the case for correcting the balance between academic and practical elements in the secondary school curriculum and showed how technology could meet the needs of society as well as stretching able pupils. These and other pressures aided the establishment, under the aegis of Schools Council, of a pilot project in applied science and technology which was later changed to 'Project Technology'. This project began in 1966 and ran until 1972 when the National Centre for School Technology was established to aid the development of this work.

Project Technology undoubtedly made a significant contribution to the establishment of craft, design and technology in the school curriculum. The project set out to:-

> 'help all children to get to grips with technology as a major influence in society and, as a result, to help them lead effective and satisfying lives.'

This project had many difficulties including finance and a lack of understanding. Criticisms ranged from accusations that it was elitist, only providing material for able sixth forms, to heavy criticism from craft teachers that projects were either purely kit-orientated or that the construction (craftmanship) was very weak. Some of these were justifiable but few could doubt that this project did not stimulate discussion in a significant way. In 1968, Schools Council Working Paper 18 identified four manpower needs which supported the need for curriculum change and thus supported the project. Firstly, there were insufficient able children choosing scientific and technological careers. Secondly, there was an inadequate supply of skilled technicians. Thirdly, administrators and managers failed to have sufficient technical and scientific understanding and fourthly, the working population needed to be able to learn new skills as older ones became obsolete with advances in science and technology. The relevance of these four points today is even greater than it was in 1968. The evaluators report on Project Technology displayed considerable criticism, but its influence can now clearly be seen. The definition of Technology established in those early days remains relevant today:- 'Technology is the purposeful application of man's knowledge of materials, sources of energy and natural phenomena.' (Project Technology 1968)

The project also established the concept of 'the process of technology', which was essentially seen as a problem-solving activity. The following model produced by the team indicates the inter-relationship between technology and other curricular areas. (Fig 1)

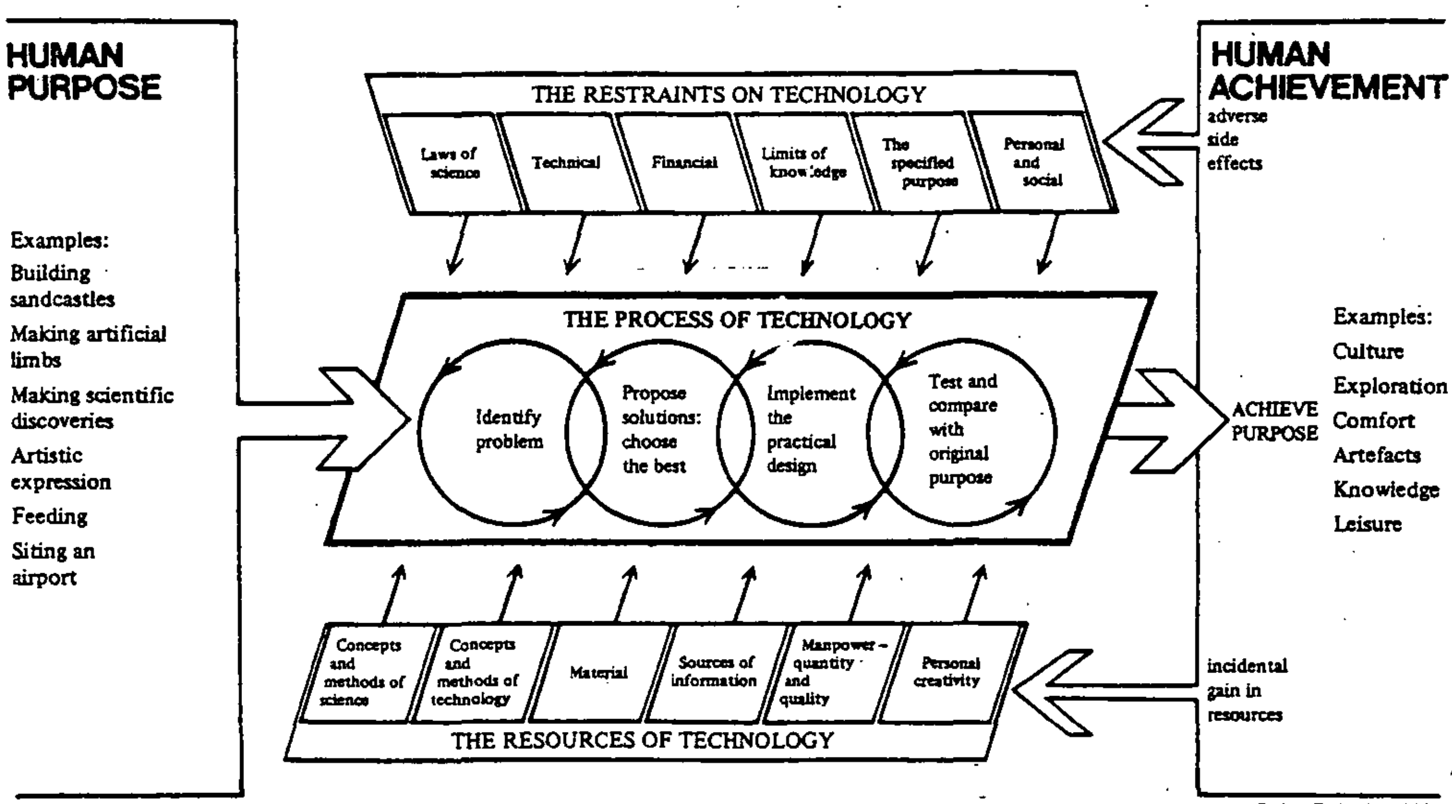


Fig 1

The relevance of technology as a problem-solving activity cannot be undervalued because this has aided its natural link with other aspects of the practical curriculum in our schools, and prevented technology merely being another scientific discipline. Equally significant was the fact that it provided a route to important high-order educational objectives, and, consequently, went some way to meeting those seeking a more intellectually demanding subject. The emphasis on cross-curricular activity was theoretically correct, but sadly also provided major difficulties for such a project in terms of whom to aim the material towards. The conservatism of the secondary school curriculum lead to little significant integration in the majority of schools, although it undoubtedly did arouse interest in technology. The project also helped disseminate good practice in Technology and thus it published the excellent work of Fox and Marshall at Danum Grammar School, Doncaster and assisted in developing material for such courses. The course called Control Technology grew throughout the 1970's but only in a few local authorities was it being promoted as a new course in Technical Studies Departments. Much of the work was kit-orientated, and little use in manipulating resistant materials was called for. Many saw this course as science rather than CDT-orientated and again, although it met the demands of many enthusiastic and progressive teachers, its relative lack of open creativity prevented its widespread use.

Project Technology was significant in the development of CDT by leading to the development of the National Centre for School Technology and the establishment of Science and Technology Regional Organisations (SATRO). Furthermore, it showed that new courses in technology could be developed and that extensive in-service provision was needed to be aimed at specific target groups. This need which now has been recognised, is being satisfied by LEAs and British Schools Technology. The significance of the establishment of the National Centre for School Technology and, more importantly, the formation of British Schools Technology, may well be crucial for 'A' level development in Design and Technology, as it could provide a focus for future developments. There is now a national vehicle for improving the quality of 'A' level Design and Technology teaching in this country, which should, if implemented correctly, create a significant improvement in status.

In 1968 another Schools Council Project was established at Keele University under Professor John Eggleston and this was called Design and Craft Education Project. This followed a feasibility study initiated by Schools Council resulting from pressure in areas such as Leicestershire. This project looked at the factors that stimulated new developments in the materials subjects and examined the role these developments had to play in education in a changing society. The project paid considerable attention to examination and assessment, and provided some excellent resource materials.

Although this project clearly placed emphasis on the use of materials and was much more aesthetically inclined, it did identify very clearly, the core activity of the subject as being problem solving. Its model (Fig 2) has a central theme almost identical to the Project Technology model:-

A design process

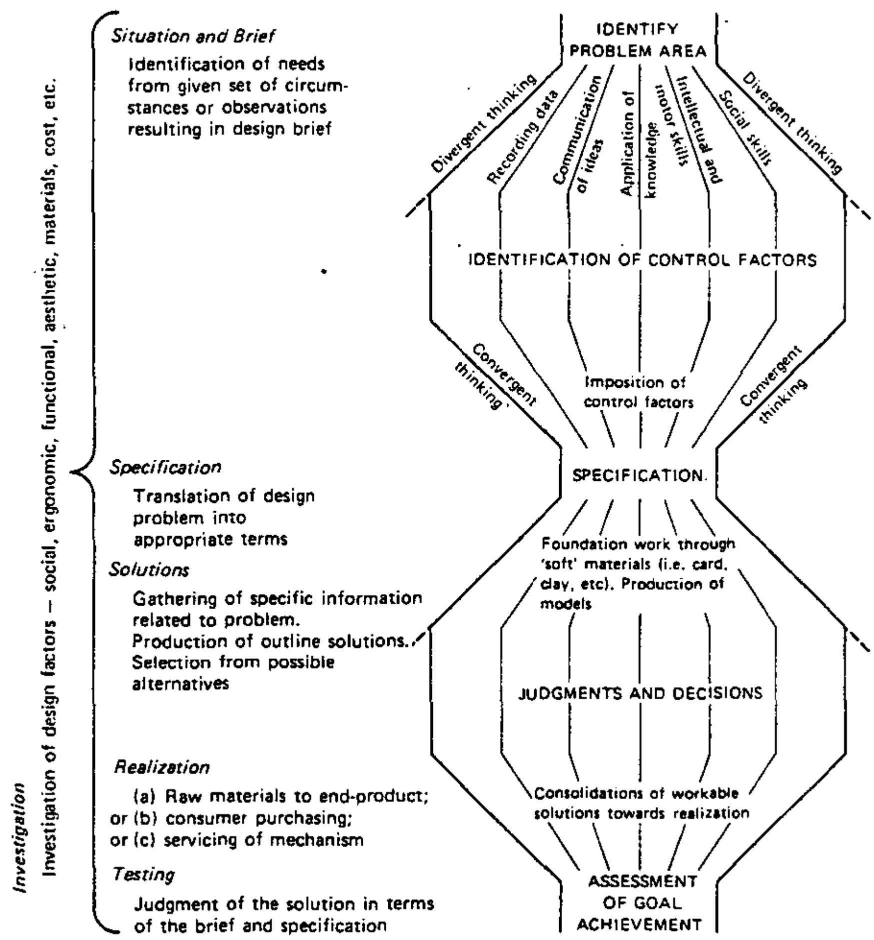


Fig 2

However, the Design and Craft Project never truly reached its potential. It was considerably under-funded and, as with Project Technology, took a very broad approach to the subject; therefore with its small staff, it never really came to terms with specific help for Handicraft/Technical Studies teachers.

In 1968, therefore, and for the next four years, Schools Council had two projects with the same central theme of problem solving, one relating to Design and Craft and the other to Technology. The two projects tended to polarise progressive views into two camps and while this took place many teachers continued to operate in their traditional mode. These projects did provide the divergent thought necessary for building a new subject area; however their evaluation was relatively poor.

For every teacher who became committed, there was certainly the same number who dabbled and became disillusioned because of lack of support or understanding; thus considerable damage was done. In 1975 Malcolm Deere in his RCA lecture classified the projects as an expensive failure. I think that some ten years on we can perhaps see more value than was evident at that time.

Certainly, it is significant that the placing together of the two projects provided the basis of Craft, Design and Technology today.

During the late 1960's and early 1970's the Design Education movement became very effective, and at school level, the work of Bernard Aylward and his team in Leicestershire was most impressive. This presented, and still does today, Design across the whole practical spectrum, from Fine Art to Home Economics and involves the traditional manipulation of materials courses. The Leicestershire initiatives led to the first major breakthrough at 'A' level when, through the sponsorship of the Oxford Delegacy, an Advanced Level in Design was introduced. This revolutionary syllabus with 60% of the marks awarded for coursework, provided the major move from skill-based 'A' levels to a process-based examination. The philosophy underlining this syllabus remains with us today. At the same time, George Hicks at Goldsmith's College, London was eagerly promoting the concept of a subject called Design and Technology. In a paper published in Practical Education in 1970 he simplified the development of the subject as follows:-

Educational Aim		Subject		Material Consideration
Physical Development	→	MANUAL TRAINING	←	Physical Structure

The success of this, encouraged a development whereby we became more aware of what we were doing with the material. Phase two, therefore, can be shown thus:-

Educational Aims		Subject		Material Considerations
Physical Development Emotional Development	→	HANDICRAFT	←	Physical Structure Form

We have now reached the third stage, whereby we have progressed still further by recognising the potential for intellectual development that our work offers and have reached this point:-

Educational Aims		Subject		Material Considerations
Physical Development Emotional Development Intellectual Development	→	DESIGN AND TECHNOLOGY	←	Physical Structure Form Technology

Hick's influence was such that he managed to make a significant breakthrough;

by persuading an Examination Board not just to introduce 'O' and 'A' levels in Design and Technology but, more importantly, making them drop Metalwork and Woodwork. This shotgun approach to curricular change undoubtedly caused problems. It certainly ensured that teachers were stirred from their conservative attitude to change, even if some merely had to change Boards and it undoubtedly sparked other Boards into making developments.

The move by the London Board in 1972 for 'O' level and 1974 for 'A' level still has not been copied by many Boards. Hicks' enlightened vision of one subject called Design and Technology replacing handicraft was farsighted, but today, causes some problems because his syllabuses had to encompass the technology of 1970, which could be taught by teachers and that was principally, at schools level concerned with materials. Today therefore, the use of the title Design and Technology has an unfortunate association with the design and the technology of materials. However, he did significantly improve the intellectual demands of the subject. In 1971 the Cambridge Board introduced another 'A' level called 'Elements of Engineering Design'. This syllabus introduced scientific aspects of the work without making it a purely applied physics course like Engineering Science. The 'A' level in Elements of Engineering Design was generally well received and was a most enlightened syllabus, but it never had sufficiently powerful advocates to develop it fully and after a promising start, the subject has remained almost static in numerical terms.

In 1973 the Schools Council published 'Handicraft at GCE 'A' Level'. This document will be fully discussed in Chapter 7, but it appears to have had little or no signficance in the development of CDT at 'A' level. In fact, it appears to have been ignored and certainly no new syllabuses used its suggested format.

It should also be noted that in 1970 the Schools Council/Loughborough University of technology Engineering Science Project was established to produce text booklets and other support material for new Engineering Science courses at 'A' level. This was based on the concept of applied physical science and, interestingly, the introduction to the project does not mention the word 'technology'. This initially looked a powerful project, but time has shown it to be a relatively ineffective development, as the statistics in Chapter 5 clearly show. However, it may reappear in the form of 'A' level Technology in some Boards.

By 1974 turmoil was rife in the Handicraft/Technical Studies field, as well as in Art and Housecraft fields, with many changes suggested. Thematic projects across faculties were common, with many faculties established without the appropriate philosophical background, many teachers confused by what appeared to be a wide range of bandwagons and curriculum development running wild. In 1974, the Royal College of Art set up a research project entitled 'Design in General Education', which enquired into the nature, value, organisation and problems of design awareness as a subject for study in general education. This Department of Education and Science funded project was intended to evaluate this plethora of developments. It discovered among other things, a 'grass roots' movement in schools towards design, and identified evidence to suggest that there was a sufficient body of knowledge for the area called 'Design' to be developed to a level which will merit scholarly regard for the future. These were significant findings because they aided the projection of design-based 'A' levels as having value in our education system. However, this report merely identified facts to the DES, which were known by those in the field. The rapid splitting and polarising of the field remained and rationalisation and leadership were desperately required to pull the subject area together. Equally important, was the need for a clear distinctive subject area title. This came from the HMI's who unveiled their new title of Craft, Design and Technology in late 1976. It is easy to see how it was derived but when John Swain took over as Staff Inspector, he quickly welded this curricular area under one title, emphasising that there is no priority in the title, merely alphabetical order. For many enlightened teachers, the title of Design and Technology or Design would have been preferable; however, by using the word 'craft', it did allow traditional teachers to see a route into the subject and thus enable a more cohesive picture for the subject to develop. However, as much as the use of the word craft has aided the total involvement of all teachers, at Advanced Level, it causes academic prejudice which sadly we are still trying to break.

Thus the current subject title was born, but then ensued debate on defining of aims, objectives and the range of such courses. Swain and his team again set the overall framework when he wrote in the Stanley Link Magazine, First Edition 1977:-

> 'Design is central to all that is undertaken in the school workshops. It is through Design activities that many educational objectives may be achieved. Technology does not imply the technology of craft although this is an essential element. Craft, Design and Technology must be concerned with energy, materials, and control if it is to satisfy the inclusion of Technology in the title.'

Thus with the publication of the HMI Curriculum 11-16 document (Dec 1977) and mounting pressures, CDT began to unfold with defined areas of knowledge and skills.

There is little doubt that the role of HMI during the late 1970's and early

1980's has contributed immensely to the creation of a more unified approach to CDT and certainly they have succeeded in welding together the factions which were created during the early and mid 1970's.

In 1977 another new 'A' level was introduced called 'Design, Craft and Technology' by the Welsh Board. This was introduced to run alongside the existing 'A' levels in Woodwork and Metalwork. The Welsh Board believed, and still does, that Design is the central theme of the subject and therefore it should come first in the title. This syllabus has a similar philosophy to both the Oxford Board's 'Design' and the first London Board's 'Design and Technology'. In 1978 JMB introduced its much awaited 'A' level in Design. This examination was first examined in 1980 and although it has a good take-up, its diverse optional structure has lead to a disappointing level of acceptability.

During the 1970's the move towards technology was accelerating and in 1976 Schools Council set up a project called 'Modular Courses in Technology'. This followed work done in Avon and Hertfordshire. The project developed specific 'O' level GCE and CSE courses in Technology. Unfortunately, the project produced two rather different examinations which have a degree of overlap on certain modules. The Avon Modular course is more scientific and investigative, whereas the Hertfordshire (now referred to as the Cambridge/East Anglian) course is more product design orientated. The development of two schemes was somewhat unfortunate but the resource material published has been invaluable in developing Technology orientated CDT courses. This development has been very powerfully promoted and now it is leading to some thoughts that technology can only be taught in a modular course form; a rather narrow view, but one which tries to make maximum use of scarce resources and teacher expertise.

These courses naturally required an 'A' level which showed progression from 'O' level and therefore, in collaboration with the National Centre for School Technology, 'A' level Technology was introduced in selected schools, and first examined in 1981. This extremely demanding syllabus developed principally in Bedfordshire has a strong design element and uses modules for its in-depth study. In terms of acceptability, it has achieved a remarkable success since its introduction.

In 1980 the Design Council published its authoritative report 'Design Education at Secondary Level'. This report was a thorough investigation of design education and was comprehensive in its recommendations. Its recommendations in terms of examinations are now being seen in schools. The report stimulated interest and thought and has provided a useful measure for future developments in Design Education.

It developed specific criteria for 'A' level Design-based examinations, (these will be analysed in Chapter 7) which have given a higher level of acceptability to those syllabuses meeting these criteria. The Design Council has, since its report, successfully negotiated a high level of acceptability with university professors of Engineering. This could lead to the assumption that in 1984 full acceptance of the selected 'A' levels in CDT had been achieved. Such a view, however, is not the case, although significant progress certainly has been made.

In 1980, the Associated Examining Board introduced its own new 'A' level called 'Design Communication and Implementation' and in 1981 the Cambridge Board added to its extensive list of 'A' levels, one called 'Craft, Design and Technology'. These show the continued development along slightly different tracks towards an acceptable 'A' level. However, the differing titles and lack of common core or criteria leave their acceptance as a whole, somewhat tarnished.

The Assessment of Performance Unit (APU) at the DES published 'Understanding Design and Technology' in 1981. This confirmed and developed further the areas of involvement for the subject area. It showed for the first time in an official document, not only the design process, but the knowledge areas and values associated with Design and Technology. Geoffrey Harrison in the APU survey used the following model to illustrate technological competence or capability across the curriculum. (Fig 3)

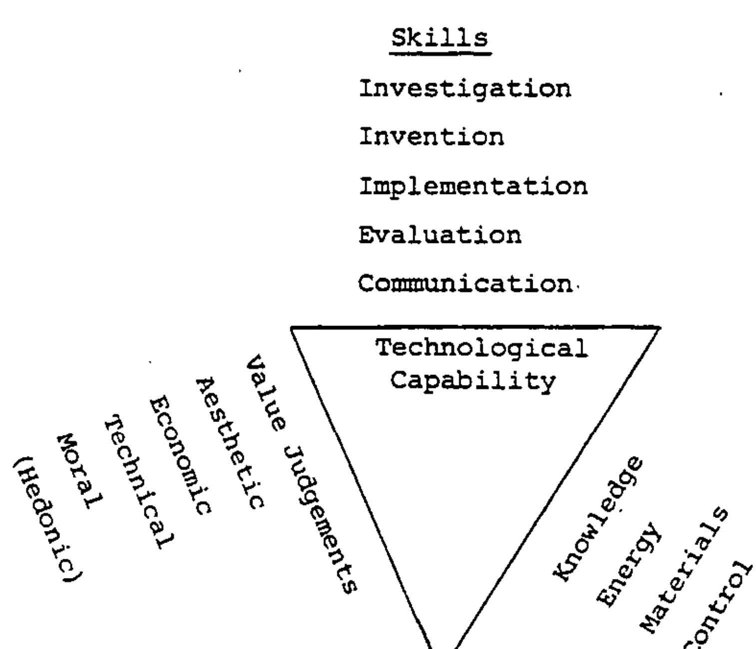


Fig 3

Therefore the steady defining of Craft, Design and Technology was taking place, and the harmony which HMI were trying to achieve was succeeding.

It was becoming apparent that in Years 1-3 of our secondary schools it would be feasible to have an integrated CDT course. This was clearly shown in the Association of Advisers in CDT Document 'Foundation Studies in CDT'. However, at fourth year stage the breadth of the subject matter could cause problems and therefore a degree of specialism would be needed. The format of 16+ examinations was established in one of the most significant documents to be published in the last decade, the GCE and CSE Boards' Joint Council for 16+ National Criteria. This document published in January 1983 set out common aims and objectives for all courses in CDT. Significantly it established designing, making and evaluating as the core activity for 16+ in Technology, Technical Drawing and Design and Craft. From this document we can see a revised technical drawing subject in the CDT 'family', but with emphasis on design and communication. This somewhat controversial decision is likely to have considerable significance during the next decade. Later in 1983 HMI published their updated paper on CDT 11-16+ which further qualified the area of craft, design and technology, building on the excellent APU work 'Understanding Design and Technology'.

It is easy to emphasise contemporary development in greater depth, rather than historical development, when establishing a subject area. However, it should be recognised that the growth of subject development has been so great that without briefly noting the early development it would be impossible to ascertain the correct context in which 'A' level developments have taken place. It would equally be unfair not to recognise the wide range of pressures from technologists, industrialists, Art and Design, Examination Boards and HMI which have been brought to bear on this development and which still apply the pressure for change or maintaining the status quo.

However, it is important to provide a model which will summarise the subject area and identify a structure upon which to build. It is evolutionary and will have differing weightings depending on the course.

The following model shows the core activity as problem-solving through Designing, Making and Evaluating. It shows the technological concepts of materials, control and energy being fed into the design process. At the same time, the skills of communication, discrimination and realisation are used as appropriate. The whole process is aimed at developing in young people the appropriate attitudes, skills and values for living and working in an industrial society.

This simplified model reflects the current position of CDT and, in principle, is the same for all levels of attainment. When developing new criteria later in this study, this model will form the basis. (Fig 4)

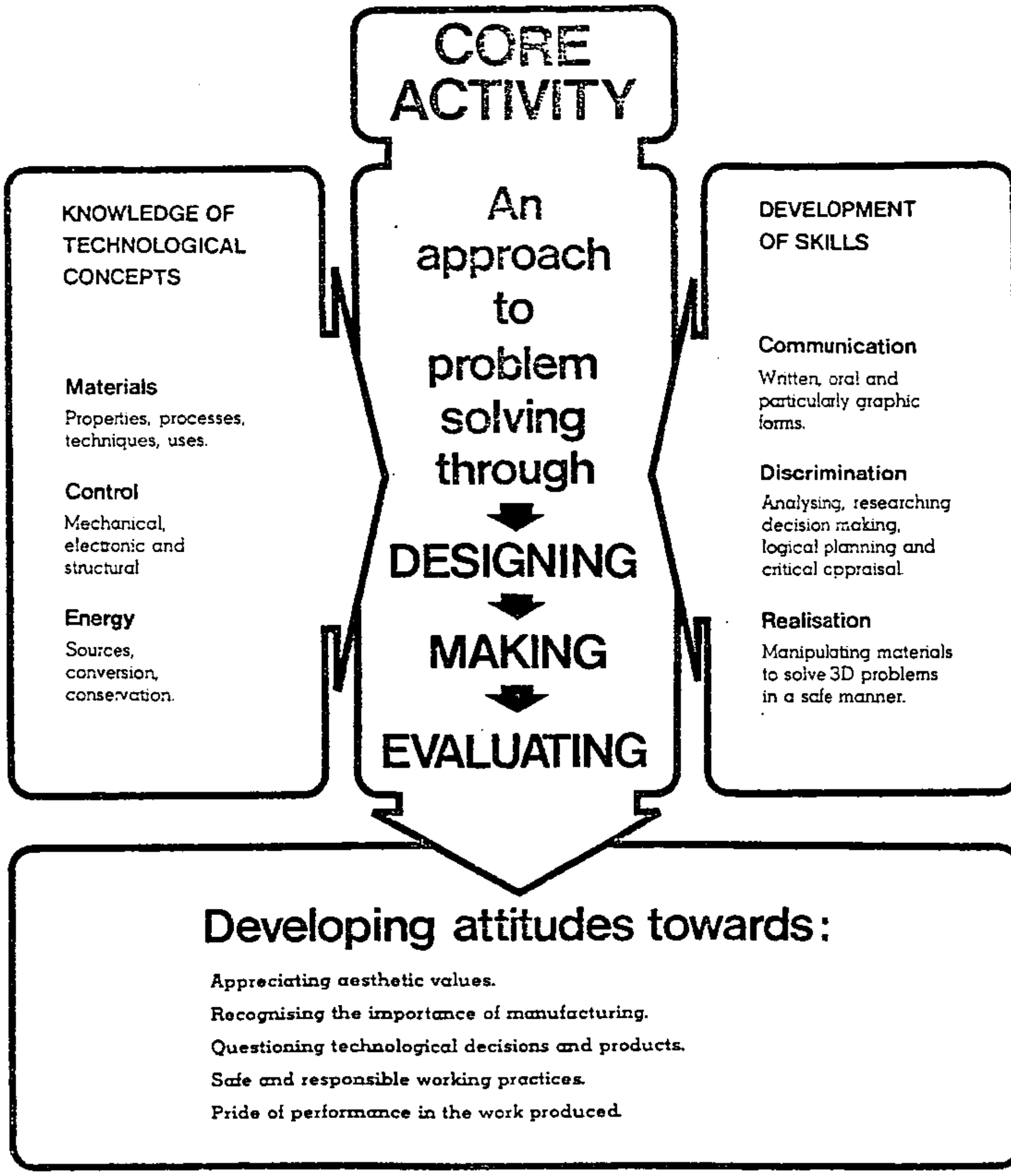


Fig 4

Thus it is clear that during the last two decades a considerable amount of divergent thinking about the subject area has taken place and many initiatives have been made. However through the turmoil of these contemporary developments an identity for the subject has been established with a sound degree of consensus, as can be seen with the 16+ National Criteria.

Equally, the level of acceptability for the subject has moved significantly forward and at 'A' level the subject can now be seen as part of the recognised 'A' level provision in an increasing number of schools. It is significant that when the new Secondary Examinations Council established its committee structure for 'A' levels in 1984, it chose the ten subject areas with the most candidates and then two further committees, which did not have the numerical justification but were seen as important developing subjects. Craft, Design and Technology like Computer Studies did not have the numbers but was seen by SEC to be an important developing subject.

CHAPTER 4

POLITICAL AND EDUCATIONAL SUPPORT FOR CDT

In Chapter 3, the contemporary developments of the subject area are identified and discussed. However, the last decade has seen a major upsurge in educational and political support and, in identifying the increased acceptability, it would be inappropriate if some analysis of this support was not made.

In Chapter 2 the need to increase technical education was shown to have been identified back in the nineteenth century. The introduction of technical schools and later, the technical grammar schools following the 1944 Act, showed some recognition of the importance of technical education, but certainly, the availability of relevant technical education for the most able pupils was not in evidence until the 1970's, neither was there any degree of acceptance by society that the most able should study subjects which involved applications.

To overcome this attitude and lack of status, major changes were and still are necessary and have been taking place, although they remain at the embryonic state. The political support has been based undoubtedly upon the concept that by encouraging designing and making in schools, British Industry will become more efficient at creating wealth through more able students entering the many aspects of engineering. Secondly, the need has been recognised to increase relevance and understanding of the modern industrial society in our schools and colleges. Educationalists do not necessarily disagree with these concepts, but see CDT as having enormous potential for children as a realistic method of achieving high order educational objectives yet having a practical relevance, as reports will illustrate later in this chapter.

The political pressure for curriculum change began to increase in the early 1970's and these pressures culminated in the now famous Ruskin College Speech of 1976 by the Rt Hon James Callaghan (Prime Minister).

> 'The goals of our education are to equip children to the best of their ability for a lively, constructive place in society and also to fit them to do a job of work.'

This was followed in 1977 by a Green Paper which was intended to stimulate the 'Great Debate', by the Secretary of State for Education and Science, Mrs Shirley Williams MP.

> 'None of this should mask the remarkable work being undertaken in many of our schools. It is the vigour, imagination and talent

> of the teachers in them that impress the visitor: schools that open their facilities and their resources for learning to the entire local community: schools that emphasise creativity in design, in making things as well as learning things: schools that tackle with sustained enthusiasm the problems of children from other cultures or speaking other languages and make a microcosm of a happy and co-operative world.'

Already the concept of designing and making was beginning to arise from the debate as having a higher level of significance in our education system.

In 1980 a whole series of initiatives arose. Firstly the Finniston Report commented on the lack of able youngsters entering engineering, and the low esteem culturally in which engineers are held. One of the themes of the report was the creation of the Engineering Dimension. The following quotations illustrate the report.

> 'The Engineering Dimension involves all the factors and activities concerned in relating the technological capabilities and expertise of an organisation to its overall objective.' (1.34)
>
> 'There are few signs of such understanding and hence the Engineering Dimension has been starved of talent and resource.' (2.44)
>
> 'Culturally, Britain lacks the 'Third Culture'....' (2.3)
>
> 'Engineering tends to be regarded as a subordinate branch of Science. This misleading tendency must be corrected by the education system.' (2.5)

Thus, as CDT was stabilizing itself and developing its new technology courses, the Education/Industry debate was asking how it could translate into schools more relevance to the world of work and a higher status for the vital wealth creating sector of our society. The correlation between the developing CDT courses and the defined needs of industry appeared high. It should be noted that this was not accidental, but occurred naturally out of CDT's developing relationship with industry following Crowther's criticism in 1959.

In response to Finniston but also as a result of their own concern for the future, 140 leading industrialists and educationalists published their now famous 'Education for Capability' Statement (see Appendix A).

This statement questioned what education is, and suggested that an 'educated man' in current terms is one of a scholarly, leisurely individual rather than someone who can exercise skills of value to the wealth creating society in which we live. It suggests that the education system is very insular and places far too little emphasis on solving problems, doing, making and organising things. These views were echoed by many working in the CDT field and clearly showed industrialists seeking a significant change in our education system. Furthermore, they stress the need for cultural change in our society by pointing out that British society has two cultures, 'Arts' and 'Sciences', but no corrsponding word for the German culture known as 'Technik', which is concerned with 'doing'. Perhaps the most significant part of this statement for CDT was that it sought the establishment of the third culture in our schools and described it as emphasising craftmanship and the making of useful artefacts; the design, manufacture and marketing of goods and services. Therefore, leading industrialists were beginning to unify their views and exert pressure upon the Education system. The statement was re-issued in 1983 with more industrial support to maintain the movement for change.

It is not without significance that throughout the late 1970's the Standing Conference on Schools' Science and Technology was flourishing with its developing Science and Technology Regional Organisations and the Department of Industry was beginning to play a very significant role with its Industry/Education Unit. In 1980, Bedfordshire and Lincolnshire received some of the Department of Industry's first grants for specific technology projects. Thus, it is not difficult to see how, within three years of the introduction of the 'Education for Capability' statement, along came another Government department, the Department of Employment with its Manpower Services Commission and created, almost overnight, the Technical and Vocational Education Initiative (TVEI). This move was undoubtedly created in order to redress the status and balance of our education system, and certainly, Craft, Design and Technology will play a significant role in this development.

The creation of the Technical and Vocational Education Initiative (TVEI) schemes by Manpower Services Board in 1983 was influenced by the desire to create the third culture and certainly Craft, Design and Technology lies in many parts at the core of TVEI schemes.

One of the signatories of the 'Education for Capability' statement was Sir Alex Smith, former Rolls Royce design Engineer and the Chairman of Schools Council and Director of Manchester Polytechnic. He went further by stating in his Stanley Lecture (October 1980):-

> 'The activities of designing and making should be regarded as being, at the fundamental stage, every bit as important as reading, writing and arithmetic, and at the more advanced stage, as important as literature, science and history. Every child in every school, every year should be involved in designing and making activity, on the grounds that, in its own right, it is a very valuable educational approach.'

At the time of Sir Alex's statement he was in an interesting position having both industrial and educational experience and his views were repeated frequently by official reports throughout the early 1980's.

In 1980 Page and Nash looked into the problems of teenage attitudes towards Technology and Industry and amongst their findings was the fact that those studying technologically-related subjects in school had a much better attitude to Industry. This further increased the view that improved quality of applicants to the engineering profession and the associated better attitudes could perhaps be achieved through the development of more technologically related subjects in schools.

However, throughout these developments the Department of Education and Science had appeared to be playing a somewhat insignificant role, although the role of the HMI's in CDT had been considerable as identified in Chapter 3. Thus in 1981, when the Department of Education and Science published 'The School Curriculum', it was somewhat surprising but very significant, for CDT to see itself identified as one of six areas which received special attention. More importantly compared with the Curriculum 11-16 paper published in 1977, it combined Technology and Craft, Design and Technology and references to technology were not in the historical sense that the Curriculum 11-16 had been written. The following quotation is taken from the section on CDT and shows how the DES understood CDT and, more importantly, how it gave academic recognition to the subject in a most meaningful way.

> 'The Secretaries of State attach special importance to Craft, Design and Technology as a part of the preparation for living and working in modern industrial society. When it is taught imaginatively, this work helps pupils to understand that the practical application of discoveries and inventions is as vital to our society as scientific research. It encourages creative skills and the ability to identify, examine and solve problems, using a variety of materials. The problems tackled by able pupils are intellectually demanding and stretch to the full their inventive and innovative powers. Problems seldom have a single 'correct' answer; their resolution requires the gathering of information, the practical application of knowledge and, frequently, co-operation with others both inside and outside school. Craft, Design and Technology can also enrich and add interest to what is taught in other subjects. It can enable boys and girls to absorb, consolidate and develop the science and mathematics they learn and to give them a practical application, and to develop their language skills in practical sitautions.'

The momentum was gathering pace and in 1982 the Prime Minister, Mrs Thatcher, entered the debate by firstly, holding a Design Seminar at 10 Downing Street and then, issuing the following policy statement in Design Magazine in May 1982:-

> 'The first theme - the one affecting all others - was education. At present, design is too often taught in secondary schools as an art subject. It is rarely taught as it should be - as a practical, problem solving discipline, that is ideal for preparing young people for work within the constraints of user needs and the market. Its status as an 'O' and 'A' subject is dismal. Many employers and higher education establishments do not recognise it as a qualification. Teachers themselves are often not fully aware of the real scope of the subject. Syllabuses are arranged to give greater merit to 'pure' art than to the practical application of design. And we must change the all too widespread attitude in this country that academic achievement is more to be admired than industrial achievement.'

The Prime Minister attached great importance to education and then, in the view of many Art teachers, was most critical of design teaching methods. She stresses that it should be taught, in what some would describe as the CDT way, as a practical problem solving discipline. Her view on the status of 'O' and 'A' level was perhaps not surprising but by implication it suggests that she wanted the status improved. The most significant aspect of the statement was the stress placed on changing attitudes in our society from recognising only pure academic achievements to also valuing industrial achievements.

This clearly showed the way forward and accelerated the political pressure for curriculum change and the development of practical problem solving through CDT. To further show the understanding of the Government, the Secretary of State for Industry, Mr Patrick Jenkins MP said the following in September 1982 at the presentation of awards to the Young Engineer for Britain:-

> 'I say to the young people here today - our future is in your hands; do not neglect the opportunities in engineering. Young engineers have the world at their feet. We owe it to them to make sure that their education and training allows them to make the maximum contribution to the process of wealth creation. And industry, indeed, society as a whole, must make the most of their skills. Engineering should be every bit as valid a passport to the boardroom as, say, law or accountancy. In particular, I want to see more design engineers at the top of British industry.'

Patrick Jenkins' plea to youngsters to consider engineering was welcomed and his establishment of the Engineering Council, following the Finniston Report, should aid developments in this field.

In November 1982 David Young (Chairman of MSC) announced one of the largest curriculum initiatives ever to be established over a mere nine months, with the TVEI schemes. The Initiative injected large sums of money to assist the development, much of which was spent on technology equipment and teaching staff. The Chairman summed up this new initiative in Technical and Vocational Education to the Directors of Education in England and Wales in January 1983 as follows:-

> 'First our general objective is to widen and enrich the curriculum in a way which will help our young people prepare for the world of work and to develop skills and interests, including creative abilities, which will help them to lead a fuller life and to be able to contribute more to the life of the community. Secondly, we are in the business of helping students 'learn to learn'. In a time of rapid technoligical change, the extent to which particular occupational skill is required will change. What is important about this initiative is that youngsters should receive an education which will enable them to adapt to the changing occupational environment.'

It is too early to establish whether TVEI will be successful, but it is significant that a body outside mainstream education has found it necessary to provide an almost shotgun approach to create curriculum change in our schools. Certainly the academic curriculum of our schools lacked the impetus to create, sufficiently quickly, the change the politicians required.

In March 1983 the Director General of the Engineering Council, Dr K Miller, made a major policy speech in which he clearly identified Design and Technology and its importance.

> 'We must begin in the schools with creating the attitude of the virtues of doing, making and organising the production of real physical things which society actually needs. The real point we must get over is that it is not in any way inferior to the traditional academic subjects. In fact, by comparison, the teaching of science is relatively easy. Science comprises known scientific facts and known laws like Newton's Law of Motion - remarkably easy on which to set examination questions and to mark them. The Design and Make concept, or the culture of TECHNIK, to use the German word, is a culture of its own, combining this scientific knowledge with the art of weighing up the conflicting requirements to meet the needs of society. The balance between reducing the initial cost of a domestic appliance, such as a washing machine, with the debit of a reduced life, less reliability and increased maintenance costs. The use of more expensive construction materials with the disadvantage of increased initial cost balanced by the advantage of longer life, say in a car exhaust system. It is understanding and appreciating these 'trade offs' and how they must be balanced that raises the Design and Make concept to a creative art. In many ways the creative element calls for greater imagination and will to stimulate the curiosity and inventiveness of the children. I was therefore delighted when the Engineering Professors' Conference agreed a year ago that Design Technology will be a suitable 'A' level subject to go with Maths and Physics for entry for an engineering degree course.'

The Engineering Council could play a most significant part in improving 'A' level acceptance; however, since Dr Miller's speech in 1983 progress has not been openly noticeable. An article by Dr Miller published in 'Eureka Transfers Technology' however, clearly shows movement behind the scenes to effect changes. He states:-

> 'The whole education system needs shaking up to ensure that design is given prominence right through from the schools to the higher and further education sector where it is essential that design studies - and these should include manufacturing, reliability, maintainability and quality assurance as well as economic aspects - should be mandatory.
>
> I will certainly be looking to the universities and polytechnics to take the necessary action and I am sure that my colleagues at The Engineering Council and within the Engineering Council Nominated Bodies, which accredit engineering degree courses, will take a tough line on courses that do not include design studies. The likelihood of courses not being accredited will, I am sure, be a strong motivating factor.'

In the same article he speaks of design activities in the primary school and the Government's support for 'Managing Design'.

In early 1984 Sir Keith Joseph, Secretary of State for Education and Science in his Sheffield speech again identified five areas of the curriculum. For CDT he stated the minimum level of achievement for a 16 year old should be:-

> ' ... that they can design and make something, using a limited range of materials and calling on a restricted range of concepts and give an account of what they have done and the problems they encountered.'

Sir Keith stated the need for four principles in primary and secondary education, breadth, relevance, differentiation and balance. Under relevance he clearly identified the need for all pupils to receive '...an adequate, practical element, to promote practical capability.'

In March 1984 the Hargreaves Report was published on the curriculum and organisation of ILEA secondary schools. This radical report suggested CDT as a core subject in the curriculum for all pupils 11-16. Under CDT Hargreaves reported:-

> 'A carefully designed and well taught course in CDT can act as an important link or bridge both between general and vocational education and between science subjects and aesthetic subjects. If these links are properly forged, CDT can play a critical function in making the curriculum as a whole more coherent and more relevant to the lives and aspirations of young people. Moreover, if its distinctive focus on problem solving is correctly conceived, it provides a balanced education in connecting the academic and the practical, the theoretical and the applied.'

'This subject has much to offer girls in developing their creative, intellectual, practical and problem solving skills; in incresing their opportunities in further and higher education; and in widening considerably the range of careers and occupations open to them. We believe that all pupils, both boys and girls, should study CDT. We conclude that CDT should be part of a compulsory curriculum in the fourth and fifth years. CDT should not be treated as an alternative to science or the aesthetic subjects.'

This report was further enhanced by Mr Eric Bolton, Senior Chief HMI who is quoted, from an article in the Times Educational Supplement in March 1984, as saying:-

'The years ahead will see greater emphasis on technology and design in an attempt to create a better balance between theory, practice and relevance to the outside world.'

It is of consequence that both Hargreaves and Bolton are beginning to plan for future developments in Design and Technology in our schools to meet Sir Keith's need for more relevance and practical capability.

In May 1984 the Engineering Employers' Federation produced a pamphlet called 'Educating for the future - an industrial view', it had a sub-title 'Policy Statement on School Education'. In this statement, it criticised the lack of employers' involvement in education and points out that only CDT had made any effort over the 16+ developments to consult such organisations. It looked at curricula motivators for potential engineers and pointed out that the studying of technology from an early age will arouse intellectual interest in engineering and criticised creative subjects such as CDT not being available to able youngsters. In another section it looked at the poor correlation between academic performance and engineering performance and notes how assessment in 'academic terms' can demotivate able youngsters who do not have the specific academic attributes being measured. The report goes on to mention CDT as a good example of where excellence is often achieved but rarely recognised as it does not fit into the preconceived academic model. Naturally such a policy statement reiterates the low status of practical skills and three dimensional conceptualisation compared with academic skills and verbal conceptualisation.
The policy recommends that:-
'Reformed CDT should be obligatory for <u>all</u> children pre-sixteen.'

This shows Industry clearly identifying itself with CDT as a key provider of relevance to the school curriculum and as a means of changing attitudes in our society. However, the fact that it needs to introduce the statement with the word 'reformed' indicates one of the problems CDT still has, in that some work which currently falls under the CDT umbrella sadly is not CDT, and this could be a danger to future acceptability of the subject, at 'A' level in particular, but other levels as well.

The sentiments of the Engineering Employers' Federation were seen by some adversaries to be industrialists having little perception of education. However, the statements on other subjects display a sound understanding and it is interesting to note that in September 1984 the DES supported the statement on CDT. In its note to LEAs on 'The Organisation and content of the 5-16 Curriculum' it stated in Para 25:-

> 'CDT is centrally the subject in which practical applications are fostered. A possible objective might be that throughout the five-year period all pupils should have in their programme this subject which requires them to study and solve problems involving the use of materials and which entails some element of designing and making things. This is an ambitious requirement, made more difficult to meet by the shortage of good CDT teachers. But it is possible to tackle it through a variety of activities and a wide range of materials, including the use of modern technology. Some contribution may be available from teachers of other subjects, with appropriate support, including teachers of art and design.'

This statement is a somewhat more realistic objective in light of teacher shortages but illustrates a distinctive swing towards CDT which must, if taught soundly, enhance society's perception of the subject.

In February 1985 Sir Keith Joseph, Secretary of State for education and Science made the following comments when launching the Northern Advisers Exhibition in Leeds called 'Designing and Making: Learning through Craft, Design and Technology':-

> 'CDT matters; and it matters to all pupils - boys and girls, infants and sixth formers, those whose talents would traditionally have been described as academic and the non-academic.
>
> CDT matters because it is about designing and making, and above all about learning through doing. It matters because when it is well taught it is among the most demanding and the most rewarding of subjects in the curriculum ....
>
> The benefits which can be gained span a very wide range: not just the skills associated with the traditional craft subjects, important though they are, but the application of scientific method, knowledge and reasoning, the encouragement of a keener visual sense, the practical application of mathematics, the need to exercise judgement based on worthwhile values, and the capability to work constructively in groups. Knowledge, skills, concepts, attitudes; the whole range of educational objectives can be fostered through CDT.
>
> The conclusion which I draw is that we should find ways of introducing all primary pupils and all secondary pupils of all abilities, boys and girls, to the activities of designing and making, in ways which will not be intimidating to primary school teachers, but can hold naturally on the strong tradition of practical work in primary classrooms; and that all secondary pupils should have a sustained experience of CDT, as part of a broad and balanced curriculum, with, I hope, more pursuing their studies beyond the age of sixteen than is now the case.'

This speech clearly shows the Government's belief in CDT when taught well and its contribution in educating pupils. The integrating nature of the subject is clearly established and its part of a broad, balanced curriculum identified. In terms of 'A' level, the final statement is most encouraging and the nature of the speech can only assist CDT's general acceptance and, as a consequence, perhaps its 'A' level acceptability.

In March 1985 HMI published 'Curriculum Matters 2 - The Curriculum from 5 to 16'. This document deals with the whole curriculum in terms of areas of experience and it is significant that since the Curriculum 11 to 16 document one important further area of experience has been added - that of technological experience. The areas of experience are not subject orientated and under Technology examples of various disciplines displaying technological awareness or understanding are shown. However, it is significant that HMI make the following statement in Para 84:-

> 'The essence of technology lies in the process of bringing about change or exercising control over the environment. This process is a particular form of problem solving; of designing in order to effect control.'

This section supports CDT as a key provider of this technological element, as well as making a contribution to the aesthetic and creative area of experience. Thus yet another official report gives reassurance and justification of CDT in the school curriculum.

On 27 March 1985 following the announcement of the White Paper 'Better Schools' (Cmnd 9469) the Secretary of State established the Advanced Supplementary (AS) levels. In setting out the subject coverage at AS the Secretary of State, in his letter to the Secondary Examinations Council and Boards, states:-

> 'The SCUE has stated that the highest priorities for development as seen by University departments are Mathematics with practical applications, English and foreign languages. The CNAA has argued for early development of AS level design and technology.'

This clearly shows the support for the subject in Higher Education; however the whole concept of AS could, when implemented, have a serious effect on 'A' levels in design and technology. But at this stage, when its level of implementation is unknown, it is difficult to judge its effects accurately.

Thus, from educationalists, industrialists and politicians there has been a growing conviction that CDT has a tremendous part to play in educating young people for the latter part of this century and for the beginning of the next. However, the subject, despite this almost unqualified support, still has many hurdles to overcome and this primarily lies in its failure to create complete recognition for its 'A' level courses. This is, naturally only a very small part of the educational processes, however, while the education system, with its traditional background remains, it is crucial that 'A' levels in CDT are understood and their acceptance is identified.

Many people who oppose this pressure for more CDT and perhaps more importantly increased technical and vocational work in schools, dislike the activity because it is linked with Youth Training Schemes and trying to solve youth unemployment. There is little doubt that the association with solving this problem cannot be ignored and many politicians may see it in this light, however, two fundamental factors cannot be challenged. Certainly CDT is as useful for leisure and associated personal interests as for the world of work and secondly, attitudes favourable towards wealth creation are necessary if our society is to maintain its current standard of living. Professor Tom Stonier in his 'Education 2000' series of lectures (1984) prognosticated that only between 5% and 10% of the population capable of working will be involved in wealth creation by the Year 2000, however, they will need to be some of our most able people if they are going to create sufficient wealth to maintain our current life style.

To achieve and maintain academic respectability, industrial and political support, is not going to be easy, but it is a fundamental task which cannot be ignored.

CHAPTER 5

CURRENT POSITION OF CRAFT, DESIGN AND TECHNOLOGY AT 'A' LEVEL

In Chapter 2,the origins of Craft, Design and Technology were established, showing it to have a low status in society. The contemporary developments were discussed in Chapter 3 which set out to determine an educational justification for studying the subject and a means of improving its status and level of acceptance. Chapter 4 shows how, during the last decade, the political and educational support for the subject has grown tremendously. This chapter seeks to show the current position in terms of subject trends and numbers of syllabuses available and students involved in taking the examinations, as well as eliciting the current level of acceptance as described by a variety of interested parties. Later chapters will look at methods of improving this by creating criteria and how the subject compares with others in the field. Chapter 10 will clearly show the actual level of acceptance in Higher Education which will place in context the current perceptions expressed in this chapter.

Statistical analysis of entry patterns for 'A' levels in Craft, Design and Technology

This is a difficult exercise to carry out as the parameters of the CDT field are not particularly easy to determine. However, before any analysis can be carried out the subjects which fall into the CDT field must be identified. In May 1984 the Secondary Examinations Council computer showed that there were 325 syllabuses at 'A' level in England and Wales. Using words which would normally be associated with CDT and the traditional subjects in the field, a list of 37 syllabuses were discovered and these are shown in Table 2. This represents 12% of subject titles but the total entry for these subjects merely represents 1.3% of 'A' level candidate entries. However, a more close analysis of the syllabuses behind the titles clearly shows subjects which do not really conform to the CDT models described by the GCSE national criteria in the model formed for CDT at the end of Chapter 3. This clearly illustrates part of the problem the subject has and will continue to have while there is a plethora of titles for the subject.

In analysing the subjects in Table 2, those indicated with an * were found not to conform sufficiently to the CDT field and the reasons for their exclusion will be identified in this paragraph. However, it must be pointed out that many of those syllabuses which remain in the list do not conform to CDT as suggested in Chapter 3. They do, however, belong to the tradit-

TABLE 2

'A' LEVEL SUBJECT TITLES WHICH COULD FALL UNDER THE CDT 'UMBRELLA'

Title	Board
Building Construction	AEB
*Craft (Design and Practice)	JMB
Craft and Design - Metal	WJEC
Craft and Design - Wood	WJEC
Craft, Design and Technology	CAMB
Design	JMB
Design	OXFORD
Design - Communication and Implementation	AEB
Design and Craftwork - Metal	AEB
Design and Craftwork - Wood	AEB
Design and Technology	LONDON
Design and Technology in Metal	OXFORD
Design, Craft and Technology	WJEC
*Electronic Systems	AEB
*Electronics	CAMB
Elements of Engineering Design	CAMB
Engineering	OXFORD
Engineering Drawing	AEB
Engineering Drawing	WJEC
Engineering Drawing and Design	OXFORD
*Engineering Science	AEB
*Engineering Science	JMB
*Engineering Science	LONDON
Fine Craft and Design in Wood	OXFORD
Geometrical and Building Drawing	CAMB
Geometrical and Engineering Drawing	JMB
Geometrical and Mechanical Drawing	CAMB
Graphic Communication	AEB
Graphical Communication	LONDON
*Industrial Studies	OXFORD
Metalwork	CAMB
Metalwork	JMB
Technical Drawing (Engineering)	LONDON
Technical Graphics	CAMB
Technology	CAMB
Woodwork	CAMB
Woodwork	JMB

Source: SEC Computer - 11.5.84

ional past of the subject and cannot be merely cast aside. The Joint Matriculation Board (JMB) has a syllabus which is entitled Craft (Design and Practice) that clearly appears to be CDT type work. However, a closer study shows it to be an Art subject with an option in Theatre Craft and Drama. JMB considers it to be an Art syllabus. The Associated Examining Board (AEB) has an Electronics Systems syllabus as well as an Electronics endorsement for Physics and Engineering Science, and University of Cambridge Local Examinations Syndicate (Cambridge) has just introduced an 'A' level Electronics. These examinations do not conform to the CDT model as they are almost solely concerned with electronics and have little designing and making or use of resistant materials. The AEB Electronic Systems, for instance, relates 20% of marks to coursework but it is split between the assessment of the candidate's 'laboratory note books (log books)' and 'two extended investigations or projects.' These syllabuses are much more closely related to Physics, although it would not require major changes for them to fall into the CDT field. This view is supported by Graham Bevis, MEP National Co-ordinator for Electronics and Control and architect of the syllabus. The view that Electronics at 'A' level is currently more closely associated with Physics was endorsed by the Secondary Examinations Council (SEC) and placed under the Physics panel for scrutiny. SEC has a similar view on Engineering Science and following analysis, this is shown to lack sufficient designing and making to warrant inclusion under the CDT 'umbrella'. Its methods of teaching and general ethos are towards Physics and as a replacement for Physics rather than CDT, which tries to complement the work.

Another syllabus which was classified as part of CDT is the Oxford Delegacy of Local Examinations (Oxford) Industrial Studies. This very broad syllabus includes knowledge of materials and industrial processing, but does not require any applied work in this field, and although it looks at industrial design from a theoretical view it does not expect candidates to actually do any design work. It is principally concerned with financial aspects of industry and is more closely related to Economics and Business Studies and thus it could not claim to be part of CDT at 'A' level.

Therefore, in looking at the remaining list of 30 syllabuses in 1984 and analysing the figures, two further titles must be removed from the list. They are the Cambridge - Geometrical and Building Drawing syllabus, which is only examined in November, primarily for overseas students - all figures shown are for Summer examinations only, and the Cambridge - Technical Graphics which is part of the list but will not be examined until 1985.

The total entry in 1984 was 5,782, which gives an average entry of 206 candidates per syllabus. What is perhaps more significant is that two syllabuses had less than 10 candidates, Oxford Design and Technology in Metal and the Welsh Joint Education Committee (Welsh) Craft and Design in Metal. However, figures appear more alarming when it is recognised that exactly half the syllabuses had less than 93 candidates, thus the waste of resources becomes apparent as well as the lack of viable numbers to realistically standardise performance. In Chapter 7, table 7, the numbers in other subjects are shown and it is significant that in Physics there are nine syllabuses at 'A' level with every one called Physics except one which is called Physics (Nuffield). The average syllabus entry in 1983 was approximately 5,400 candidates. History which has fourteen 'A' level syllabuses uses only seven titles and they are all 'History' plus an endorsement. In 1983 these had an average syllabus entry of 2,975. CDT had 30 syllabuses with 26 different titles. There is only one other area that has more syllabuses and that is Mathematics, which has 33, but it had 69,364 entries in 1983 giving an average of 2,101 candidates per syllabus. The 33 syllabuses in Mathematics also include Further Mathematics and there are 27 different titles, but it is significant that all have the word Mathematics at the start of the title except for Further Mathematics. Most have an endorsement to follow the title. English, by contrast, has twelve syllabuses with five different titles and an average candidature per syllabus of 5,685 in 1983. More detailed figures of subject entries in 1983 can be seen in Table 7 in Chapter 7. However, in looking at the current position, the plethora of syllabuses totally confuses the positive promotion of the subject area. It is not only the number of syllabuses but also the range of titles. It is ludicrous for an area of the curriculum with very low numbers and an urgent need to project a clear image to improve its acceptability, to have only one less subject title than Mathematics which has the largest subject entry (12 times that of CDT) and at least that subject uses Mathematics or Further Mathematics to prefix the various endorsements in the titles. The current position leaves the subject immensely weak and undoubtedly stifles acceptability.

It could be argued that the above analysis includes syllabuses which should not be included as part of CDT. In an ideal world it would perhaps be appropriate to cast aside the many subjects that are on the list which do not have a design element, or a technology element, or that do not carry words like, design, craft and technology in the title. Such action is perhaps needed; however, while these syllabuses continue to run, there is no doubt that the general public and educationalists will continue to assume they have something to do with CDT and, by implication and/or association, will undoubtedly lower the status of the subject. The SEC must

take action as part of its role with Boards to reduce the 'clutter' from the examinations field in CDT. It would be a valid exercise to remove all syllabuses with candidate numbers below 350. Obviously, it is wise to allow new syllabuses to start with lower numbers but any syllabus which has run for more than five years with less than 350 candidates could be stopped. The idea of using 350 candidates is somewhat arbitrary but based on the notion of providing sufficient evidence for some form of norm referencing of results. This would not prevent the use of common titling with an endorsement as in History and Mathematics.
Thus the current position over titling and number of syllabuses is most unsatisfactory, and in urgent need of attack. The creation of the National Criteria for GCSE is likely to vastly reduce the number of syllabuses and titles at 16+ and this may enable more radical changes at 'A' level to be made. This together with the SCUE/CNAA report should provide more leverage than in the past.

In analysing the current position it would be inproper not to identify subject trends. In Chapter 3, Table 1, the number of CDT 'A' level passes is shown to rise and then fall between 1965 and 1970 while Mathematics had a significant increase. In 1970 the Craft and Drawing syllabus had 3,897 candidates compared to 43,469 in Mathematics, which gives a ratio of one CDT candidate to 11.15 mathematics candidates. In Table 3, it is significant that the figure for 1983 has become slightly worse with one CDT candidate to 11.95 mathematics candidates. Mathematics has grown slightly compared to other subjects at 'A' level but the conclusion must be drawn that in overall terms the whole of the Craft, Design and Technology field has not made any increase in candidate entries; if anything, it has been reduced despite all the new syllabuses and curriculum initiatives. It may, however, be too early to show significant improvement yet, as education moves very slowly in its reaction to change.

In 1970 the CDT area had some 3,897 candidates with 30% doing metalwork and woodwork and 70% doing technical drawing. Table 3 shows that by 1983 only 3,159 candidates took technical drawing which is an increase of only 16% while mathematics increased by 59% and the workshop/studio area increased by 123%. However, more significant are the figures for 1984, where numbers taking technical drawing actually fell by 393 or 13%, while workshop/studio activities maintained their steady growth. In 1984 the Technical Drawing and workshop/studio activity had almost equal numbers of candidates entering, a significant change in light of the 70:30 ratio in 1970. This appears to enhance the views in the National Criteria for GCSE where the drawing work of CDT is given a design dimension and has the same aims and objectives as Technology and Design and Realisation.

TABLE 3

Comparison of Technical Drawing entry patterns with Workshop/studio based CDT and Mathematics

	TD	Workshop/Studio	Total CDT	Maths
1970	2713	1184	3897	43469
1983	3159	2645	5804	69364
1984	2766	2734	5500	71200

Source: Collation of Boards published figures

The move towards Design and Technology was shown in Chapters 2 and 3 and clearly comes from developments in the workshop/laboratory area of the subject rather than the drawing office. Therefore, in identifying the areas, the classification is best placed in two sections;- those traditional single material, craft-based syllabuses and those design-based syllabuses. There are nineteen syllabuses which enter the classification and the following table puts them into the two sections (Table 4).

TABLE 4

Craft, Design and Technology Syllabus Classification

Single Material Craft-based Syllabuses	Design-based Syllabuses
Engineering - Oxford	Design - Oxford
Metalwork (Design and Technology in Metal) - Oxford	Elements of Engineering Design - Camb
Woodwork (Fine Craft and Design in Wood) - Oxford	Technology - Camb.
Woodwork - Camb.	Craft, Design and Technology -Camb.
Metalwork - Camb.	Design, Communication and Implementation - AEB
Design and Craftwork - Metal - AEB	Design - JMB
Design and Craftwork - Wood - AEB	Design and Technology - London
Metalwork - JMB	Design, Craft and Technology - Welsh
Woodwork - JMB	
Craft and Design - Metal - Welsh	
Craft and Design - Wood - Welsh	

Thus, when the figures for these subjects shown in Table 5 are displayed they show a series of trends for the subject. In 1974 there were almost five students taking single material craft-based 'A' levels for every one taking a design-based 'A' level. Eleven years later, for every candidate taking a single material heavy craft-based subject at 'A' level there are

TABLE 5 'A' LEVEL STATISTICS IN CRAFT, DESIGN AND TECHNOLOGY (Source: Collation of Boards' published figures)

BOARD	SUBJECT TITLE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Oxford	Design	65	99	132	190	243	248	321	397	478	592	642
	Engineering	92	83	73	92	76	87	74	101	135	91	92
	Metalwork(*now D & T in Metal)	85	98	79	97	74	63	54	62	62	28	* 9
	Woodwork(*now Fine C & D in Wood)	101	94	75	117	70	68	42	75	92	61	*56
Cambridge	Elements of Engineering Design	58	52	58	46	87	91	106	101	123	103	104
	Metalwork	89	52	54	64	56	42	40	40	44	49	56
	Woodwork	79	45	42	56	49	41	55	59	51	42	54
	Technology								8	29	63	151
	Craft, Design and Technology										17	40
AEB	Design and Craftwork - Metal	90	94	108	120	99	90	68	57	55	50	38
	Design and Craftwork - Wood	146	138	147	164	148	117	95	69	68	98	79
	Design, Communication & Implementation								5	17	42	40
JMB	Design							69	145	238	414	421
	Metalwork	220	172	151	170	164	113	116	103	73	90	68
	Woodwork	215	193	218	180	179	127	113	84	97	99	71
London	Design and Technology	130	182	234	321	386	398	429	452	552	623	646
Welsh	Craft & Design - Metal	53	53	52	46	36	27	29	24	18	17	7
	Craft & Design - Wood	65	64	69	65	54	51	67	35	48	44	28
	Design, Craft and Technology				10	24	19	32	55	63	122	139
Totals	Single Material Craft	1235	1086	1068	1171	1005	826	753	709	743	669	558
	Design	253	333	424	567	740	756	957	1163	1500	1976	2183
	Overall	1488	1419	1492	1738	1745	1582	1710	1872	2243	2645	2741

four students taking a design-based 'A' level. In light of the somewhat conservative nature of schools, this is a most significant change-over, because the change has been relatively smooth. Figure 5 shows the change in graphical form. This graph shows that 1980 was a significant year in that it was the first year that the design-based 'A' level exceeded the single material, craft-based candidates. Since then, the difference has increased rapidly.

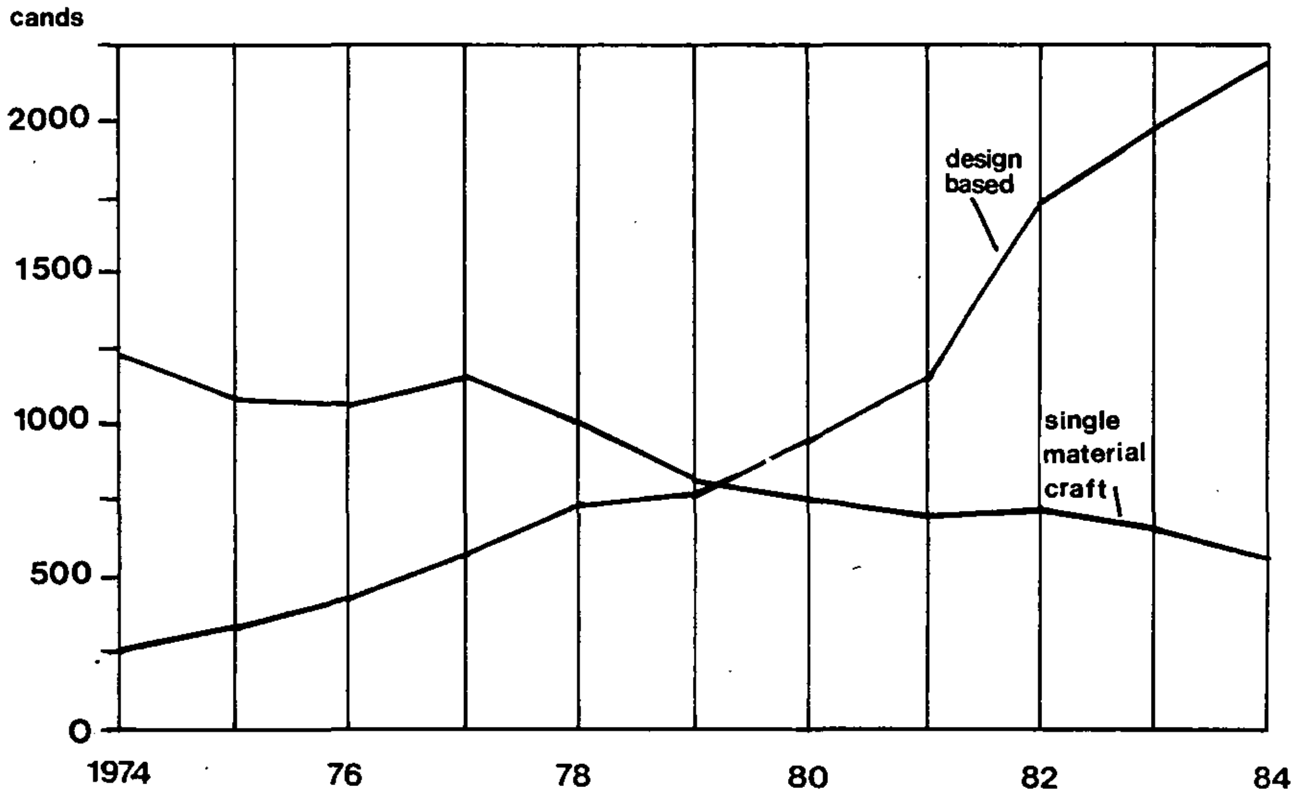


FIG 5 - Graph showing the growth in number of candidates taking design-based 'A' levels and the decline in numbers taking single material, craft-based 'A' levels.

In 1984 there were only 558 candidates for single material craft based 'A' levels using eleven syllabuses, giving an average syllabus size of 50 candidates. Surely this must be uneconomic. The design-based 'A' levels have 2183 candidates using eight syllabuses, giving an average syllabus size of 264 candidates. The growth in the combined single material craft and design-based 'A' level examinations has been somewhat erratic during the decade 1974 to 1984 as shown in Fig 6. The years 1977, 1978 and 1979 show a platform and then a decline but since 1979 the growth has been impressive with increases of 8%, 10%, 20% and 17% respectively, but in 1984 the increase was less significant, only 4%. This latter drop may be a result of the declining number of school sixth-formers which now exists in the North of England.

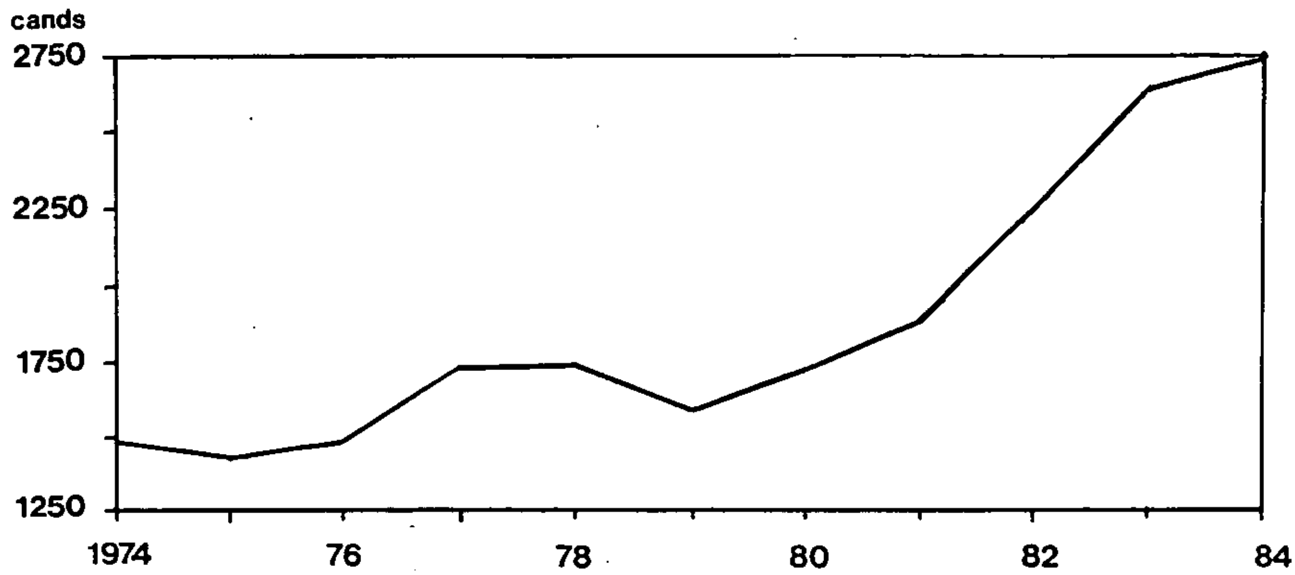


FIG 6 - Development of single material Craft and Design based 'A' levels..

Another factor of some interest is to see if there has been any significant decline in woodwork as opposed to metalwork or vice versa over the eleven year period. The graph (Fig 7) clearly shows an almost uniform reduction in wood and metal based syllabuses over the period. The prediction regarding these graphs clearly shows that single material, craft based 'A' levels are in decline relatively uniformally and their existence beyond 1990 must be very doubtful if the current trends are projected.

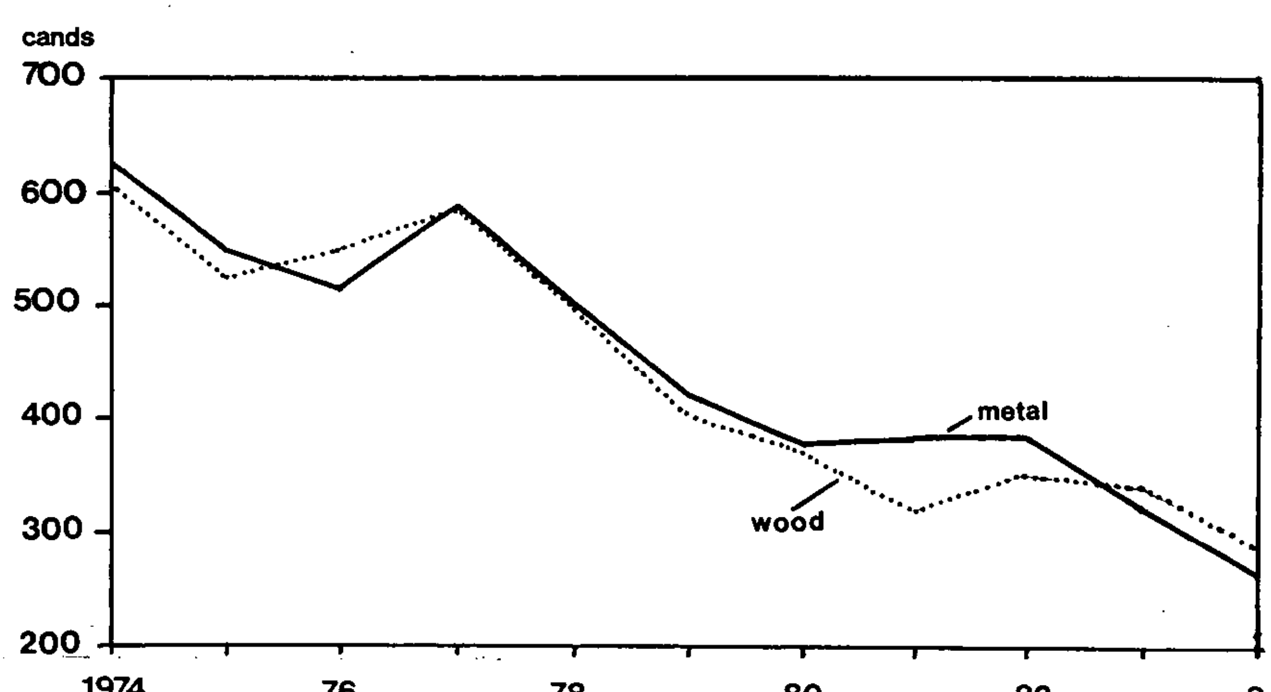


FIG 7 - Decline of metalwork and woodwork

There are two other factors of some signficance in this field although, as previously described, they are not part of CDT at 'A' level. These factors surround 'A' level Engineering Science and Electronics. In Chapter 2 the investment in the 'A' level Engineering Science Project was shown to be very considerable with backing as an alternative to Physics, and many Engineering Departments of Universities heavily supporting the development. Thus it would be reasonable to assume that fifteen years later this development would have flourished and Engineering Science would now be playing a significant part in the 'A' level curriculum. However, this has not been the case, and Table 6 shows its development alongside the development of Electronics.

Table 6	Year	Engineering Science	Electronics
	1969	37	
	1970	84	
	1971	227	
	1972	204	
	1973	281	
	1974	221	
	1975	266	6
	1976	231	58
	1977	332	66
	1978	356	91
	1979	320	167
	1980	335	278
	1981	324	434
	1982	344	593
	1983	332	677
	1984	250	802

Although Electronics at 'A' level received considerable support from the Institute of Electrical Engineers and Essex University, it has not had the same support from the universities as Engineering Science.

The graph in Fig 8 clearly shows Engineering Science has platformed at about 340 candidates in 1977 and in 1984 it dropped, this in spite of the fact that there are three syllabuses. AEB and JMB had syllabuses since its inception in 1969 and in 1978 London introduced its own syllabus. The AEB was the only Board to have an Electronics syllabus up to 1984 when Cambridge introduced a syllabus. It is difficult to establish clearly why Engineering Science has not developed enough to have a larger entry. One significant reason may be that it is too closely related to Physics and more difficult to teach or it may be that it is not sufficiently interesting to pupils for them to become fully involved. Another reason could be that the term 'engineering' still has the 'oil and dirt' view in the academic world of 'A' levels. Certainly to teach Engineering Science at 'A' level a school would require a suitably qualified engineer on the staff to assist the Physics staff. The demands on Physics staff are very considerable and there are few schools with surplus teaching time available in the Physical Science area. Thus expansion of the curriculum is difficult and Headteachers are concerned about introducing 'A' levels which cannot be continued should a specific member of staff leave the school. It is however surprising that the subject has not been successful in tertiary education where engineers and scientists work closely together, although 89% of entries in 1984 were from Further Education.

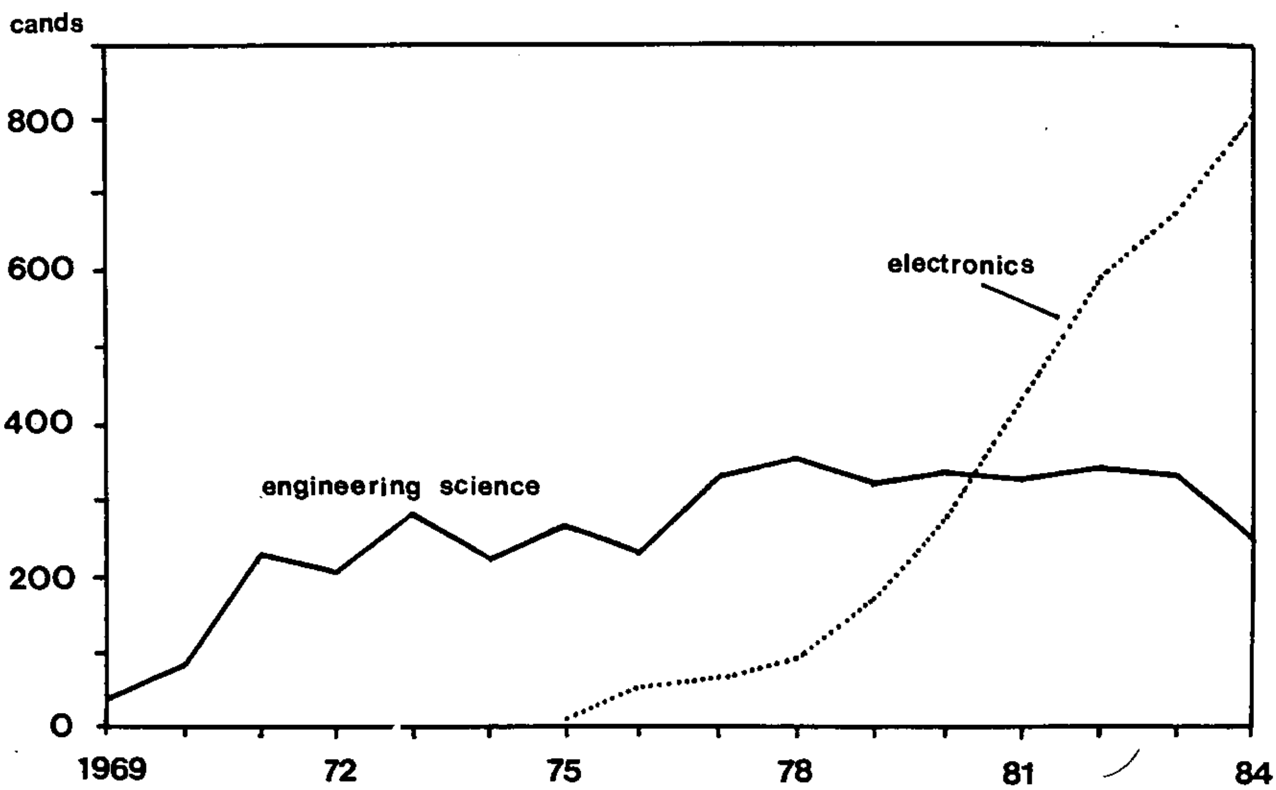


FIG 8 - Candidate entry pattern in Engineering Science and Electronics.

In looking at Electronics at 'A' level, this is obviously an attractive subject for many 'A' level students who see it as a highly relevant subject and as a passage to a future career. It is particularly popular in Further Education colleges and should continue to develop in a similar manner owing to students perception of it as a relevant and useful subject, despite the Standing Conference on University Entrance (SCUE) having negative views on Electronics, which are given later in this chapter.

In concluding this section on the statistical analysis of trends in CDT 'A' levels it becomes clear that Design-based 'A' levels are going to be the way forward and the Craft 'A' levels will do well to survive the 1980's.

The area of Technical Drawing and Graphic Communication remains difficult to appraise. It is beginning to drop in entry terms but it remains a relatively easy, cheap subject to teach and one where success is comparatively easy to determine owing to its ability to be highly structured. The HMI discussion document and GCSE changes will probably enhance the decline. This is not to reduce the need for drawing which will always remain a vital component in design education, but there is little doubt that the level of graphic communication in some Design and Technology syllabuses is so high that it virtually subsumes some graphics syllabuses.

The 'A' level Technology Cambridge syllabus is likely to become a significant force in the next three years as the National training programmes organised by British Schools Technology are undoubtedly geared to that syllabus at present. However, one factor which must not be lost is the current work of the three Engineering Science panels on AEB, JMB and London who have all decided to try and develop an 'A' level in Technology. This has grave dangers in that they may reproduce Engineering Science syllabuses under the guise of Technology. The demise of Engineering Science is obviously going to take place and despite some criticism, 'A' level Electronics is likely to grow rapidly.

External Views on CDT at 'A' Level

In Chapters 2 and 3 the background to CDT was shown and clearly indicates that although CDT was gradually beginning to be recognised as having some educational value and industrial significance in educating pupils, in mainstream education it fulfilled a very minor role; and thus, the views expressed about its acceptance at 'A' level were very rare until the late seventies when a series of statements began to be made and which have continued to the present time.

The first significant comments concerning the subject's acceptance were published in Schools Council Examinations Bulletin 26, Engineering Drawing at GCE 'A' levels. In the section entitled 'The state of the subject' pages 10 and 11, there are several comments. Initially this section suggests that 'A' level Technical Drawing may be slightly less demanding than some other subjects and that 'almost without exception' the Universities declined to accept a pass in Technical Drawing as one of the two qualifying 'A' level passes for entrance purposes. However, several Universities saw the subject had some relevance and one University lecturer remarked that it was the pedestrian approach to the subject and the method of using the material which debased the subject. In conclusion, this section stated:-

'The situation, therefore, is that although the subject has grown in popularity with schools and pupils, it carries little weight as a qualifying subject, and even in schools it is often regarded as a "soft option" compared with a foreign language or a full science. Among professional engineers there is some disquiet that a subject with such a low status should carry the adjective "engineering" in its title.'

This latter point about devaluing the status of engineering cannot be overlooked as it was raised again in the Finniston Report as a recognisable problem concerned with improving the recruitment of professional engineers. Thus in 1969 Handicraft's most popular subject 'A' level Engineering Drawing (70% of total entry) was heavily criticised and lacked any real acceptance at 'A' level. The association of the subject of theoretical value to engineering having low status in schools and devaluing the engineering profession could, however, be over emphasised as the engineering profession itself was held in very low esteem amongst other professions.

In the early 1970's Handicraft changed to Technical Studies and syllabus changes at 'A' level took place and this lead to pressure being exerted on SCUE to make recommendations about acceptance. On 22 March 1977 SCUE recommended to Universities that those 'A' levels incorporating elements of design should be given full recognition for the purposes of the general entrance requirement. The list was as follows:-

AEB	Design and Craftwork (Metal) Design and Craftwork (Wood)
Cambridge	Elements of Engineering Design
JMB	Craft (Design and Practice)
London	Design and Technology
N Ireland	Graphics Communication and Technical Design
Oxford	Design
Welsh	Design, Craft and Technology

Thus some recognition was made of design-based syllabuses and this provided considerable encouragement in the field. The recommendations were for general entrance requirements which is all SCUE is concerned with. However, closer scrutiny showed the list to have weaknesses which cannot be overlooked. The list contained some subjects which were unsuitable for such acceptance in terms of design education. For example, the AEB syllabuses were really nothing more than Metalwork and Woodwork and the JMB syllabus, as mentioned before, was concerned with Theatre Craft not CDT. However, everyone in the CDT field welcomed the list as a basis for further developments.

In 1978 the Design Council held a Seminar at the Royal Society of Arts in London called 'Design Examinations at Advanced Level: Their Relevance to Tertiary Education and Industry'. This was a key event because it clearly brought to the debating room many experts in the field from Examination

Boards, Universities and Schools. One of the most controversial speakers was Professor M J French from Lancaster University, Department of Engineering. In the report of his speech, he referred to the subject having little reliability as an indicator of design talent. He also considered that the subject did not compare with other subjects so, for example, a Grade A in Design may only be the equivalent to a Grade C in Physics. However, his final remarks were very condemning and are taken here from the report.

> 'Professor French felt that the courses at present could do as much harm as good to the design cause within engineering, and he identified it with lack of rigour and with low standards. They seemed to him to lack sufficient intellectual demands.'

Such statements naturally provoked considerable comment. Geoffrey Harrison commented upon the mismatch between what industry claimed to want and the demands of Universities. Industry wanted applications whereas Universities appeared only concerned with pure knowledge. Mr H Wassell, Managing Director of Marconi in Chelmsford criticised narrow 'A' level Electronics, but saw a place for design courses; however, he felt that the knowledge base for the subject needed defining. He saw Design courses as useful in motivating pupils. The over-riding view of the seminar was that CDT had not made as much progress in the level of acceptability as one had thought at the time. However, the Design Council supplemented the report with some post seminar comments from the participants. Interestingly, Professor French wrote much more positively about Design courses and their use than he had spoken about them but again stressed the need for a common core of knowledge. He saw Mathematics and Physics as essential for engineering but design courses could comprise a third 'A' level. He went on to plead that design courses should be targeted slightly broader than Engineering Design. Professor Allanson, Birmingham University and Executive Member of SCUE stated that the CDT areas should not be so pessimistic. Acceptance takes time and attitudes were beginning to change. He felt that Design did not deserve special status in University Entrance but it did have value. Courses must not place too much emphasis on academic excellence and they should not claim too much universality. However, there was a need for rationalisation and some common core. Professor M W Thring, Department of Mechanical Engineering, Queen Mary College, University of London felt very strongly that everyone, whatever his/her ultimate career, should learn design at school because it is an essential part of education for a complete person. He went on to state:-

> 'The intellectual aspect of design is to be able to pick up the critical factors in order to calculate them and to synthesise the various aspects of the other designs ...'

The seminar report carries further statements and comments criticising and praising design at 'A' level. However, it is clear that the debate on design 'A' levels was starting to be fully aired.

The next significant development came in December 1979 with a letter from Professor Parnaby on behalf of the Northern Universities' Professors in Mechanical Engineering (See Appendix B). This letter was sent to all schools in England and Wales and caused great annoyance to those in the field. Parts of this letter have been quoted in Chapters 3 and 6, its main argument being the promotion of engineering science at the expense of design-based courses. Figures shown earlier in this chapter clearly show that this letter has not helped the development of engineering science, and how much it has inhibited the growth of design-based courses cannot be determined. In light of the criticism attached to this letter it is appropriate to look closely at this criticism. Firstly, the Northern Universities' Professors were accused of basing their judgements on insufficient evidence as they did not seek information from the Boards. In fact, they failed to even mention the syllabus with the largest candidate entry, London's Design and Technology. They appear to have ignored the SCUE views of 1977 and they put forward the view that Design cannot replace Physics or Mathematics for Engineering. However, research would have told them that no-one was suggesting this. The Professors' prescription for a third subject was to encourage the broadest possible education and develop creative and other abilities. In passing, they recognised the educational value of open-ended project work but went on to recommend a language or economics. They did not feel design had anything to offer against these broad criteria but would accept Engineering Drawing. Such views seriously undermine the value of the letter and bring their integrity into disrepute. It is ironic that at the same time as the letter was published, the Finniston Report was being published and it placed doubt about the appropriateness of University engineering courses. Perhaps the entry requirements were suited to outdated courses.

The outcry about the Parnaby letter resulted in a response in July 1980 from Professor B Cole from the University of Leeds (See Appendix C). This letter partly rectified the situation but its posting to schools in July lost some of its impact. It is significant that within seven months a group of professors could change their views so much, although in Section 3 of the letter, considerable prejudice and misunderstanding still remained, particularly with reference to project work and its assessment. The Cole letter appears to have played little significance other than to slightly calm the storm.

The Parnaby letter certainly stimulated HMI, LEAs, Association of Advisers of Design and Technical Studies and the Design Council to improve the level of acceptability of Design-based courses and to communicate what CDT was all about. This stimulant was very useful and has lead to increased acceptance of CDT at 'A' level.

In 1980 considerable discussion and response was taking place on the Finniston Report and at the National Conference on Education and Training in October 1980, the need to implement Finniston in schools was widely discussed and emphasis placed on developing Craft, Design and Technology in School and improving its status. John Mann, Secretary of Schools Council pointed out that 'there is curiously little esteem for designing and making in school at the present.' However, Dr Parker of the Council for National Academic Awards (CNAA) stressed:-

> 'the need for technical subjects in schools to be enhanced in effect and rating, in order that they could be properly used at the point of selection to higher education engineering courses and thus improve the matching between school and tertiary education.'

It is significant that in its written evidence to the Conference, CNAA made the following statements:-

> 'Present school curricula do not always encourage pupils to develop their creative potential and often fail to identify that potential Degree courses in Engineering are not long enough to be able to do other than align themselves solely to 'A' levels in Mathematics and Physics.
>
> This mismatch between school and higher education must be corrected.
>
> Schools should foster creativity (technicacy) as well as 'A' level Mathematics and Physics and B Eng courses should recruit on the basis of creative talent as well as the usual 'A' level performance and must be longer than traditional courses; for synthesis and design take time.
>
> There should also be a place for some B Eng courses with a greater emphasis on creative talent and a somewhat reduced reliance on Mathematics and Physics.
>
> The point is that the full range of Engineering disciplines and degree courses is a wide one and in some measure entry qualifications must reflect course requirements; hence there must be a spectrum of entry qualifications from Mathematics and Physics through to high creative talent. And degree courses must match their own entry qualifications.
>
> Thus, whilst all 'A' level pupils should be strongly encouraged to continue with Mathematics and Physics, both to 'O' level and 'A' level, the "Crafts, Design and Technology" subjects should be raised in status and made attractive both in schools and by the attitude of polytechnics and universities in the admissions policies for degree courses in Engineering. 'Craft, Design and Technology' or some development of that subject as 'Design, Technology and Applications' for example, should have greater standing and acceptance as a basis for degree courses in Engineering. To that end, it should be uprated and made attractive to able pupils.
>
> There is a need to ensure that courses such as 'Craft, Design and Technology' are not undertaken at a late stage when pupils have shown signs of weakness in subjects often felt to be more 'academic'.
>
> An uprating of creative (technical) subjects in schools, matched by their acceptance for entry to higher education, postulates good teaching.'

Thus CNAA can be seen to be providing considerable support at the same time as some Universities are taking a somewhat negative approach to acceptance.

Mr Graham Bevis, Chief Examiner for 'A' level Electronic Systems and now National Co-ordinator for the Control and Electronics domain within the Microelectronics Programme wrote in 1981 about acceptability in Electronics Systems News:-

> 'I must emphasise that I am not advocating that Electronic Systems be regarded as a substitute for Physics. It cannot be that, as it is quite a different subject. It is significant that the Finniston Report suggested that Higher Education should stipulate only Mathematics as a faculty requirement for Engineering.'

The view which Bevis gives regarding replacing Physics is one which most people in the CDT field hold, although many would agree with the view that the only requirement should be Mathematics. One of the reasons many Engineering Professors have attacked CDT 'A' levels is that they have felt, on occasion that they were being suggested as a replacement for Physics; this is borne out in the Parnaby/Cole letters.

In 1981 Durham County Council published 'Craft, Design and Technology - A Review of GCE 'A' level Examinations; their content and their acceptability' The foreword was written by Malcolm Deere, former University Lecturer in Mechanical Engineering and then Chief Examiner Oxford 'A' level Design, and he stated:-

> 'It is clear that the acceptability problem is far from solved. The process may be long and even difficult, but one needs to persevere. One of the worst frustrations in education is that it is very hard to prove that you are right, and harder still to prove that the others are wrong; one has ultimately to have recourse to one's inner convictions. On that score, our position is not really weak. We know that Design is demanding, and it is very much in alignment with the country's needs and problems.'

This Durham Report carried out a series of surveys principally concerned with London Design and Technology and it concluded that there was a very good level of acceptance from both universities and polytechnics in 1980. The following list of universities shows the range of general acceptance.

Aston	Essex	Salford
Belfast	Exeter	Sheffield
Bradford	Glasgow	Southampton
Bristol	Lancaster	Stirling
Brunel	Leicester	Strathclyde
Cambridge	Liverpool	Surrey
City	London	Sussex
Dundee	Loughborough	Wales
Durham	Nottingham	Warwick
East Anglia	Oxford	York
Edinburgh		

The only negative replies were received from Keele and Newcastle, although Newcastle had the matter under review. Following this review, the University of Newcastle wrote to all technology advisers stating that the following syllabuses were acceptable for matriculation to the Faculty of Engineering:-

Design (JMB and Oxford)
Design Communication and Implementation (AEB)
Design and Technology (London)
Elements of Engineering Design (Cambridge)

It is significant that Cambridge University replied 'This subject is approved for purposes of matriculation at Cambridge'. Other evidence in the Durham report showed a sound level of acceptance for the subject, although it is merely at the general matriculation level. In Chapter 10 the actual level of current acceptance will be shown.

On 18 March 1981 the Civil Service Commission finally accepted London 'A' level Design and Technology for entry to Executive Officer posts following a four year fight with the Civil Service. This clearly shows that patience eventually is rewarded when fighting for acceptance.

In 1981 Mal Evans, Head of Design and Technical Studies at Orange Hill School wrote to Mrs Thatcher (Prime Minister) about the difficulties of acceptance for 'A' level work in his school. Mrs Thatcher replied on 16 March 1981 pointing out the Royal Charter under which universities operate and how she could not directly interfere. However, she felt that students were not now handicapped by offering a design based 'A' level, as one of three, when applying for University and in the future she expected the level of acceptance to be improved.

In the early 1980's the Industry Education Unit of the Department of Industry helped fund many initiatives, some as pilots for the TVEI Scheme. In 1982 Dr E Bates, Head of the Unit wrote the following about the 1984 London Design and Technology syllabus:-

> '.. it seems to be an imaginative course which attempts to introduce a modern and relevant approach to the teaching of design and technology.
>
> Both the breadth and depth of teaching that must underpin this syllabus augurs well for the benefit of the pupils ...
>
> I hope that the exclusion of the word 'Craft' will help to raise the esteem of the course in the eyes of the higher education sector.'

This shows acceptance by the Department of Industry and its recognition of the dangers involved in using the word 'craft' at 'A' level. This has lead to a considerable amount of promotional work for 'A' level design and technology.

Following the publication of the Design Council Report 'Design Education at Secondary Level', representation was made to the Engineering Professors about acceptance. At the Engineering Professors' Conference held at Loughborough in March 1982 the following statement was agreed:-

'The present requirements for entry are as follows:-

a good pass in Mathematics
a good pass in Physics or Engineering Science
a good pass in a third subject (Chemistry for those intending to enter courses in chemical engineering).

Most Engineering Departments are willing to accept a very wide range of subjects for the third 'A' level. The conference decided that those 'A' level Design and Technology courses which satisfy the criteria laid down in the recent Design Council Report 'Design Education at Secondary Level' should be acceptable as a third subject.'

Since that statement the Design Council has applied its criteria and determined the following syllabuses meet it:-

AEB - Design Communication and Implementation
Cambridge - Craft, Design and Technology
Cambridge - Technology
London - Design and Technology
Oxford - Design
Welsh - Design, Craft and Technology.

This information was then transmitted to Universities by Professor MacLellan, Department of Engineering at Leicester University, Chairman of Engineering Professors' Conference in December 1983. Also in 1982 the Association of Advisers in CDT gave a presentation to the Standing Conference of Heads of Departments of Mechanical and Production Engineering in Polytechnics. This resulted in the following statement being made to all Polytechnic courses and it is now part of the handbook.

'CDP Courses Handbook

Draft comment to fit in at the head of the BSc Mech and Prod section (ie before the Brighton entry, to apply generally):-

Polytechnic departments are glad to give individual consideration to applicants. In particular, the Standing Conference of Heads has given warm support for the development of Design and Technology teaching in schools which stimulates early motivation towards the interest of engineering. Some of the syllabuses appear to them very acceptable as alternatives, as well as additions, to Engineering Science or Physics, alongside Mathematics. Any of the departments listed below would be glad to discuss sympathetically the position of applicants studying towards these qualifications.

CDP Courses Handbook

Comments to go at the head of the Mech and Prod section of the Higher Diploma part (and I suggest the Electrical and Electronic part as well):-

Polytechnic departments are at present planning replacement Higher Diploma courses to start in 1984 (or earlier) after the last intakes into the Higher

National Diploma courses in the areas of Mechanical, Production and Electrical Engineering. They will cater for a similar level of entry qualification. Design and Technology subjects may lead to these Higher Diplomas as well as to degree courses.'

Such statements obviously greatly enhance the acceptance of Design based 'A' levels for CNAA courses, although much ground work still remains to be done.

Thus it would be easy to conclude that by late 1983 the level of acceptability had grown significantly from the low period of late 1979. In 1983, Dr K Miller, Director General of the Engineering Council made a key speech at Birmingham, where he welcomed the universities' recognition of 'A' levels in Design and Technology and put the Engineering Council's full weight behind the development of design and technology (See Chapter 4).

In 1984 CNAA, on behalf of SCUE/CNAA commissioned Mr P Trelfall, former lecturer in Mechanical Engineering at Bristol University, to develop a core syllabus in GCE 'A' level Design and Technology. This work by SCUE/CNAA appears to give recognition to design and technology,but clearly they felt that the subjects needed better definition, thus giving improved reliability between Boards. In 1984 the Secondary Examinations Council began its new 'A' level sub-committee and this gave a degree of acceptance to the subject, especially as the committee was chaired by Lady Parkes, Press Council Member and a senior SEC council member. The SEC also saw the need for a clear image for the subject and therefore it set out to develop criteria for the subject area.

Thus 1985 began with a sense of confidence that the level of acceptance was improving amongst Headteachers, Universities and Polytechnics, parents and pupils. However, on 27 April 1985 Brian Heap launched his Degree Course Offers 1986 with the resulting Press Report 'Dons rule out 12 'A' level subjects' - Daily Telegraph 29 April 1985. The twelve subjects were:- Sociology, Law, Home Economics, Art, Music, British Government and Politics, Communication Studies, Religious Education, Ancient History, General Studies, Economics and Computer Studies. This was encouraging for CDT as it did not mention design and technology. It is true that many of Brian Heap's statements are not included in his book and those that are provide scant evidence upon which to base such statements. However, on 17 May 1985 the Committee of Vice Chancellors and Principals and the Standing Conference on University Entrance produced a pamphlet entitled 'Choosing 'A' levels for University Entrance'. The Press Report in the Daily Telegraph on this was inaccurate but very damaging to design and technology. The article headed 'Black list of 'A' levels for University Entrance' on 18 May 1985 claimed the pamphlet broadly endorsed Brian Heap's view. It stated:-

'In general, sixth formers who want to get into university should steer clear of 'unconventional' 'A' levels like computer science, electronics, design and technology, human biology and home economics and stick to traditional ones like mathematics and physics, say the committee.'

This Press release caused great concern, particularly in light of the Government's own commitment to the practical applications subjects such as design and technology as developed under the TVEI schemes. However, it is necessary to study the pamphlet itself rather than the damaging press article. The following reference is made to design and technology, in the section 'The third 'A' level: Some examples'. With reference to engineering:-

' ..up to 25% of candidates gain places outside the traditional Mathematics, Physics and Chemistry. In some cases this will be Biology but equally the subject can be one which enables you to demonstrate interest and proficiency in the practical applications of science, for example Computer science or Design and Technology.'

That statement is hardly placing Design and Technology on a Black List. The SCUE pamphlet states the following under Practical and Vocational subjects.

'If we take the least acceptable category, it is better not to choose subjects which predominantly involve practical skill. There may be cases where an admissions tutor will accept Geometrical and Technical Drawing or Graphic Communication, as the third 'A' level, but they are rare. In general you should not regard these subjects as leading towards university. This is also true for the various 'A' levels which include craftwork in metal or wood ...'

'Design and Technology is the most acceptable subject for combining artistic ability with the understanding and practical application of scientific principles. The subject is increasingly considered to be intellectually demanding in a way that is not true for the craft subjects. While a combination of Mathematics, Physics and Design and Technology is not likely to qualify you to study medicine, veterinary science or chemical engineering, the subject would, as indicated earlier, be acceptable for many departments of civil, electrical or mechanical engineering.

You might think Electronics 'A' level has specific relevance as a preparation for university courses in the same field. But the two 'A' level subjects which are generally considered essential for admission to a course in electronics or electrical engineering are Mathematics and Physics. Electronics is not acceptable as an alternative to Physics. Most admissions tutors will be prepared to accept Electronics as a third 'A' level but it is a common view that a traditional arts subject such as English or a foreign language is preferable on general education grounds.

Computer Science or Computer Studies is now universally considered to be a quite separate subject from Mathematics. It is never required and rarely preferred for admission to degree courses in computer science and is therefore, for the most part, best considered in the third 'A' level category like Electronics.'

This section is very condemning about Geometrical and Technical Drawing and Graphic Communication and in principal says you should not take them if you think you may apply for university. It equally condemns Building Construction, Surveying, Ceramics, Embroidery and Home Economics. With regard to Design and Technology it states that it is the most acceptable subject and shows an understanding that design and technology is different from craft. The exemptions in the paragraph relating to Design and Technology such as medicine, veterinary science and chemical engineering are factual but could well be written about almost any other subject and thus it would appear illogical here to give them the emphasis they are accorded. The whole tone of the pamphlet, which gives emphasis to the negative and then follows with the positive aspects shows the attitude of SCUE/CNAA to this subject area. The report's criticism of Electronics and Computer Studies can be seen to enhance the growth of design and technology. It is sad that the press report was written in such a damaging manner. The pamphlet makes no other comment regarding design and technology and sadly it is left out of the list on the last page.

The current position of CDT at 'A' level is that there is a growth in design-based 'A' levels with the almost total demise of single material craft-based syllabuses. Technical Drawing and Graphic Communication syllabuses have platformed and are beginning to show signs of decline. Electronics is growing rapidly but Engineering Science is in decline. The level of comment supporting CDT is growing despite Parnaby and a few bad press reports of SCUE. However, the messages from SCUE/CNAA and the Northern Universities' Professors are that criteria and common cores must begin to emerge so that the subject has a clear, coherent platform with a sound academic base upon which to build and a means by which it can justify its existence. This tends to indicate that there has been no criteria and no attempt to develop any, but Chapter 6 will evaluate current criteria and Chapter 7 will propose new criteria to assist in the improvement of the level of acceptability. The current position is hopeful and if progress is maintained in the next decade as it has been in the last, the subject may have achieved its rightful place as a viable and worthwhile 'A' level with a first-class level of acceptance for its courses.

CHAPTER 6

EVALUATION OF EXISTING CRITERIA FOR 'A' LEVELS IN CDT

In Chapter 5 the need for increased compatibility between 'A' levels in Craft, Design and Technology (CDT) and the subject's common core base was established. This compatibility is crucial to increasing the level of acceptability and in encouraging able students not to be dissuaded from taking the subject. There is little doubt that as the SCUE/CNAA working party on 'A' levels in Design and Technology (1984-5) stated in its introduction, there is a need to establish a clear identity for the subject with a distinguishable common core. Thus the need for relevant and applicable criteria is crucial to the subject and its level of acceptability.

The following three chapters seek firstly to evaluate existing criteria and their effectiveness, then to propose new criteria which are relevant and capable of application and thirdly to evaluate the new proposed criteria against the old criteria to determine how much change is necessary to meet the new criteria.

This chapter is concerned with investigating the bodies which are responsible for scrutinising the Boards to elicit their powers and effectiveness and then to evaluate existing criteria to provide guidance for the development of new criteria.

Scrutinising Bodies

In 1917 the Government recognised the problems of comparability of standards across the various Examination Boards; thus, it set up the Secondary Schools Examinations Council (SSEC). This body remained the co-ordinator and evaluator of examinations until the Lockwood Committee established the Schools Council in 1964. The Schools Council inherited the responsibility vested in the SSEC for GCE 'O' and 'A' level approvals and scrutinies. In 1966, the Schools Council suspended the requirement for the GCE Boards to submit new 'O' level syllabuses for approval; although new subjects had to be submitted, they were not commented upon. However, Schools Council maintained the approval and scrutiny system for 'A' levels. Therefore, with subject panels evaluating syllabuses and carrying out scrutinies throughout this period, a pattern of development in the various subjects could have been expected, so that compatibility between Boards was seen. Unfortunately, a survey in 1982-3 by the GCE Boards in English Literature, Modern Languages, History, Geography, Economics, Music, Mathematics, Physics, Chemistry, Biology and Geology showed these subjects to have little commonality across the Boards. (See Chapter 9). Certainly the CDT field is devoid of a high degree of commonality. In fact, it could be argued that the unsupervised 'O' level examinations have as much in common as the supervised 'A' levels and when one considers 'A' levels, in general, have a more specific purpose, this is not particularly encouraging in terms of showing good educational planning.

Since 1983, the responsibility for scrutinies and approvals at 'A' level has been given to the Secondary Examinations Council (SEC). In the Secretary of State's letter dated 18 May 1983 setting out the work of the Council, he states:-

> 'The Secretary of State for Wales and I envisage that the Council will need to undertake a broad range of tasks in order to discharge these important responsibilities. These tasks will include, the scrutiny and approval of new syllabuses proposed at GCE 'A' level and of revisions to existing syllabuses along the lines of the annual programme which has been carried out for many years.'

Thus the Secondary Examinations Council has a similar role to that previously held by the Schools Council. When scrutinising syllabuses and examinations, Schools Council was, as SEC now is, working to the following published aims:-

(i) To determine whether the syllabus is both educationally sound and likely to be effective in measuring the stated objective.

(ii) To determine whether, in the judgement of the scrutineers, the examination being scrutinised was fair and effective.

(iii) From such evidence as is available, to determine whether the grading could be considered to be reasonably accurate, having particular regard to the need for comparability with other examinations under the same or a similar title.

(iv) To provide suggestions to the Board on ways of improving its provision of 'A' level examinations in the subject.

(v) To identify good practice which is worthy of encouragement and possibly dissemination.

(Source: SEC 1984)

Thus a scrutiny of a Board's examination could create an effective means of assessing how that examination is functioning. But in CDT, the diversity of the syllabuses, as shown in Chapter 5, clearly indicates that (ii) and (iii) are very subjective, and therefore discussion between Boards and the scrutinising body can easily degenerate into being a matter of opinion. The effectiveness of such procedures can only be provided if the scrutiny committee has written criteria upon which to base their judgements. The problem of gaining approval for syllabuses is equally difficult; certainly the legality of whether a Board can do what it wants, despite the views of Schools Council or SEC, appears never to have been put to the test. In setting out the terms of reference for 'A' level syllabus approvals, SEC states to the Boards:-

> 'Committees will be empowered to accept revisions, subject to written confirmation by the Board, at their meeting or, with staff assistance, to continue the dialogue with the Board in order to obtain agreement.
>
> In abnormal cases it might be necessary to refer the matter to the 18+ General Committee.'

Thus the whole procedure is a working together between the Boards and the scrutiny and approval body. The need for the Boards and supervisory body to communicate their criteria is considerable, if Boards are not to bring forward syllabuses, which do not meet the aspirations of those empowered to vet that work.

In CDT the need for guidance or criteria on future 'A' levels has been recognised for many years and there have been several attempts to create acceptable criteria. Some have emerged from letters and statements and some from official working parties.

Engineering Drawing at GCE 'A' Level

In 1967, the Crafts, Applied Science and Technology 'A' level sub-committee of the Schools Council agreed to set up a working group to consider advanced level examinations in Technical Drawing. The philosophy of the subject, the purpose and status of the examinations and the need for changes were included in the terms of reference. This report, published in 1972 as Schools Council Examinations Bulletin 26, unfortunately had the relationship between Technical Drawing and the developing field of technical and design studies excluded from its remit. It is apparent from the report that this was considered by the working group an unfortunate exclusion, as they specifically draw attention to this point in the foreword. The working group was chaired by Peter Threlfall of the Department of Mechanical Engineering at Bristol University and its recommendations were as follows:-

> 'The subject of engineering drawing involves a range of behaviour from recall of knowledge and manual skills to the more sophisticated process of analysis, synthesis and evaluation. It is suggested that the implementation of the following recommendations will lead to a challenging, coherent syllabus which should considerably enhance the status of the subject:-
>
> 1 A systematic study should be made of the objectives of courses and examinations in 'A' level engineering drawing.
>
> 2 Consideration should be given to reducing the content of syllabuses to enable teachers and examiners to range more deeply in selected topics, thus enhancing the intellectual challenge of the subject.
>
> 3 The classification of cognitive behaviour should be used as a guide for future developments.'

This report did not set up criteria but suggested the development of problem solving skills in terms of both single solution and multiple solution systems through analysis, synthesis and evaluation. It is significant that recommendation two was acted upon by some Boards with project work entering syllabuses but until the 16+ National Criteria were developed, little work on objectives or cognitive behaviour had been considered, although Boards like Cambridge and London had moved their syllabuses towards Graphics. However, Boards like JMB still have in 1984-5 the same syllabuses as in 1967 when the working party started its work.

Handicraft at GCE 'A' Level

In 1973 the Schools Council, Crafts, Applied Science and Technology Committee produced a report called 'Handicraft at GCE 'A' level'. This report was written at a very formative stage in the development of CDT. In Chapter 3, it was shown that the forward thinking members of the profession had moved from departments called 'Handicraft' to Technical Studies and progressive teacher training departments were called 'Creative Design' or 'Design' departments. However, this report was called Handicraft and in truly representational terms at 'A' level that was perhaps accurate. This report identified the steady growth of the subject from 1949 when it was first introduced. It discovered that 'A' level Handicraft students are likely to have taken five or more 'O' levels with English, Mathematics, Physics, Geography and one or more art/craft subjects with modern languages being the most common subject not studied at 'O' level. This report noted the changes taking place at several Boards. In Section 3, 'Present examination structure and movement towards a combined syllabus', a sound case is made which is not significantly different from today, yet Chapter 5 of this report shows the majority of Boards still offering a single material subject. In introducing section 3, the report states: 'a redefinition of the subject is now overdue.' It goes on to identify the central theme of handicraft as 'the artefact and its production; starting from the first stage of need identification, through the design process, the tools/materials encounter to the final evaluation of the finished product against the original proposal. The context of this sequence is essentially practical.' This definition is not distinctively different from the central theme used today, 'design, make and evaluate.' It was perhaps unfortunate that 'the artefact and its production' was emphasised in such a manner and only qualified by design and evaluation skills and processes.

The report identifies the unique contribution to general education of handicraft and goes on to point out the need to study materials in some depth and that associated science disciplines will be brought to bear upon the design problem. Thus the link between applied science and handicraft was emerging, but at this time was seen as principally through knowledge and understanding of materials. This was reflected in the London Board's 'A' level Design and Technology, introduced in 1974. The report stresses the need for practical aspects to be worthwhile and wide ranging, otherwise, it points out, the subject would be 'narrowly operational or vocational.' Sadly, many syllabuses remained 'narrowly operational and vocational' in a somewhat outdated mode and the criticism levelled at Woodwork and Metalwork was their lack of intellectual content. This was justifiable and naturally prevented the growth in acceptability.

The report questioned the need for metalwork and woodwork to run as separate subjects. It felt that the overlap in terms of skills was too great but it identified the following reasons why continuation might be supported. The first was the small school, usually with no metalwork facilities and secondly the fact that many students obtained two passes at 'A' level with Woodwork and Metalwork. The first reason may be viable but only in a small minority of cases. The second is unjustifiable because it undoubtedly narrowed pupils experience too much in the sixth form and the degree of overlap between the two subjects was too great. This narrowness certainly did not enhance the subject's level of acceptability and students leaving for higher education with Metalwork, Woodwork and often Technical Drawing could find few courses except for teaching handicraft. This report expressed concern at the size of groups and the desirability of using combined syllabuses which will then perhaps create larger groups. Furthermore the economics for the Boards would surely be beneficial. In many cases in education, this latter point would have been acted upon, but with the exception of the London Board, those that did develop new syllabuses, did so while maintaining the old ones. The review of the syllabuses in 1972 criticised the single material approach for debarring some solutions to problems because they went outside the defined material; thus it concluded that design was essential for the intellectual elements of the subjects to be present and the unity of design would be better expressed in one examination.

In the report's appraisal, it acknowledged that drawing was playing an increasingly important part in design work, but it made no conclusions about whether Engineering Drawing and the new combined syllabuses should be put together. It may be that such developments were not considered as it was outside the remit of the working party. With regard to developments in electronics, engineering science, project technology et al, the committee identified that the subject was moving steadily away from the acquisition of craft skills rigidly separated into woodwork and metalwork towards a situation of problem solving and consideration of design.

So in concluding the appraisal as seen in 1973, the report stated:-

> 'If the suggestion is really to bring all materials together under one examination title (because they share common ground in "design") then a number of options could provide for some knowledge in depth.'

So the concept of Handicraft as a core plus options was identified as a means of progressing, the only concern being the demands made on the candidate.

Section three of the report was an enlightened piece of work and provided a useful, philosophical platform upon which could be built criteria for the subject. It had identified the core of the subject, possible future trends and a means of facilitating this in an examination.

However, that enlightened view and assessment of future trends requires to be put in the context of the education debate on 'A' levels, which was taking place at the same time as the Q & F, CEE and subsequent N & F proposals.

In 1961 S Wiseman published 'Examinations and English Education' and in the chapter entitled 'Efficiency of Examinations', he stated:-

> 'The syllabus content approach tends to perpetuate ineffective educational practices, it is a reactionary instrument helping to encapsulate method within the shell of tradition and accepted practice.'

The methods of examining and means of drafting syllabuses were frequently under criticism throughout the sixties. G H Bantock in 'Education in an Industrial Society' published in 1963 stated:-

> 'The effect of examinations, for instance, is likely to be a concentration on those aspects of the discipline which are thought to be susceptible to treatment within the temporal and ideological restrictions of the forty-minute question and the three hour stretch. And this is bound up too with the expectations created in the mind of the student as to the conditions relevant to question answering; these can be summed up as the need for a journalistic fluency - the temporal requirement - a state of booklessness - the reliance on memory.'

This was followed in 1965 by Dr B Wilson who, in 'Eighteen plus: Unity and Diversity in Higher Education' was very critical of the learning methods employed and expected by students in University. He wrote:-

> 'The pattern which develops is a process of feeding information to students in lectures so they can feed it back in examinations ... The occupational skill of students ceases to be intellectuality and becomes the ability to pass examinations without being exposed to mental discipline.'

These views show the concern at the content-based curriculum which was just as apparent in Woodwork, Metalwork and Technical Drawing as in other subjects.

However, as more design-based examinations were being developed, which were rather more process-based than content-based, the Examinations establishment had very heavily preconceived ideas and resistance was considerable. There was a gulf between preferred teaching method and the methods necessary to exact a good 'A' level pass. Therefore, the examination was dictating the method of teaching to what the Schools Council Working Paper 20 'Sixth form examining methods' published in 1968, considered to have 'repressive and restrictive effects on education in the sixth form.' This paper also put forward a strong case involving teacher assessment at 'A' level and allowing coursework to have a significant part in determining the pupil's performance.

One of the principal recommendations of this working paper was that syllabuses should be based on aims, with the content meeting the aims rather than being purely content-based. This paper on examinations was not particularly well received by the Examination Boards who disliked the teacher assessment recommendations and generally displayed their traditional responses although they recognised the need for aims. It was against this backcloth in the late 1960's and early 1970's that changes in CDT 'A' levels were being made. Difficulties were experienced in gaining the correct format for examining the subject, and in its recognition, because unconventional means were needed to assess the subject properly. So it is clear that in the early 1970's there was a dilemma in terms of acceptable examining techniques as well as general acceptability in Universities. It can be argued that these two aspects were closely linked as all but one Board, the Associated Examining Board, are directly linked with Universities. This may well have influenced some developments and provided pressures, but one of the most prestigious Boards, Oxford, did allow the 'A' level 'Design' in 1970 to have 60% coursework with a considerable element of teacher assessment, externally moderated; so views did vary considerably.

Thus, the Schools Council Occasional Bulletin, 'Handicraft at GCE 'A' Level', which established a forward looking stance, in Section 3, was working against a backcloth of opposing views. Following Section 3, it failed to draw up aims for Handicraft but it did identify, in considerable detail, the educational objectives. In Section 4 it argued that by only specifying content (in 1972 all syllabuses in the Handicraft field did just that) it would be seen as an end in itself rather than as an educational media. As a means of identifying the appropriate objectives, the report used Bloom's Taxonomy based on 'Taxonomy of Educational Objectives: The Classification of Educational Goals - Cognitive Domain' edited by B S Bloom. Bloom's Taxonomy offers a scale or hierarchy of objectives, starting with Knowledge and moving through Comprehension, Application, Analysis, Synthesis to Evaluation. This section was well illustrated in the report and has provided a basis for many developments and the one means of justification of CDT in the school curriculum. It remains confusing as to why the report did not provide aims in light of Working Paper 20.

Therefore, it could be said that this report provided both the philosophical and the educational objectives for the future of the subject and also loose criteria upon which to approve future syllabuses. Furthermore it provided the means of evaluating scrutinies. This appears not to have been the case for a number of reasons. The first is that not all members of the CAST committee accepted the report and certainly, Boards were not in total agreement even with the notion of combined materials. Sadly, therefore, the opportunity was lost to provide clear guidelines for the future. Other factors may have been the clash of traditional versus progressive, or the pressure on committees concerned with developing Engineering Science, which, although it was considered progressive, did not meet the objectives and philosophy as set out in the report. The notion of assessment via criteria was something not used in many subject areas. It perhaps showed signs of 'big brother' type assessment and was not the Schools Council's mode of operation.

Two key factors illustrate the report's ineffectiveness in setting out criteria. The first concerns the suggested examination format in Section 5. No examination devised following the report's publication, uses the suggested format and secondly, no scrutiny report or minuted discussion from 1977 onwards refers to this document. Four senior members of the 'A' level committee, who had been involved in scrutinies in the late 1970's had not even seen the document, let alone used it. Certain conclusions should be drawn from such an experience; firstly, it is essential to get broad agreement on criteria and this must involve the Boards. Secondly, the criteria must include a plan of action for implementation of the proposals.

Letters from Northern Universities' Professors of Mechanical Engineering

In Chapter 5 the letter sent to all schools from the Northern Universities' Professors in Mechanical Engineering was referred to. (See Appendix B) In looking at criteria, this letter should not be overlooked. It stated the following criteria for an 'A' level if it was to have equal parity with Engineering Science:-

(a) Provide intellectual challenge via quantitative applications of Engineering Science;

(b) Provide breadth of education;

(c) Encourage creative and other abilities, avoiding over-traditional, unimaginative approaches;

(d) Avoid too much choice of topics in examination papers. It is important for us to be able to rely on a defined core foundation being covered because of the short length of the British Engineering Degree course.

(e) Avoid grading systems in which a large proportion of the marks is obtained from 'seen' coursework. We do, of course, recognise the important educational value of open-ended project work.

Many other aspects of the letter were contradictory and negative, but the criteria are worthy of some consideration. Paragraph (a) is somewhat difficult to interpret as few want to provide a subject identical to Engineering Science; if that was the case, why not simply use Engineering Science? Paragraph (b) would bring considerable agreement in the CDT field, but, do all accepted 'A' levels fulfil this requirement? Paragraph (c) is fundamental to CDT, and the move away from traditional approaches to teaching and examining is clearly seen in this field. Paragraph (d) is an important point and lies at the heart of much work currently being undertaken by SEC and SCUE/CNAA and is a key reason for the development of criteria in Chapter 7. CDT undoubtedly requires a core to help its acceptability and although there is no doubt about the designing, making and evaluating core, it is certain that the Engineering Professors also want a minimum content core. Paragraph (e) referring to not too large a proportion of marks on 'seen' coursework, is a valid point in terms of overall assessment. Naturally the precise percentage will always be under debate but with one Board's expectation the allocation is in the order of one third of the total marks. Thus in terms of the Northern Universities' Professors in Mechanical Engineering a significant proportion of the criteria is actually met by design-based 'A' level and only the core content (d) is as yet somewhat under-developed. The letter from Professor Cole (Appendix C) did not take the issue any further forwards in giving guidance on developing criteria.

Design Council Criteria

The Design Council Report 'Design Education at Secondary Level' published in 1980 included a valuable section on criteria for 'A' levels in Design and as shown in Chapter 5, it has played a significant role in improving the level of acceptability. The following nine points show the criteria as established:-

(a) Planning

Provide guided experience in the planning, management and execution of open-ended design tasks within given constraints of time and cost;

(b) Knowledge

Provide a comprehensive background of knowledge about the nature and behaviour of the range of materials, processes, energy sources and control systems commonly employed in at least one area of design application;

(c) Problem Solving

Provide experience in applying a combination of analytical, inventive, and operational skills and judgement to the resolution of real design and construction problems;

(d) Comprehensiveness and coherence

Demonstrate how functional, economic, aesthetic, social and ethical considerations are interrelated in the design, production and use of a selection of man-made things or systems;

(e) Search

Provide experience in seeking out information and resources, and in judging their usefulness, adequacy and reliability;

(f) Evaluation

Provide experience in the critical appraisal of the student's own efforts and those of other people in planning, designing, making and using; and in defending that appraisal;

(g) Evaluation

Provide experience in the determination of the overall value, including social consequences, of at least one substantial man-made thing or system;

(h) Communication

Develop a high level of skill in the communication of facts and ideas in the chosen areas of application, through appropriate media;

(i) Integration

And generally foster the student's confidence in his or her ability to integrate knowledge and experience in tackling problems of the practical world.

These criteria are from Paragraph 5.4 of the Keith-Lucas Report 'Design Education at Secondary Level', published by The Design Council in September 1980.

In addition to the these nine, a tenth termed the 'spirit' of the design process has been added to the above criteria. This appears to have been included by the sub-committee vested with assessing syllabuses by the Design Council. It only came to light following personal correspondence and was confirmed in a letter dated 23 May 1984. The following quote from the Design Council Senior Secondary Education Officer explains the tenth criterion:-

> 'The sub-committee wishes to emphasise that, in addition to the nine listed Keith-Lucas criteria, there was a further feature which might be termed the 'spirit' of the design process. No matter which area of the design spectrum is involved, this has to do with the overall intention of the syllabus constructors as it appeared to the subcommittee. This 'tenth criterion' was borne in mind and applied to each of the courses that was considered.
>
> In other words, we are trying to ensure that the nine Keith-Lucas

> criteria cannot be interpreted solely mechanistically in such a way that their content is met, but the crucial understanding of the design process is lost. We believe that correctly interpreted, the spirit of the design process is already encapsulated in the Keith-Lucas criteria. The 'tenth' criterion simply spells it out.'

These criteria require close evaluation as they are the foundation upon which certain Design 'A' levels have gained increased acceptability and by inference others have lost status. Initially if we look at the tenth criterion first, that of the 'spirit' of the design process, it is easy to be critical of such looseness in phrasing the statement and certainly, syllabuses which fail to be acceptable because they do not meet the 'spirit' of the design process but meet the other nine criteria would be difficult to envisage. In looking further, one assumes that 'spirit' is intended to encapsulate the complete design process from conception through manufacture to evaluation, with the ability to constantly feed back into the system. Another way of describing this tenth criterion is 'the essence of designing'. Whatever words are used it is difficult to define, undoubtedly it is very subjective and is a measurement of sensitivity of syllabuses to designing. The other nine criteria are presented in a somewhat random manner. They appear to define areas of experience necessary to facilitate the design process. However, the integrated nature of the design process leads to superficial divisions and a considerable amount of overlap.

Understanding of the Design Council Criteria (usually known as the Keith-Lucas Criteria) is essential to the development of new criteria for CDT as this has undoubtedly achieved the highest level of acceptance for the subject. It should, however, be recognised that the Design Council looked at Design in a wider context than CDT so the implications for CDT may not be quite so subject specific. The following analysis is related directly to the Keith-Lucas criteria and is lettered with reference to each specific criterion heading:-

a) Planning

This refers to guided experience in planning, management and execution of open-ended design tasks. As pupils must be supervised in schools it would be unwise if the teacher did not guide; however the level of guidance will vary very considerably depending upon the problem being tackled and the ability level of the candidates. It is difficult to assess candidates involved in the designing and making process when there is a degree of teacher involvement. Questions asked include such matters as did the teacher provide ideas or restrict materials or direct rather than guide the students' work. This shows the need for internal assessment so that the teacher has an opportunity to honestly express his views, however, despite the queries which can be raised regarding the guidance, there remains no doubt that design work needs the development of planning skills and this must be considered in terms of time and cost. It is unfortunate that Keith-Lucas did not also include available resources. It is easy to reflect that in the industrial world designers may need to determine new materials or processes, but at school or college in the 16-18 age range one could only reasonably expect the student to plan within existing resources.

b) Knowledge

The statement referring to knowledge is very plausible, but when applied to a syllabus it is meaningless. It states the need for a comprehensive background of knowledge; this is undoubtedly necessary to service the design process, however, what is comprehensive at 'A' level? It includes 'the nature and behaviour of the range of materials, processes, energy sources and control systems.' This indicates that Keith-Lucas' committee knew the materials, processes etc but did not define them. It raises debate regarding 'breadth versus depth' which will be returned to in Chapter 7. This may be appropriate to leave vague but how does one then assess syllabuses against this? Is, for instance, a range of timbers or metals sufficient, or should candidates cover a range of materials from timber, plastics and metals to glass, china and fabric? Likewise, a range of control systems - is it sufficient to merely consider mechanical or structural control or could it be simply electronic control? The knowledge background of design-based subjects is very considerable but difficult to reach agreement upon a definition; however, criteria must be more specific if they are to be used for syllabus assessment. The final part of this criterion (b) concerns the phrase 'commonly employed in at least one area of design application.' This could be interpreted that students must work in an area of design application which involves a range of materials, processes, energy sources and control systems. However, one could contend that it is areas such as furniture design, electronic systems or jewellery in which case, the definitions of control systems and energy sources will need to be very broad indeed and, some would contend, fundamentally different. This item of the criteria is certainly one of the weakest and does, through its lack of precision, devalue judgements made about syllabuses assessed under this criterion. However, at the time of writing no other material was available to help Keith-Lucas.

c) Problem Solving

This item is fundamental to the designing and making process and it is significant that this emphasises real design and construction, which is at the heart of CDT activities. It could perhaps have related to single solution problems and multiple solution problems, as by implication, the statement appears to be referring to the latter, where judgements are necessary; however some technological courses have elements of single solution problem-solving.

d) Comprehensiveness and Coherence

This seeks to discover a student's ability to demonstrate how functional, economic, aesthetic, social and ethical considerations are interrelated in the design, production and use of a selection of man-made items or systems. This is very difficult for students or syllabuses to achieve because, without detailed product analysis as a design activity, it is difficult to show and the social and ethical aspects could be far from clear when looking retrospectively. Few students could demonstrate this item of the criteria effectively although they might consider these items in their own design work. If the criterion had suggested the consideration of and use, where appropriate, of these items, then it would have been more realistic. The aspect of product analysis which underlies this point is undoubtedly important but somewhat casually treated. It may be important to stress such activities to enable a better understanding to be gained and thus improve personal design skills.

e) Search

This is a valuable aspect of Design and Technology and could have been written more comprehensively. Students at 'A' level are concerned surely with more than just seeking out; there is a degree of evaluation and more importantly, interpretation and adaption of information.

f/g) Evaluation

The two separate items of evaluation are difficult to justify. It is clear that they show on-going appraisal in (f) whereas in (g) it is a post-production evaluation, but (d) appears to indicate post evaluation as well and it remains questionable whether the skills involved are fundamentally different. However, (g) further emphasises the relevance in terms of Keith-Lucas, of product analysis. Certainly the subsequent work of the APU in 'Understanding Design and Technology' shows little difference in evaluation skills.

h) Communication

This is a very appropriate and relevant criterion. The importance of communication in design activities must be recognised. It is rather unfortunate that the concepts of seeking, interpreting, transforming and transmitting information were not put forward because certainly, with the development of Information Technology in the last five years, this area has grown. However, it would have been difficult for Keith-Lucas in 1980 to have perceived such growth.

i) Integration

This lies at the core and unique nature of design, its stength is its ability to integrate knowledge and skills to solve real practical problems. It would be possible to claim that this integration in many ways is the spirit of design activity.

This appraisal of the Keith-Lucas criteria shows that most aspects of Design and Technology have been incorporated, but the lack of specificity and overlap leads to difficulties in interpreting the work, and furthermore, it is difficult to see clearly how the Design Council could apply this to syllabuses and subsequently decide some were acceptable to Universities and by inference that others were not. It is interesting to compare for example, the Oxford 'Design' syllabus, which was approved, with the Cambridge 'Elements of Engineering Design', which was not.

a) Planning - Both cover this item through project work.
b) Knowledge - 'Elements' covers this item in a very analytical manner, 'Design' more subjectively. 'Elements' covers all items and ''Design' makes no mention of energy.
c) Problem Solving - Both involve Design and thus problem-solving, however, 'Design' uses only multiple solution problem-solving whereas 'Elements' also uses single solution problem-solving.
d) Comprehensiveness and Coherence - This is clearly in the 'Design' syllabus and although an implicit part of 'Elements' is certainly not as strong.

Items (e) to (i) are common to both syllabuses but with 'Elements' having a more objective, mathematical analysis and evaluation compared with 'Design'.

This very brief summary shows the difficulty in assessment against very subjective criteria. It may be that 'Elements' fails in the area of the 'spirit' of design, through its strcutured approach; certainly, many teachers of 'Elements' are bemused by the decision. This clearly shows that such assessments are difficult and need careful consideration, but the principal lesson to be learnt is to ensure that criteria are written which do not allow such flexibility.

Schools Council Draft Criteria

Following the Design Council Report, the Schools Council decided in 1980 to establish a small working party from its CDT committee to develop criteria for 'A' level syllabuses. (See Appendix D). This committee was chaired by Professor Geoffrey Harrison and reported in 1982. Its brief was to establish some criteria and guidelines for the content and the methods of assessment of 'A' level syllabuses in the CDT field. This committee took into account five factors in preparing the paper, which are all relevant today. The first concerned the need to assert and make self-evident the intellectual validity of CDT at 'A' level; secondly, to recognise the general tendency towards a convergence of opinion and expectation in the field; thirdly, to recognise the trends in number terms, specifically, towards a design-based approach; fourthly, to attempt to rationalise the profusion of titles and finally, to remedy the lack of current criteria for the tasks in subject development.

This committee stated its belief that all the 'materials-based' subjects in the CDT field had the potential to be developed to meet the proposed criteria. It recognised the problems of engineering science but considered it should not try to meet the criteria. In looking at the subject title it was concluded that 'Craft' was implicit at 'A' level and it would not assist the subject's cause; therefore, the committee recommended the title 'Design and Technology'. The specific criteria were written in terms of the requirement of students and were in two sections, intellectual and physical skills and Knowledge and Understanding, both related to designing and making. These criteria were broad but more specific than the Keith-Lucas criteria. However, it must be recognised that the Design Council's brief was much broader and the Schools Council was able to build on the Design Council's work. The criteria, although approved by the CDT committee of Schools Council, were never implemented as the Schools Council was closing. It would be fair to say that the criteria were received with some hostility from certain Boards, who fundamentally questioned the right of Schools Council to develop criteria. This question cannot be ignored but Chapter 7 sets out the current reasons for criteria.

SCUE/CNAA Common Core

The need for criteria however remained clear to many, and the Council for National Academic Awards (CNAA) and Standing Conference on University Entrance (SCUE) had established core curriculum statements for Mathematics in 1978 and Chemistry and Physics in 1980 and these documents had proved most useful to GCE Boards in formulating cores in 1981-83. Thus CNAA asked Professor Geoffrey Harrison to establish a working party and, with funding from CNAA and the Manpower Services Commission, they established a researcher to identify a core syllabus in GCE 'A' levels in Design and Technology. CNAA would collaborate with SCUE in developing this core. This initiative was very important because it brought a sense of urgency to the matter at a very formative stage of development in the subject.

The researcher, Peter Threlfall, has made a survey of Higher Education and leaders in the field to discover their views on Design and Technology at 'A' level. The response has been very favourable; however, the report has found difficulty in establishing whether the subject is principally a process examination with little emphasis on specific common content, or whether it should be a delicate balance between process skills and core content for all. However the report established a distinct need for a common title and put forward a strong case for inter-Board agreement so that continuity may be possible with the agreed syllabuses for undergraduates in Engineering.

Engineering Degree Course Criteria

It is significant that CNAA in its policy statement booklet 'Engineering First Degree Courses' published in 1984, identified several interesting and relevant pieces of criteria for future undergraduates. Section 3.4 states :-

'Engineering degree courses should provide a technologically broad education, particularly in its early stages ...'

3.6 'Engineering degree courses should give due consideration to the place and importance of design, manufacture and marketing on the work of the engineer ..'

3.7 'All engineering degree courses should provide an emphasis on engineering applications by, inter alia, covering the applications of engineering principles to the solution of potential problems based on engineering systems and processes (this aspect should be integrated into the academic curriculum), and an introduction to the fabrication and use of materials.'

It is clear from these statements that many skills and abilities which can be developed in Design and Technology have a very close relationship with the CNAA degree proposals and the Engineering Council's view of future undergraduate courses. The most significant part is the notion that undergraduates will be able to design; a concept which several leading professors had previously questioned, thus doubting their ability at school level. Professor Parnaby's letter and Professor French's comments noted in Chapter 5 are good examples. It can be concluded from these statements that initially, undergraduates will want breadth rather than depth, design capability, introduction to systems and processes, marketing and the fabrication of materials. Thus, if in developing criteria and improving acceptability the subject can take account of these points, a sound educational progression could be established for our young people from school to higher education.

Conclusion

This chapter clearly shows a plethora of criteria by different bodies having been or currently being developed and there is one further set being developed by the Secondary Examinations Council (SEC). The SEC was aware of this unsatisfactory state and commissioned the author of this study to draw up a common core criteria paper. This was done and subsequently, a working party was established under the author's chairmanship to produce criteria. The chairman's criteria and justification can be seen in Chapter 7 and are not substantially different from SEC's new agreed criteria. One significant fact concerns the agreement of the National Criteria at 16+ which will influence 'A' level examinations from 1988 onwards.

Having discussed and analysed the criteria for 'A' levels in CDT it would be inappropriate not to identify the difficulties which could occur in developing criteria as well as justifying the need. The dangers of specific criteria are that the richness of choice and innovation could be lost through too tight criteria. If criteria had been established in 1966 it is unlikely that significant developments in CDT would have taken place in the last two decades. However, if the criteria had been forward looking and implemented then perhaps the plethora of very traditional syllabuses would have disappeared and perhaps the stigma and devaluing of the subject area these have caused would have diminished.

In developing criteria and cores it is essential that they are flexible and forward looking yet with some precision and with the provision for periodic review. The question asked is 'Why develop criteria and cores?' Surely the market forces on Boards will determine whether syllabuses operate. If that notion were applied it is likely that no 'A' level in the CDT field would operate because almost all make losses in financial terms. However, there are sound reasons for developing cores and criteria for 'A' levels in CDT. Firstly, eleven subjects have already established common cores in various forms following the Secretaries of State announcement in 1980 to continue with 'A' level and reject N and F proposals, but to seek from Boards subject revisions leading to clarification and rationalisation of syllabuses. If the subject wishes to gain increased acceptability then it urgently needs to project a clear concise image to the users of the certificates; furthermore, the confusion is more likely to lead to rejection through ignorance rather than clearly knowing what a student has done. As the subject's popularity increases it is apparent that much better in-service training is required for 'A' level teachers, a feature sadly lacking at present. This is exceedingly difficult to achieve with so many syllabuses but some common criteria could provide guidance for teacher trainers.

CDT needs criteria to bring it into line with other subjects, to meet the

Secretary of State's requirements to reduce "clutter", to aid the projection of the subject and, as a consequence, its level of acceptability and improve teaching quality by developing appropriate in-service training. However, criteria and common cores must have a policy of implementation otherwise the activity becomes relatively futile. The concept of only projecting three possible syllabuses at GCSE is most encouraging; however, if the 'A' level provision could be reduced to one then CDT would be in a stream-lined position to project a clear image for the future.

CHAPTER 7

PROPOSED NEW CRITERIA FOR 'A' LEVELS IN CDT

In Chapter 6 the evaluation of exisiting criteria for 'A' levels was identified and analysed and some points regarding the development of new criteria were established. However, the findings clearly show the need for new criteria, which this chapter will seek to create. The principles underlying the development of new criteria are the need to create a coherent image, the need to maintain opportunities for change, the capability to give breadth and depth and finally the need to provide curriculum continuity from 16+. Thus in developing new criteria, it is important to consider how they should be presented, what to present, as well as suggesting methods of implementing the proposals. In this chapter the questions posed above will be answered and new criteria will be established which hopefully will reflect current good practice, but also provide a suitable platform to take the subject into the 1990's. There is little doubt that without some agreed National Criteria for 'A' levels, the subject will continue to bury itself in developing a plethora of syllabuses and titles which reflect individual preference but little cohesion.

It is important to consider whether you wish to reflect current practice or to be more radical and suggest criteria for the future.

Approaches

The decision about a radical approach to new criteria has several dangers. Firstly, the criteria may be so radical that no one would wish to implement them, therefore they would be worthless. Secondly, they may be radical but not reflect future practice accurately. Thirdly, the criteria may antagonise Examination Boards, so that they do not participate co-operatively in the move towards change. However, it would be feasible to develop criteria which are radical in how they treat the whole subject area, but at the same time reflect some current good practice syllabuses with high recognition. This is the strategy of combining the various strands of the subject into one, while at the same time, giving a level of acceptability to the prime syllabuses on several Boards. This strategy, although probably resented by Chief Examiners, may be more acceptable to Boards where they can justify dropping uneconomic syllabuses thus reducing "clutter" and generating possibilities for future developments. In the short term such a strategy may be fraught and difficult for those suggesting it, but in the long term, it could harmonise the subject and create a first class platform for the future. There is now a precedent for such work, following the dramatic change resulting from the introduction of GCSE National Criteria and grade related criteria. Here, clearly, CDT has been drawn together with common aims and objectives for all GCSE examinations with merely slightly differing skills and content in each strand of the subject. The National Criteria must be the starting point for any development of criteria at 'A' level,as all students entering 'A' level courses in 1988 for first examination in 1990 will have followed courses with these aims and assessment objectives. It is important to note that the CDT Technology, CDT Design and Realisation and CDT Design and Communication will be taught by similar methods; thus, 'A' levels should reflect these syllabuses. The obvious conclusion to be drawn would be to develop three types of 'A' level in the CDT field to create continuity. However, that is not a sensible approach,when one considers the aims and assessment objectives at GCSE are identical for all syllabuses. Perhaps the work of the committee on grade related criteria for CDT at GCSE sheds some light on this in that it discovered so much similarity between the syllabuses in educational terms that it decided to formulate identical criteria for all three syllabuses and saw the long term future as one subject for CDT at 16+.

Constraints

There are, however, far more constraints on the 'A' levels than GCSE, ranging from numbers available, possible AS level and CPVE, less staffing owing to growth in compulsory commitment to CDT and sheer financial sense, if we consider that at GCSE all candidates are of compulsory school age and with the subject moving nearer to a core position, numbers are likely to be substantial whereas at 'A' level the case is quite the reverse. From 1988 onwards the approximate 25% drop in the school population will hit the sixth forms. The following table illustrates the population fall in England and Wales based on 1981 census figures.

Population	0-4 year olds	2,910,164
	5-9 year olds	3,206,589
	10-14 year olds	3,846,272
	15-19 year olds	4,019,994

Secondary schools are already beginning to feel the effects of falling numbers but this will accelerate towards the end of the decade. It remains unclear whether it would reduce sixth forms by 25% but certainly numbers will decrease. At present,numbers are already declining in the North of England although nationally there is still growth due to the above average growth in the South East, so there will be some 'A' level reduction due to falling rolls. This factor may be exacerbated considerably by several other changes.

The new AS level could decimate the CDT 'A' levels, although it is possible that it could assist greatly creating large AS groups in the sixth form. The AS scheme will cut candidates to two 'A' levels with two AS subjects. If we look closely at the more able students taking 'A' levels in CDT we discover Mathematics and Physics are common combinations. In surveying a sample of a hundred such students some 70% saw Design and Technology as their third 'A' level. This is realistic as universities will continue to require Mathematics and Physics + 1 for engineering. Thus the reduction to two 'A' levels could almost remove a large percentage of more able students from the subject of Design and Technology. There is little doubt that AS level could lower 'A' level groups so significantly that they would become totally uneconomic in most schools and colleges. It is questionable even in 1984 whether 'A' level Design and Technology groups are viable. The London Board had 213 centres in 1984 giving an average group size of 3.05 candidates. They are only viable in that many centres have combined first and second year sixth form groups, and, secondly, that the groups are frequently not taught solely in the timetabled lessons. If AS level is successful in its implementation and the courses can be structured to run alongside 'A' levels, it is feasible that groups and the quality of learning through inter-pupil discussion will be greatly enhanced.

A second unknown, but potentially major source of difficulty to the growth of 'A' level numbers, is the Certificate of Pre-Vocational Education (CPVE). This is currently aimed at 17+ students and is cross-curricular in structure. It may require CDT teachers to participate in the teaching but could reduce numbers taking 'A' level from the less able 'A' level students who prefer a one year course with a clear vocational aim. Together, with this, is the growth of BTec courses for this age range, possibly a 'super' YTS course. All these developments will, together with the lack of capable staff, undoubtedly decrease take-up for such courses. The current use of 'A' levels in Design and Technology for weaker students in the lower sixth is very considerable. In February 1983 there were 921 lower sixth students studying 'A' level London Design and Technology but when the examination was taken only 646 took the whole examination, that is a drop of 30%. This displays a high number of candidates who fail to stay the course and many may have been unsuitable in the first place. Thus the 'A' level groups which start do not necessarily finish. Comparable figures are not available for specific subjects but the DES statistics show a drop for combined Mathematics and Science subjects from the first year sixth to second year sixth to be 162,639 to 154,581 for 1981 to 1982, that is a drop of 5% and for 1982 to 1983 from 171,540 to 158,784, a drop of 7.5%. This

Mathematics/Science group has a slightly higher drop-out rate than the Humanities subjects.

There are positive elements towards growth. The TVEI scheme should generate more technologically capable students interested in taking 'A' levels, so through this innovation there could be a growth in the subject area. Certainly TVEI has spurred Boards like London to speedily introduce a Computer Aided Engineering option at 'A' level. However, despite the TVEI scheme which currently covers less than 5% of the school population, there is little doubt about 'A' level numbers contracting from 1988 onwards, thus the total candidates doing 'A' level in CDT are never in the foreseeable future going to be equivalent to the major sciences, humanities or indeed 'A' level Art. These subjects all have common titling and most users at least have a perception of what the subjects are about. Their perception may be wrong but this does not seem to affect acceptability because the subjects are accepted by society.

In creating new criteria for a subject it must be determined how the criteria should be developed and presented. In looking at the common core at advanced level prepared by the GCE Boards,it is significant that there was a lack of common format (see Chapter 9 for detailed analysis) but the following areas were covered; titles, aims, objectives, skills tested, core skills or content, percentage breakdown of marks. The GCSE national criteria did establish a format for presenting criteria. It recommended titles, aims, assessment objectives, core comment, relationship between assessment objectives and content, techniques of assessment and grade description. The development of criteria for 'A' levels does not have at present the same authority as the national criteria at GCSE although if the introduction of grade related criteria at advanced level takes place then undoubtedly specific criteria would be essential. There is no doubt that the subject titles currently cause confusion,so that must be involved. The aims and objectives are essential but to prevent too much constraint on the Boards it may be better to describe them as objectives of the examination rather than assessment objectives. It is noticeable that the common core booklet uses this approach. The common core is important to establish a base for the subject and it would be inappropriate not to describe a format and examination structure.. Grade description would be a useful addition but will require considerable research to provide something worthwhile. Such a format should provide coherence for the Boards and display progression from GCSE.

Titling the Subject

In light of the common approach of aims and objectives at GCSE and the likely contraction at 'A' level it would appear both sensible and prudent to co-ordinate the subject by using one simple title; this would surely reduce confusion and uncertainty by the user.

To illustrate the confusion it is perhaps appropriate to put CDT 'A' levels in context. In Chapter 5 the number of subjects in the CDT field was identified as twenty-six in June 1983 with 5,804 entries thus providing an average subject entry of 223 candidates per syllabus. The following table of total candidates for 1983 puts CDT in context.

TABLE 7 Total Subject Entries - June 1983 - 'A' level

Art	25,892
Biology	42,626
Chemistry	40,684
Economics	40,617
English	68,218
French	26,555
Geography	37,117
Geology	4,188
German	9,469
History	41,660
Latin	2,431
Mathematics	69,364
Music	4,745
Physics	48,590
Religious Studies	6,200
Sociology	17,584
CDT	5,804

The position is worse if we identify Geometric and Engineering Drawing as one subject and Craft, Design and Technology as a second, this gives 2,622 for CDT and 3,159 for Technical Drawing. Thus there are sound reasons why the subject area is often forgotten.

It must be accepted that a conflict will occur between on the one hand the need for the title to reflect adequately the content and aims of the syllabus and on the other hand, the need for the title to gain general acceptance outside as well as inside the teaching profession. The first conclusion to be drawn is that Craft, Design and Technology is the name of the subject area and, as such, is the appropriate title. It is significant that the Cambridge Board has an 'A' level by that title. However, although the term CDT is becoming increasingly well-known in the educational field there is little doubt that in Higher Education 'craft' would be an unacceptable term. It is not without significance that both

University departments responsible for initial teacher training in the subject area use Design and Technology to describe their activities and that the Schools Council paper on criteria chose the title 'Design and Technology'. Therefore, there may be good cause for accepting this title. It would be appropriate to look further at why the word 'craft' should be dropped. This relates to society's notion of words, where craft conjures up in people's minds everything from basketwork to carpentry. It evokes the thought of specific practical skills and, in terms of jobs, of one of the lowest status trades and basic skills without the need to think. Many people are able to see more in the word craft, its effectiveness and high capability that many craftsmen have. Society in general has a relatively low opinion of these able people and thus having 'craft' in the title would tend to devalue its esteem in the eyes of Higher Education and many parents. Furthermore, it may indicate that the subject is merely 'dressed-up' woodwork to some people. It would, however, equally be incorrect to assume that craft skills have no place in 'A' levels in this subject area. The skills of manufacture remain important to design activity and although not the most important factor, they must not be totally neglected, as they provide a realistic method of evaluating against the need. Product design in whatever form needs to display good realisation skills if evalaution is to be meaningful.

It would therefore be easy to conclude with the specific title of 'Design and Technology' for this subject area at 'A' level. Looking at the modern syllabuses recently developed, it is quite likely that if one Board had not already had the title Design and Technology, one of the other Boards would have used it. There has been a desire for some reason to have the individuality of different titles as the mark of each Board's syllabus. A good example of this was work carried out in 1978-9 for the Cambridge Board when an 'A' level was written and called 'Design and Technology' until the last meeting when a committee overturned the decision and called it 'Craft, Design and Technology'. Such individuality has been one of the great tragedies of the last fifteen years in CDT, with far too many parochial developments to the detriment of the national picture.

It would be appropriate to look at other titles for the subject area. The most obvious would perhaps be 'Design'. This is a broad title used by the Oxford and JMB Boards and many would argue its breadth allows the subject to be covered most satisfactorily. Design could be said to subsume Technology and Craft and in many cases it obviously does. However, there are reasons which detract from the use of such a title. Firstly, Design is often considered part of Art and, in fact, the subject area is referred to as Art and Design. Secondly, the current support for the subject area comes from the involvement of technology in the design activities; thus, the subject's status would be weaker owing to the lack of technology in the title. So, although using Design could accurately reflect the subject, it would confuse many and certainly lower the status of the subject. Equally, it would be feasible to call the 'A' level 'Technology' as the Cambridge Board currently does and several Boards are at present working on. This title would be high in status but in many ways it would be much narrower than the true CDT activity. Furthermore, it is interesting to note that the technology examinations place high emphasis on design and multiple solution problem solving activities. Thus, Design and Technology could be a more accurate title for the technology syllabus. There is one danger suggested by some, that technology lacks the human interface and thus girls will not associate well with such a title. The antithesis of this is that boys may do a subject with technology in the title but not design on its own. Hopefully, the CDT courses at GCSE will enable young people to know more about the subject and thus girls will make a decision about taking 'A' levels based on substance rather than titles.

Before one can recommend Design and Technology as the subject title, the built-in resistance from Boards to agree will be very considerable, because some Boards would feel their syllabus is better than London's and it would be inappropriate to bring their syllabus down to the level of acceptability found with London's current 'A' level. One solution to this may be to look wider and create a totally new title for 'A' levels, so taking away the prejudice. This idea would, however, lose the subject's status already developed and would lead to the creation of a totally new publicity campaign, undoing much good work over the last five years. However, on analysis, most words and phrases have now been used which accurately reflect the activity. One word which has usage and reasonably describes the subject is the German 'Technic', however it would be inappropriate to use a German word to describe the activity. The only phrase which reflects the activity is 'designing and making'; this however sadly lowers the status, with a tendency to see it in a narrow manner. Much concern will be shown by the Technical Drawing/Graphical Communication group which in 1984 still exceeded the CDT group of subject entries although the two are clearly moving towards each other. Earlier, the significance in the change of Technical Drawing at 16+ was identified and thus its change at 'A' level forecast, or the gradual decline of the subject at 'A' level will almost certainly be accelerated by the HMI publication on Technical Drawing which was very highly critical of the subject area in terms of relevance and rigour. Thus, in looking at the subject area in radical terms, the area should be incorporated within the CDT umbrella if its status is to have value. In the 1960's, Technical Drawing was undoubtedly the academic part of handicraft in the eyes of the profession. It no longer has that status.

In appraising possible titles the conclusion drawn is that the most suitable title for the subject encompasses the words 'Design' and 'Technology'. It could be used as 'Design and Technology' displaying a broad based subject involving both design and technology or it could be called 'Design Technology'. 'Design Technology' implies the design of technology not the integration of design and technology which is essentially what the subject is concerned with. Therefore, it appears relevant, appropriate and expedient to use the title of 'Design and Technology' to describe the subject at 'A' level and thus to recommend such a title for all 'A' levels in the field. It is not without significance that both SEC and the SCUE/CNAA working parties are recommending the title 'Design and Technology' and already the JMB Board has responded by re-titling its design syllabus 'Design and Technology'.

In looking at aims, one should perhaps establish why we need aims. In Chapter 6, reference was made to Working Paper No 20 from the Schools Council 'Sixth form examining methods'. This document, published in 1968, stated the case clearly for 'A' levels to be based on aims and not content because it states the process of learning is more important than specific facts. It is noticeable that over the last seventeen years syllabuses have slowly moved towards the introduction of aims, although many still do not, particularly Mathematics. Aims at 'A' level range from Economics (London):-

> 'The aim of the syllabus is to introduce the candidates to some of the main principles of economic theory and their applicability to economic and social problems.'

to Chemistry (London):-

> 'This syllabus has been designed to enable schools and colleges to develop courses in Advanced level Chemistry which will:-
>
> 1 follow on directly from the Ordinary level syllabus in Chemistry, both in knowledge and approach,
>
> 2 provide a firm foundation for the further study of Chemistry and give an adequate basis for the study of related disciplines at the tertiary level,
>
> 3 provide a balanced and satisfying course for those who will cease formal education in Chemistry at this level,
>
> 4 enable students to gain a knowledge and understanding of Chemistry appropriate to this level and the ability to apply this knowledge and understanding to both familiar and unfamiliar situations,

5 develop skills in laboratory procedures and techniques, the ability to assess the uses and limitations of these, and to acquire good habits for health and safety,

6 enable students to recognise and appreciate the interlinking patterns which form a distinguishing feature of Chemistry,

7 foster imaginative and critical thinking as well as the acquisition of knowledge,

8 present Chemistry as a field of enquiry in which students can recognise the intellectual discipline which the subject provides,

9 relate the study of Chemistry to everyday life and to the society in which we live.

It is envisaged that a course based on this syllabus should reflect the experimental nature of Chemistry and present chemical theory and experimental work in an integrated approach. The practical work should offer scope for students to develop skills in common laboratory procedures and techniques. These include simple preparative work, volumetric analysis, electrochemical measurements, techniques for purification and separation including crystallization, distillation and chromatography, and the use of melting and boiling points as criteria for purity. It is expected that students will develop the ability to devise simple experiments, to assess the uses and limitations of experimental methods, to make and record accurate observations, and interpret results.'

Thus aims can be short and succinct or quite comprehensive. It would, therefore, be sensible to clearly identify what we mean by aims. A suitable definition of aims is a statement of the educational purposes of a subject and of a particular examination syllabus. The aims may be broader than the objectives and may well include qualities and attributes which cannot or may not be assessed for examination purposes; for example, pupils' motivation and attitudes. So, in developing aims, the purpose of the examination must be clearly shown. It would be appropriate to begin by analysing the aims of the GCSE national criteria for CDT as they will provide the basis for future 'A' levels.

'3.1 The aims of any course in Craft, Design and Technology are:

1 To foster awareness, understanding and expertise in those areas of creative thinking which can be expressed and developed through investigation and research, planning, designing, making and evaluating, working with materials and tools.

2 To encourage the acquisition of a body of knowledge applicable to solving practical/technological problems operating through processes of analysis, synthesis and realisation.

3 To stimulate the development of a range of communication skills which are central to design, making and evaluation.

4 To stimulate the development of a range of making skills.

5 To encourage students to relate their own work, which should demand active and experiential learning based upon the use of materials in practical areas, to their personal interests and abilities.

6 To promote the development of curiosity, enquiry, initiative, ingenuity, resourcefulness and discrimination.

7 To encourage technological awareness, foster attitudes of co-operation and social responsibility, and develop abilities to enhance the quality of the environment.

8 To stimulate the exercising of value judgements of an aesthetic, technical, economic and moral nature.

(CDT National Criteria 1985)

The aims stress the complete design process and appropriate communication skills. They wish to promote curiosity, enquiry, initiative and ingenuity in young people as well as stimulating the exercising of value judgements in a range of areas. These aims also encourage technological awareness and the acquisition of a body of knowledge applicable to solving problems in practical and technological areas. These aims give a scund feeling of the subject, display its breadth and give teachers and syllabus constructors guidance on the ethos of the subject. At 'A' level, the aims developed must show increased capability and progression from the GCSE criteria. It is vital that the integration of skills, knowledge and experience associated with CDT are coherently exploited at 'A' level. This is only achieved through designing, making and evaluating, so the aims must reflect this. Therefore, in outline terms, there appears to be five aims:-

1 Creative designing, making, testing and associated skills.

2 Provision of a body of knowledge.

3 Development of communication skills.

4 Encouragement of personal interests, flexibility, resourcefulness, initiative and commitment.

5 Exercising of value judgements.

To show progression in aims is not particularly easy but in terms of accountability it is obviously important to show the subject aims beyond GCSE. Thus it is important to determine phrases or words which display a form of heirarchy from terms such as encourage, promote, foster and an awareness. At 'A' level we are principally concerned with greater depth, more knowledge, a better integration of the process, a greater ability to exercise value judgements and technical decision making and to show more responsibility for the designing and making processes. The five outline points and the essential upgrading of terms can be put together to create the following aims for 'A' levels in Design and Technology as follows, they are:-

1 To provide opportunities to seek out and obtain relevant interdisciplinary skills, knowledge and understanding and to apply them logically and coherently, with initiative, imagination and resourcefulness to the solution of practical design problems.

2 To enable students to participate in, and exercise some responsibility in, the whole process of specifying designing, making, testing and communicating in relation to an end product which is functional in the widest sense.

3 To extend a student's knowledge and understanding of current theory practice and opinion relevant to designing, planning and producing artefacts in single and multiple units.

These three aims provide a platform upon which to develop the subject at 'A' level, while at the same time providing flexibility for new material. The key phrases are, interdisciplinary, logically and coherently, responsibility and extension of knowledge and understanding. The interdisciplinary work will be crucial and the ability to work logically and coherently is essential to successful completion of work but perhaps the most important difference between 'A' level and GCSE is the responsibility anticipated in applying value judgements and displaying commitment to a task.

Objectives for 'A' Level Examinations in Design and Technology

Objectives are a means of expressing and describing the skills and abilities which are measured and recorded usually for assessment purposes. An objective therefore must be expressed in terms of the observable and/or measurable behaviours which the achievement of the educational aims of the course in the subject are intended to bring about. The degree of measurement is difficult to quantify because although some aspects of Design and Technology can be tested objectively, others rely on an amount of subjective judgement by the assessors. The reliability of such assessment is always open to some degree of doubt. Such lack of accuracy should however not detract from trying to establish the objectives.

In establishing objectives, the format was difficult to define. Out of the eleven subjects in the common core booklet produced by the GCE Board in 1983 only two defined objectives and only Economics used any in depth. The 'Economists' used Blooms Taxonomy of Educational Objectives: Cognitive Domain as the format and this clearly identified the subject's principles. However, design and technology is equally concerned with the affective and psychomotor domains. It would be in keeping with much development work in CDT to use Bloom's clasification, as 'Handicraft at 'A' level' used it, and its six heirarchical stages of the cognitive domain fit into the designing and making process. Bloom's affective domain is however, less satisfactory as a means of expressing the subject as by nature it is less explicit and thus this may be better described as sensitivities and attitudes. The psychomotor area is much simpler and should cause few problems in developing suitable objectives.

It is important, as with aims, to display progression from the GCSE objectives. Therefore it is appropriate to identify these before developing 'A' level objectives. The assessment objectives state in 4.2:-

'Candidates should be able to:

1 Describe and apply facts, principles and concepts related to artefact and/or systems design, realisation and evaluation.

2 Demonstrate graphical and other communication skills necessary to give, in a clear and appropriate form, information about an artefact or system.

3 Identify problems which can be solved through practical/technological activity.

4 Analyse problems which they have identified, or which have been posed by others and produce appropriate design specifications taking into account technical and aesthetic aspects.

5 Identify the resources needed for the solution of practical/technological problems.

6 Identify the constraints imposed by knowledge, resource availability and/or by external sources which will influence proposed solutions.

7 Gather, order and assess the information relevant to the solution of practical/technological problems.

8 Produce and/or interpret data (eg diagrams, flow charts, graphs, experimental results).

9 Generate and record ideas as potential solutions to problems.

10 Appraise solutions to a design problem relative to the initial specification.

11 Select and develop a solution after consideration of the constraints of time, cost, skill and resources.

12 Plan the production of the selected solution.

13 Demonstrating appropriate skills, make or model the artefact or system.

14 Propose or make modifications to a product or system both during manufacture, and after completion and evaluation.

15 Compare and evaluate the performance of an artefact or system against its specification.

16 Satisfy all mandatory and other necessary safety requirements during the planning and making of an artefact or system.

17 Describe the inter-relationship between design/technology and the needs of society.'

(CDT National Criteria 1985)

This is an extensive list of objectives covering most aspects of the subject but perhaps being weakest in representing sensitivities, attitudes and the application of value judgements. The following table illustrates a classification of the GCSE objectives.

TABLE 8 Classification of GCSE Objectives

Knowledge	1,11,14,15,16,17
Comprehension	2,17
Application	1,7,8,12,16
Analysis	3,4,5,6,7,9
Synthesis	9,11,12,14
Evaluation	10,15
Realisation	2,8,13
Sensitivities/Attitudes	4,17

The classification shows the degree of overlap between objectives which is both natural and desirable. However, it also displays difficulty in appraising a list of seventeen detailed objectives. Thus in developing objectives for 'A' levels in design and technology there are at least three approaches which are feasible. The first is to mirror 'A' level History and identify five general objectives, the second to provide an extensive list of objectives but sub-classify them into families, and a third approach is to adopt the strategy developed by the Secondary Examinations Council. The SEC was concerned about the educational standing of using a classification similar to Bloom. Therefore, it used its own classification which has at its core, designing and making and evaluating. Such a classification also seeks to combine objectives and content. This causes a somewhat imprecise classification with difficulty in determining the order. As Chairman of the working party which determined the strategy it would be improper to comment further on its finding. The classification provided by SEC is as shown in Table 9.

TABLE 9

1 Investigation
2 Designing
3 Aesthetic Understanding
4 Design and Technology in Society
5 Communication
6 Synthesis
7 Making
8 Evaluation

In terms of gaining recognition and acceptance it is important to be comprehensive and explicit in determining the subject's objectives. This may also assist in showing the development from GCSE to Advanced Level study; thus the second method is seen to be the most appropriate method of representing objectives.

The following objectives seek to establish the range of knowledge and abilities which the subject should be assessing. The breakdown shown under each heading is intended to provide some classification, not necessarily in heirarchical form. However, the knowledge and abilities should not be seen in isolation but as part of the whole experience. It is the integration of knowledge, skills and experience which is essential if a coherent solution is to be found to a design problem within the constraints of time and cost. The classification has some affinity to Bloom's Taxonomy where appropriate because it undoubtedly is applicable to the activity.

The candidate should be able to:-

1 Knowledge

(a) display knowledge of the terminology used in design and technology;

(b) state facts relating to components, control, energy, materials and processes, and the environment;

(c) show knowledge of conventions used in communicating design ideas and solutions;

(d) know how to investigate specific problems and/or determine sources of information related to design and technological activity;

(e) demonstrate knowledge of the main concepts, laws and theories relating to design and technology;

(f) display awareness of design and manufacture in industry, of marketing, and of sales methods;

2 Comprehension

(a) understand design information and technological information presented in oral, graphical, written or computer processed form and to translate such information from one form to another;

(b) interpret information and reorder or rearrange it to help solve a particular problem;

(c) determine the implication of changes to designs;

3 Application

(a) apply appropriate conceptualisation to unfamiliar problems;

(b) work within the constraints of time and cost;

(c) research information about appropriate topics and utilize this when tackling specific design problems;

(d) combine tenacity with flexibility when solving practical problems.

4 <u>Analysis</u>

(a) recognise unstated assumptions;

(b) distinguish between statements of fact, statements of value and hypothetical statements;

(c) divide specific design briefs into a series of sub-problems;

(d) prepare a design specification;

(e) identify a conclusion from given information;

(f) recognise which facts or assumptions are essential to a specific problem;

(g) recognise the techniques of persuasion, such as those used in advertising;

5 <u>Synthesis</u>

(a) initiate ideas and subsequently optimise them to solve specific problems:

(b) combine ideas and known facts into a coherent product;

(c) plan a sequence of operations to enable the satisfactory execution of a problem;

(d) modify proposed solutions to problems, in light of new facts or considerations;

6 <u>Evaluation</u>

(a) make personal, critical assessment of designing and making activities;

(b) apply aesthetic criteria to discrimination of the objects in the environment;

(c) apply objective criteria and personal judgement to the appraisal of man-made objects and systems;

7 <u>Realisation</u>

(a) state design concepts with clarity using graphic/numeric and written forms;

(b) model design solutions in appropriate media;

(c) use a range of hand tools, machinery and equipment in a safe and effective manner;

(d) manufacture products and systems using materials and components in an appropriate manner when solving specific problems;

8 <u>Sensitivity/Attitude</u>

(a) recognise the importance of aesthetic factors in the environment;

(b) develop critical awareness of colour, form, shape, arrangement and design in the objects and structures in the environment;

(c) appreciate the feelings of those affected by, but not directly involved in, design decisions;

(d) develop increased sensitivity to human needs related to product design;

(e) apply technological, scientific, economic, aesthetic and moral values to situations within the designing process;

(f) develop self motivation and the appropriate interpersonal skills to complete a design task.

These objectives are intended to be self-explanatory otherwise they would fail to meet the needs of the users, the Examination Boards. Throughout, the objectives are attempting to place the emphasis and responsibility with the student for interpreting and making decisions as well as applying knowledge. This raises another issue concerned with assessment, because, with such emphasis on student responsibility, the role of the teacher becomes more difficult. How much of an interventionist the teacher should be is difficult to assess and the assessment of the quality of that intervention will need consideration. The whole area in project work of teacher involvement and the quality of that involvement has concerned assessors for sometime and, as yet, it has not been satisfactorily resolved.

Common Core Content

The objectives state what a student doing 'A' level Design and Technology should be able to do. It could therefore be argued that the objectives establish sufficient material and to define common core content is superfluous. Such an argument, however, does not appreciate the understanding of many readers of such documents. There is a tendency for Higher Education to still have a view that schools are concerned with imparting knowledge, and unless the proposed criteria are spelt out in simple common core terms, which can be quickly read, they may dismiss the document. The SCUE/CNAA working party equally found it necessary to define such terms. There is always a danger of overloading a common core with knowledge, an aspect which has certainly occurred in the sciences and Mathematics. The Chemistry and Physics 18+ committees at SEC both produced papers on 'Principles and Good Practice' in the subject at 'A' level. The paper stated the syllabuses were 'too long' and that 'overcrowded syllabus inhibit good physics'. Although not directly applicable, both 'Science 5 to 16: a Policy Statement' and 'Mathematics 5 to 16: Curriculum Matters' point out the great difficulties in reducing content to allow for more flexible teaching and more practical work. Therefore, in developing a common core, it is essential that only the minimum amount of skills and knowledge necessary for the activity of designing, making and evaluating to be soundly serviced are included. The phrase 'necessary to be soundly serviced' is the key part in relation to defining the core content. It is intended to imply that while participating in design activity, the candidates will require a basic knowledge of concepts such as energy, materials, and control to apply sufficient breadth of experience to a design problem. Some core concepts may be at little more than the awareness stage, while others will be well developed, and candidates will have a good understanding. The core content is stated in more generic terms, so Boards are able to define more specifically the depth of content.

In developing the common core content, two classifications have been established which are central to design and technology. These are skills and knowledge, which are the same classification as used in the National Criteria for GCSE. It is appropriate to analyse the GCSE criteria in order to create a sound foundation upon which to build the 'A' level common core. In the GCSE, the core content varies somewhat between the three defined areas of CDT, Design and Realisation, Technology and Design and Communication in specific content, although the generic terms are very similar. As one aims to increase the acceptability at 'A' level by placing the subject under one title and one common meaning, it is important that a common core which embraces the GCSE syllabuses is produced to integrate the subject. The proposed criteria are as follows:-

1 Skills

(a) Investigation - Recognition and identification of a problem, research, analysis, specification and the development of a plan of action.

(b) Designing - Initiation and development of ideas, utilizing appropriate materials, techniques, components and systems. The preparation of design proposals in relation to the specification.

(c) Synthesis - Collation of ideas into a coherent final design.

(d) Making - Preparing, manipulating, joining and processing of components and materials in a safe manner. Manufacturing of 'mock ups' and models where applicable and the assembly of systems.

(e) Evaluation - Critical appraisal of a personal work; critical appraisal of products designed and manufactured by others.

(f) Communication - Understanding, conveying and interpreting of differing forms of information. Communication of ideas and final designs in a clear and appropriate manner, using different media.

2 Knowledge

(a) Materials and components - Characteristics, properties, performance, market forms, costs, manipulative and joining techniques. Materials including metals, plastics, woods and appropriate adhesives. Components of control systems.

(b) Control - Identification and use of control concepts of systems, both static and dynamic; control devices and control concepts of system, input, output, feedback and lag; electronic, mechanical and structural control.

(c) Energy - Sources, forms, storage, conversion, transmission and efficient use.

(d) Aesthetics - Understanding line, shape, form, proportion, space, colour, movement and texture in both natural and manmade forms.

(e) Design and Technology in society - Constraints on design (costs, skills, resources and time). Ergonomics and anthropometrics. Relationship between design and technology and the individual and society.

This common core has no aspects which are not currently examined at 'A' level, although no one syllabus includes all these aspects in a common core. It is important to recognise that the skills defined are those considered essential for the activities of designing, making and evaluating and the knowledge is considered the minimum resource necessary for candidates to make sound, informed judgements in design and technology.

Examination Structure and Techniques

In developing criteria for an 'A' level core, it could be argued that having set the objectives and content, no further prescription is required. However, it is feasible and currently occurs with the Cambridge 'A' level Technology, that the common core is defined but only implicitly examined. Likewise it would be possible for Boards to state that they wish candidates to do coursework in designing and making but will not assess it. By contrast, the Board may decide to assess the course totally through coursework. Therefore, it is apparent that guidance is needed both to set out some mark weightings and state desirable assessment techniques. One aspect which must be remembered is that Boards enjoy their autonomy and a too prescriptive guidance could lead to Boards making little attempt to meet the criteria, a factor which sadly occurred to the 1973 'A' level Handicraft recommendations.

Design and Technology is a very diverse subject area and consequently the development of an examination structure is a compromise between breadth and depth. When this factor is considered with the compromise between process-based examinations and content-based examinations, it becomes very difficult to establish a fixed structure. Certainly, future developments may be curtailed by a tight limit. This therefore points towards a structure of core plus options approach, but with the possibility of a Board which wishes to use only the core doing so. It is important that the core and optional studies have a relationship which does not lead to a really small core but large optional studies area. This could seriously distort the quality of the certification awarded, or lead to Boards feeling the need to have Design and Technology syllabuses with an endorsement, such as Design and Technology (Microelectronics) or Design and Technology (Jewellery). This would immediately lead to greater confusion amongst potential uses and the devaluing of the subject area. Therefore, it is important to ensure the core provides a significant part of the syllabus. It should be remembered that the core refers to both the skills of designing and making as well as content in this context. Thus to ensure the title adequately reflects the subject and the level of reliability to the user is sound, it is important not to have too large an element for options. In 'good practice papers' produced by SEC for 'A' level Physics and Chemistry, the recommended core represents two thirds of the marks. In design and technology, there is considerable flexibility in the open-ended coursework students undertake. To ensure reliability the optional area should not exceed 25% of total marks. The notion of in-depth optional studies is, of course, quite common with options such as Automation, Computer Aided Engineering, Structures, Technology in Society, Materials and Computer Graphics. But of course the optional study area could be used for an Industrial Study report or as a thematic coursework project. It is important to recognise that this area will hopefully provide the flexibility for future development.

The core of Design and Technology could therefore vary from 100% to 75% depending upon whether Boards wish to use the optional study capacity. So it is important to determine closely the essential elements within the core. The first and most important is the coursework which involves students in designing, making and evaluating. This element provides for the integration of skills, knowledge and experience to generate an artefact. One aspect is concerned with how often the candidate should go through this process. A range of syllabuses currently examines one project tackled by the candidate. These syllabuses tend to ask candidates to do some designing and making in the first year course but do not examine this, merely the final project. Such methods have some advantage in that the initial flexibility for candidates is welcomed where no examination demand is placed upon the candidate. The weakness of this approach is that Design and Technology stresses the importance of designing and making but then sadly only examines it once over a two year course. The reliability of such a strategy is doubtful and leaves one to conclude that candidates should be assessed in more than one design and make project. This may still be rather narrow because it would be quite feasible to design and make two almost identical artefacts. Consequently it is desirable to conclude that such criteria should be qualified with the phrase 'which are substantially different in character from each other'. This begins to qualify coursework However, another important factor concerns the 'making' aspect of a student's work. This part is usually by far the most time consuming for students but it is the most difficult to allocate marks to; thus the practical component usually receives a low weighting. Cambridge 'A' level Technology, for instance, uses merely 10% of the total marks for manufacture and London Design and Technology only gives 13% of total marks for manufacture. These low marks reflect a lack of confidence on behalf of the Boards to allocate large sets of marks which will be subjective and which, through the diverse nature of practical coursework, cannot easily be sub-divided. This drive for increased acceptability and the lack of sound training for assessing coursework has undoubtedly led Boards away from giving an appropriate allocation of marks for this vital element of Design and Technology work. It is noticeable even from the Oxford Board's Design which allocates 60% of total marks to coursework that the allocation for making is still very low and is represented by one point in a seventeen point scale. Many examiners and Examination Boards would argue that it is the process of designing, making and evaluating which is important and thus the manufacture is but a small part of this activity. That is undoubtedly true, but it is the success of the end product which is usually a key factor for the candidate and the undoubted increase in acceptability is partly due to the most impressive project work realised by some students. Thus, it is vital that a higher weighting should be given to the manufacturing element of a project, even if the marks have to be presented in a large group and that Boards and Examiners should have more confidence in accepting the subjective nature of such marking. Certainly, Art colleagues do not hide from such responsibilities. Therefore in drawing up criteria it is important to stress a minimum mark for the manufacturing element. If this was common to all Boards it might ensure more emphasis on training assessors which would increase the credibility of Design and Technology and perhaps arrest the trend towards syllabuses which are too academic. An appropriate weighting for the 'making' element would be 45% of coursework marks, a figure which matches SEC recommendations.

The second element which is essential concerns the recall and understanding of knowledge which is traditionally examined by a written paper. Skills of comprehension of knowledge and interpretation are important in such a paper. This written paper is what Higher Education most closely looks at and what it expects. This is merely because it understands such papers and has little comprehension of design folders and project work. This paper is not a particularly good indicator of Design and Technology capability but does have a good correlation with other traditional examinations. Thus in terms of traditional school assessment of young people it is the best indicator in placing candidates in rank order. The use of a written examination paper will undoubtedly aid the acceptance of the subject and it is difficult to perceive an examination in Design and Technology without one in the foreseeable future.

The third area of assessment concerns a design paper under timed conditions. This type of examination has virtues and many, including SEC, advocate it as a compulsory element of a Design and Technology examination. This view is well supported but is by no means universal. There is, however, little doubt that the practice of giving students a design problem in a timed examination with no prior knowledge is not a satisfactory practice. Such views are formed from the notion of unreality about design examinations with no prior knowledge and that it can wreck a student's confidence being posed with a topic he had not expected. In 1981, when redrafting the London 'A' level a pre-design paper was introduced to prepare candidates. Following the first examination in 1984 the Chief Examiner's report stated:-

> 'Candidates did not appear to have made good use of the pre-design paper and the overall performance of candidates did not show a significant improvement over previous years with no pre-design paper.'

This perhaps could have been because teachers had not come to terms with the new format, but it does bring into question the issue of the pre-design paper. However, the 1985 paper Chief Examiner's report states that there has been a significant improvement in the performance on the Design Paper. In 1985 Professor G Jackson reporting on the Cambridge Craft, Design and Technology examination scrutiny, drew attention to the relationship between the pre-design paper and the actual paper and concluded that many candidates had virtually copied during a five hour examination. So the pre-design topic may require further development to operate effectively. Much of this assumes the classical design type examination with graphics and notes predominantly looking at multiple solution problem solving. However, it is feasible to develop an examination which has only single solution problem solving in technology and some would consider that a design examination would be viable within mathematical and scientific constraints. Such a view is not within the spirit of design and technology, and although such activities undoubtedly should be part of the subject, they do not warrant a specific paper.

To return to those who find a design examination undesirable, the argument surrounds two key issues. The first is concerned with the unreal nature of designing in a tightly timed examination with the notion that creativity will automatically follow. Naturally, designing does not work like that but students can show techniques of analysis, developing a specification, sub-probleming, evaluation of ideas and developing a solution, so perhaps the only aspect which seriously suffers is the initiation of ideas. The second argument concerns designing with no view to making and therefore without a real need other than to pass the examination. This does have a degree of futility but so do almost all examinations other than helping to sort out people in order to give grades. Thus the argument against hinges on the unreal nature and the artificial environment in which creativity is expected. Those supporting the design examination forward the view at the simplest level that there is a technology examination and therefore there should be a design examination, and at the philosophical level that designing so underpins design and technology that it must be thoroughly examined. It is significant that the National Criteria for GCSE stated that 'a design question or brief is capable of high discrimination between candidates.' This comment is a widely held view in CDT, but using London Board statistics, it is not such a good discriminator as coursework. In 1984, on the London examination, the Design paper had the lowest correlation and the smallest range of marks, so that particular examination was a particularly good discriminator. However, one other factor which supports the design examination is that it provides a good control unit for moderating coursework and increases the amount of designing being examined. There is a good correlation between the performance on a design folder and the design examination. In 1983 an analysis of 560 candidates showed a correlation factor of 0.93. Thus it appears sound that there is a design examination at 'A' level with some prior knowledge of the tasks to be set, but some research into this method of examining needs to take place.

There are other forms of examination that could be used including the timed manufactured piece from a set drawing. This is deemed undesirable at GCSE and is equally unreliable and undesirable at advanced level. Another examination is the viva-voce. This examination is a very effective assessment technique, as it allows the examiners to come to terms with the context of the project work, although it is difficult to standardise over large numbers. It is usually used as part of the coursework assessment and in that role, it is very effective. Such a technique should be used by all Boards but it is undoubtedly an expensive technique, especially with many small centres.

The arguments forwarded in this section on Examination Structure show the complexity of the topic and the need for a clear summary. Chapter 8 shows a breakdown of existing syllabuses and their mark weighting and, naturally, any projected criteria should show some relevance to current good practice. In determining a structure, it is appropriate to note the compulsory elements and the discretionary optional element.

Compulsory

(a) Coursework - Designing, Making and evaluating with a minimum of two projects which are substantially different in character from each other. 45% of the total coursework marks should be allocated to making.

(b) Written Technology Paper based on Common Core.

(c) Design Examination with some pre-knowledge of the areas of examination. The examination may concentrate on aspects such as analysis rather than taking a complete solution.

Discretionary

Optional Study areas in the form of Industrial Study, or studies of specific technologies such as Automation, Computer Graphics, Jewellery or Structures.

The weightings of such elements need careful consideration. The Schools Council considered each examination unit should not fall below a mark allocation of 20%. This appears to be a view also held by the SEC, although as yet it does not appear as a policy. This is fair because if a unit falls below that percentage it is doubtful whether it would have sufficient signficance in determining the candidates final grade. The marks allocated are arbitrary but based on experience and yet allow for some flexibility. The option area has no minimum because it may be combined into one examination paper with the core as shown on Model 2 below.

Summary of Structure

Compulsory	(Coursework	30% min	45% max
	(Written Common Core	20% min	30% max
	(Design Examination	25% min	30% max
Discretionary	Optional Study Areas		25% max

The examples of possible formats are to show the flexibility of the proposed structure. Model 3 is the most worrying, in that examining four elements in different units could be exerting considerable pressure on candidates; however, other 'A' levels do have four elements, including several physics examinations, so students should not find this model too demanding.

Examples of possible formats

MODEL 1	Coursework 45%	Core 30%	Design Exam 25%	
MODEL 2	Coursework 40%	Core 20% + Option 15%	Design Exam 25%	
MODEL 3	Coursework 35%	Core 20%	Design Exam 25%	Option 20%

The proposed criteria developed in this chapter seek to establish a rationale for Design and Technology at 'A' level and establish a sound foundation upon which future syllabuses can be created. It could give design and technology a clear distinctive identity across all Boards. Furthermore, the implementation of the proposed common core will undoubtedly assist in the creation of a viable, easily identifiable and acceptable advanced level subject. The proposals are very similar to the new Secondary Examination Council proposals for an 'A' level core in Design and Technology and the SCUE/CNAA proposals. This is not insignificant in that part of this study has contributed to both working parties.

The effectiveness of the proposed criteria will be its ability to take current good practice at 'A' level and harmonise it in moving the subject forward. In Chapter 8 current syllabuses are analysed to determine the current position and to see how effective the criteria may be.

CHAPTER 8

EVALUATION OF EXISTING CRAFT, DESIGN AND TECHNOLOGY SYLLABUSES AGAINST THE PROPOSED CRITERIA

The criteria developed in Chapter 7 and collated in Appendix D, seek to establish a firm base upon which to build the subject's acceptability. In concluding Chapter 7, it was suggested that the proposed criteria should not be too dissimilar to those syllabuses which have already received a high level of acceptance. This chapter looks at 'A' level syllabuses to establish the applicability of the criteria and to show how syllabuses meet it and any changes which may be necessary. It would be inappropriate to attempt to evaluate all twenty-six syllabuses and therefore it is proposed to evaluate those which received Design Council approval and thus acceptance by University and Polytechnic Professors of Engineering. The syllabuses are as follows:-

AEB - Design -Communication and Implementation
(now called CDT: Design and Realisation)

Cambridge - Craft, Design and Technology
Technology

London - Design and Technology

Oxford - Design

Welsh - Design, Craft and Technology

There are many ways of carrying out an evaluation of syllabuses against given criteria and naturally it is in some parts very subjective. The criticisms noted regarding the Design Council criteria in Chapter 6 show how subjective such an evaluation can be, so there is a need for careful consideration of each aspect. To highlight the differences between syllabuses, they will be looked at under each of the sections of the criteria, in a similar manner to the instruments being used for GCSE scrutiny.

Subject Titles

The proposed title of 'Design and Technology' is only used by the London Board at present. However only the Cambridge Board Technology syllabus does not include the word 'design' and only the AEB and Oxford Boards do not have the word 'technology' in the title. What is significant is that all syllabuses have design activity as a relatively central theme. The fact that the Cambridge Craft, Design and Technology syllabus, when written, was called Design and Technology until the final meeting, indicates how close this syllabus may be to the proposed title. There may be some movement to create Design and Technology as a title for the subject as both University departments for initial teacher training in CDT call their departments Design and Technology and the JMB has recently redefined its proposed new syllabus 'Design and Technology'. It is unlikely that the Cambridge Board will re-title its syllabuses and it would require them to be reduced from two to one. The move to a single title is very desirable and the SCUE/CNAA working party has recommended Design and Technology as a title. Unfortunately, at a time when some rationalisation is beginning to take place and SEC is starting to apply pressure to rationalise syllabuses which do not meet the 'A' level criteria, a range of new syllabuses can be seen appearing called 'A' level 'Technology'. This is an interesting development but will probably prevent the single title approach. It is significant that the technology syllabuses will be following the Cambridge success but will not be derived from the same philosophical base. Both London and JMB who are currently working on 'A' level Technology syllabuses are working from an engineering science base rather than a designing and making base. The failure of Engineering Science 'A' level, in spite of the enormous pressure and resources from the Northern Universities in particular, may now be regenerated under the title Technology.

To summarise, the designing and making philosophy of Design and Technology is present in all six syllabuses and the movement is towards Design and Technology as a title taking place. However, the generation of subjects called Technology may slow down such movement, if not curtail them completely. The danger of introducing a Technology syllabus into the field to compete with Design and Technology could be argued against by the fact that it will expand the field. However, if it comes from an engineering science philosophy, then there are grave dangers that it could diminish the numbers in Design and Technology leading to a loss of identity again, at a time when it is striving to move forward. The introduction of Design and Technology as the AS title may be significant and with a degree of rationalisation, design and technology could develop as a sound title.

The title Technology is attractive to Boards, but if developed as merely a new title for engineering science without the Cambridge Technology's design element, it could set the subject back. This has already occurred at GCSE.

Aims

The initial look at the six syllabuses identifies three with stated aims and three without. This is, however, a somewhat over-simplified analysis as both Cambridge CDT and Oxford Design syllabuses have an introductory paragraph which sets out a general philosophical statement about the syllabuses. It is only the Welsh Design, Craft and Technology which has no introduction or stated aims, although somewhat lost in the text is a statement which could reflect the aims. The three Boards who set out aims range from three on London, to eight on AEB and ten on Cambridge Technology. The London aims pull areas together whereas both the AEB and Cambridge aims tend to be more specific. The following extracts show each Board's specific aims or the appropriate paragraph from the introduction.

AEB - CDT Design and Realisation

Aims

To develop:

(i) the ability to use practical, intellectual and inventive skills in 3-dimensional design, in which the relationships between function, technical execution and individual expression are demonstrated;

(ii) an understanding of the physical, mental and emotional nature of man in relation to the design of products to meet specified human needs;

(iii) the ability to conduct a reasoned analysis and evaluation of ideas;

(iv) technological capability;

(v) the ability to conduct a reasoned analysis and evaluation of finished products;

(vi) an understanding of the social implications of design and of developing technologies;

(vii) a range of making skills;

(viii) the ability to make value judgements in respect of considerations which are aesthetic, technical or economic in nature or which relate to honesty in terms of designing and making activities.

Cambridge - Craft, Design and Technology

Introduction

The syllabus provides opportunities for candidates to identify, analyse and evaluate problems and then use their experience and knowledge of materials, processes and related technologies to attempt to solve these problems. Candidates will be encouraged to use their intellectual, communicative and practical skills in 3-dimensional design situations, making a qualitative relationship between the aesthetic, the functional and the technical realisation. The syllabus is intended to promote the industrial awareness of students through actual involvement in industry as well as the study of manufacturing processes and techniques.

Cambridge - Technology

Aims

1 To give an understanding of the design process, its inherent decision making and its application in the solving of technological problems, culminating in self-critical evaluation of the solution against the original specifications.

2 To challenge those sixth form students who have the aptitude and ability to become engineers with a course combining academic rigour and technological creativity.

3 To give an opportunity for sixth form students to obtain a technological dimension to their education that will assist them in becoming informed decision makers in a technological age.

4 To exploit inherent creative and inventive talents by providing a stimulating course that will produce a high degree of technological capability.

5 To provide a course upon which faculties in higher and further education can build.

6 To give sixth form students a body of knowledge and the confidence that will enable them to overcome technological problems by means of workable and workmanlike solutions.

7 To give sixth form students the comprehension and communication skills, both oral and graphical, that will enable them to discuss technological issues with informed and less informed members of the public.

8 To give sixth form students an awareness of the resources and restraints of technology.

9 To give sixth form students an understanding that technology is concerned with working with people and for people.

10 To illuminate the importance of, and provide opportunities for, the application of mathematical and scientific principles.

London - Design and Technology

Aims

The aims of the syllabus are

(a) to provide a wide understanding and appreciation of the resources relevant to the solution of design problems in a technological context, permitting study in depth of chosen areas,

(b) to develop the essential continuum of work of an open-ended and problem solving nature, with the intellectual content reflected by a maturing of experience in design,

(c) to offer a breadth of study relevant to creative work whilst affording the opportunity for candidates to identify their own priorities within the general area of design.

Oxford - Design

Syllabus

Candidates are expected to acquire a general understanding of the design process, at the level appropriate to sixth form studies. In the context of the course the definition to be assumed is that the design process is the conscious attempt by someone to determine some part of the environment in a way suitable to the individual's purpose. The syllabus allows varied approaches to the subject to be accommodated. These approaches may range from the expressive to the technological. It is expected that candidates will receive a balanced exposure to both the functional and the aesthetic aspects of design. For the purposes of the course the core of the design process is seen as a tripartite relationship between designers the means of production (as it relates to manufacturer and client) and the user.

The statement in the Welsh Design, Craft and Technology syllabus states:-

> 'The syllabus seeks to provide a study of the nature of design and an awareness of the social implications of technology, together with creative experience in the design studio and workshop. Candidates will be expected to show a high degree of technical expertise, creativity and intellectual rigour indicating a lively, inventive and technologically informed mind.'

The aims, introductions or obscurely presented statements show that a common format as suggested at GCSE is urgently needed. The following table 8 seeks to show how the syllabuses meet the proposed criteria in terms of their aims. The letters used are (C) to indicate this is completely covered and (P) to show partial coverage. The fifth column shows those aims outside the proposed criteria aims.

TABLE 8 Aims from Proposed Criteria (See Chapter 7)

Syllabus	1	2	3	Additional Notes
AEB CDT:D&T	C	C	C	-
CAMB CDT	C	P	C	Industrial Awareness
CAMB TECHNOLOGY	C	C	C	3, 10
LONDON D & T	C	C	C	-
OXFORD DESIGN	C	C	C	-
WELSH D,C T	P	C	C	-

It is significant that the proposed aims are reflected by most syllabuses; in fact, there are only two that do not meet the aims and some may have been lost in the imprecise manner in which they have been expressed. Thus future detailed evaluation may not be valid in those cases. It is significant that two syllabuses do add to the proposed criteria. The Cambridge CDT syllabus clearly states, 'The syllabus is intended to promote industrial awareness ... through actual involvement in industry.' It is of consequence that the syllabus most usually thought to reflect the needs of industry i.e. Cambridge Technology, does not state this in its aims, although it does have an industrial project. The Cambridge Technology syllabus does extend its aims to two other factors however. In aim 3 and aim 4, the stress on technology is high, and although the AEB syllabus does have Aim 4 as technological capability; in essence it is at a lower level than the Cambridge syllabus. The second difference with the Cambridge Technology concerns its stress in aim 10 on mathematical and scientific principles. This, perhaps, helps the notion that Cambridge Technology aims at a higher level of capability in Technology than other syllabuses.

It is feasible to draw the conclusion that none of the Keith Lucas-approved syllabuses would have great difficulty meeting the new proposed aims for Design and Technology.

Objectives

The proposed criteria in this study identify a comprehensive list of objectives in which it is feasible to assess syllabuses. It is unlikely that any syllabus at 'A' level would be defined in such detailed terms because it is, in principle, an instrument for assessing syllabuses. However, before applying the objectives it would be appropriate to identify which syllabuses set out any objectives. There are only two which define overall objectives, that is the AEB CDT Design and Realisation and the London Design and Technology. Both sets of objectives are almost identical and are based upon the designing, making and evaluating process.

AEB - CDT Design and Realisation

Objectives

The examination will test the ability of the candidate to:-

(i) recognise a need;

(ii) identify, analyse and evaluate a problem;

(iii) formulate ideas and apply knowledge and experience to the resolution of problems;

(iv) search, identify and record relevant information and communicate ideas in an appropriate manner;

(v) demonstrate technological capability when designing and making;

(vi) use skills and processes appropriate to the use of materials;

(vii) be critical of personal standards of work;

(viii) anticipate dangers and use equipment and materials with care and safety;

(ix) design products which can be used safely;

(x) evaluate a personal solution to a problem and suggest possible improvements;

(xi) discriminate between different solutions to the same problem;

(xii) identify the implications of design and technology upon society and the environment.

London - Design and Technology

Objectives

The objectives of the examination are to test the ability to:

(i) identify a problem;

(ii) research, analyse and evaluate;

(iii) visualise ideas and develop a viable solution;

(iv) communicate ideas through a range of media;

(v) interpret appropriate technological concepts and apply them to the solution of a problem;

(vi) select and safely use suitable materials, tools and process in solving problems;

(vii) apply the appropriate physical and intellectual skills in manipulating materials systems;

(viii) evaluate solutions to a problem and where necessary modify;

(ix) understand the implications of design and technology upon society.

In assessing the six syllabuses against the criteria objectives, it is recognised that through the coursework projects any one students may well have met the objectives fully but the assessment will be based on the ability of the syllabus to reliably deliver the objectives to all students doing the course. This will have a degree of subjectivity as the techniques of examining vary considerably. An example is the Cambridge Technology with its implicit core examined by a Case Study folder, compared with London's common core examined with compulsory questions. Thus Table 9 uses three classifications, E for examined, I for implicitly present and N for not present.

The analysis of objectives clearly shows a high degree of consensus as one would expect in light of all syllabuses meeting the Keith-Lucas criteria. On some occasions the degree to which syllabuses meet the objectives is rather borderline and, of course, two syllabuses use a core plus options which can distort the syllabus. In looking at Knowledge, (1b) and (1e) were difficult to determine as some syllabuses placed little emphasis on control and energy and many did not define any laws and theories but did define the main concepts. (1f) was equally difficult to determine; most syllabuses expected some awareness of industry, but few included marketing and sales methods. All syllabuses involved students in comprehension in a balanced manner, although only Cambridge 'Technology' expected the computer to be used. The six syllabuses covered the Application objectives, naturally 3(d) was only implicit but most syllabuses were sufficiently demanding. Under analysis, 4(b) and 4(c) were implicit but no direct reference was made, although the published assessment

TABLE 9

Analysis of Syllabus Objectives against Proposed Criteria Objectives

(See Chapter 7)

Proposed Objectives			AEB CDT: Design & Realisation	CAMB Craft, Design and Technology	CAMB Technology	LONDON Design and Technology	OXFORD Design	WELSH Design, Craft and Technology
			Syllabuses					
Knowledge	1	a	E	E	E	E	E	E
		b	E	E	E	E	E	E
		c	E	E	E	E	E	E
		d	E	E	E	E	E	E
		e	E	E	E	E	E	E
		f	E	E	E	E	E	E
Comprehension	2	a	E	E	E	E	E	E
		b	E	E	E	E	E	E
		c	E	E	E	E	E	E
Application	3	a	E	E	E	E	E	E
		b	E	E	E	E	E	E
		c	E	E	E	E	E	E
		d	I	I	I	I	I	I
Analysis	4	a	E	E	E	E	E	E
		b	I	I	I	I	I	I
		c	I	I	I	I	I	I
		d	E	E	E	E	I	I
		e	E	E	E	E	E	E
		f	E	E	E	E	E	E
		g	E	N	N	N	E	E
Synthesis	5	a	E	E	E	E	I	E
		b	E	E	E	E	I	E
		c	E	E	E	E	I	I
		d	E	E	E	E	I	I
Evaluation	6	a	E	E	E	E	E	E
		b	E	E	N	E	E	E
		c	E	E	I	E	E	E
Realisation	7	a	E	E	E	E	E	E
		b	E	E	E	E	E	E
		c	E	E	E	E	E	E
		d	E	E	E	E	E	E
Sensitivity/Attitude	8	a	E	E	N	E	E	E
		b	E	E	I	E	E	E
		c	I	I	I	I	I	I
		d	I	I	I	I	I	I
		e	E	E	E	E	E	E
		f	I	I	I	I	I	I

booklet for London Design and Technology does expect, where appropriate, sub-probleming and it is stated. The first area where aspects are found not to be present concerns 4(g) which is concerned with recognising the techniques of persuasion, such as those used in advertising. The two Cambridge syllabuses make no reference to this and the London syllabus has a large section on it but in its optional section. Most syllabuses conform to the synthesis objectives; however, the Oxford Board 'Design' sets out very little guidance for teachers and makes no mention of synthesis. The Welsh syllabus has some weakness in this section but both syllabuses would consider it implicit. In terms of 'Evaluation', the Cambridge 'Technology' is perhaps weakest in terms of objectives, although it places great emphasis on evaluation. The syllabus only makes one reference to aesthetics and that is an additional note. This is perhaps unfortunate because it is not the Board's intention to place so little emphasis in this area. As all syllabuses involve designing and making, naturally the 'Realisation' objectives are all achieved. Under sensitivities/attitudes, 8(c)(d) and (f) are implicit and only the Cambridge 'Technology' syllabus does not fully meet the objectives and again it is a result of the lack of reference to aspects such as aesthetics, colour, form, shape.

The conclusions to be drawn are that most syllabuses have a good broad base and only the most specific syllabus (Cambridge Technology), which goes for greater depth, fails to meet all the objectives. This also shows the proposed objectives provide a broad base upon which to build the subject.

Common Core Content

This area is the one in which Higher Education is likely to be most concerned. Naturally the objectives give an indication of the coverage but the core content tries to define specific skills and knowledge. The skills are all covered to similar levels, as shown in the objectives; thus, it is not necessary to reassess that area of the core. It is in the area of knowledge, which many design teachers would consider to be less important, that Higher Education appears to show most concern and it is here that some syllabuses give the idea that design and technology is a soft option. In carrying out the analysis, it would be valuable to look at depth of treatment; however, the subjective nature of such an analysis makes it invalid. As with the objectives, such an analysis will only look at core material and not include optional areas. The implicit core of the Cambridge Technology is included in this analysis. If the identified aspect is present it will be indicated with a (/) and where not present with an (X). The analysis is shown in Table 10.

TABLE 10

Analysis of Core Knowledge in Syllabus against Proposed Criteria Common Core Knowledge

(See Chapter 7)

Syllabuses

Common Core Knowledge	AEB CDT: Design & Realisation	CAMB Craft, Design and Technology	CAMB Technology	LONDON Design and Technology	OXFORD Design	WELSH Design, Craft and Technology
(a) Materials and Components						
Including:- Metal, plastics & Wood	/	/	X	/	/	/
Adhesives	X	/	X	/	X	/
Characteristics/Properties	/	/	X	/	/	/
Market forms and costs	/	X	X	X	/	X
Manipulative forms	/	/	X	/	/	/
Joining techniques	/	/	X	/	/	/
Components for fixing	/	/	X	/	/	/
Components for Control systems - Characteristics	/	X	/	/	X	X
Market forms & Cost	X	X	/	/	X	X
(b) Control						
Identification & Use of Control systems	/	/	/	/	X	X
Static-Dynamic	X	X	X	X	X	X
Concepts of input, output etc	X	/	/	/	X	X
Electronic	/		X	/	X	X
Mechanical	/	1 off	X	/	X	X
Structural	/		X	/	X	X
(c) Energy						
Sources and Forms	/	/	/	/	X	/
Storage and Conversion	/	/	/	/	X	X
Transmission and Efficient Use	/	/	/	/	X	X
(d) Aesthetic Understanding						
Principles	/	X	X	/	/	/
Natural and Man-made	/	/	X	X	/	/
(e) Design and Technology in Society						
Constraints	/	/	/	/	/	/
Ergonomics and Anthropometrics	/	/	/	/	/	X
Relationship to society	/	/	/	/	/	/

The analysis of core content immediately provides a much more distinguishing method of assessing the syllabuses. However, it does not provide quite as clear a picture as first impressions might suggest. The Cambridge 'Technology' and London 'Design and Technology' both take students further than the core and, therefore some elements would be covered. It is also significant that these two syllabuses are the only ones which indicate the advantage of some previous 'O' level work in the subject. Thus the following comments must be considered in that context. The AEB syllabus is very comprehensive, although there is little or no indication of depth, a feature which must pose problems to teachers and candidates alike. Its only areas which are not present concern adhesives, of which there is no mention, perhaps implicit in the generic terms used in this syllabus; no reference to market forms of materials and weakness in the control concepts of input, output, etc.. This syllabus provides a good broad course in design and technology. The Cambridge 'Craft, Design and Technology' syllabus is, like the AEB syllabus, very broad but gives slightly more depth in several areas. In looking at materials it really only expects the study of materials in two areas from metals, plastics and wood. It does not look at market forms or costs of materials and is weak in the area of aesthetics. On control it looks at control concepts of input, output etc but then only asks candidates to work in one of the forms:-mechanical, electronic or structural. However, this again is a sound syllabus. The Cambridge 'Technology' syllabus is extremely difficult to analyse against a proposed core and the principle of implicitly expecting students to know about materials, processes and techniques is ambiguous when it does not make 'O' level a pre-requisite. The stated core is very industrially-orientated and does not provide a foundation for the use of materials in solving design problems. However, the principal test of knowledge is through the study of two modules and depending on the choice of these modules, then many points could be covered within that study. However, at present this syllabus remains weak in terms of core knowledge but to compensate, it undoubtedly provides the greatest depth of any syllabus in its modules. The London syllabus 'Design and Technology' does not meet the core in two areas;- no recognition of cost in the core and weakness in the area of aesthetics. Otherwise, this is a syllabus with strong broad core with most aspects examined in the core theory paper and the more general issues defined in the design syllabus. The Oxford Board syllabus which is more concerned with the role of the designer in society and the use of materials, is very weak in the technology area of the core and although such a syllabus makes no pretence to include technology, it would require some significant changes to cover the relevant technological concepts.

The Welsh 'Design, Craft and Technology' defines less knowledge than any other syllabus and it is hard to see how it justifies the term 'technology' in its title. There is only the technology associated with materials and the remainder is left out, except for a reference to energy sources. It is also surprising to see the topics of ergonomics and anthropometrics missing in a design syllabus. In terms of the knowledge core there is no doubt that this syllabus is the weakest and it does call into question its viability as an acceptable 'A' level. The lack of a technological aspect to the Oxford Board's 'Design' syllabus makes it difficult to see how it can meet the design and technology criteria, although it is likely that this Board would not wish it to meet such criteria. The Cambridge Technology syllabus requires either an 'O' level pre-requisite or a more closely defined core in terms of the knowledge necessary to realise a practical project. Thus in terms of the core content knowledge, AEB's "CDT: Design and Realisation,' Cambridge 'Craft, Design and Technology' and London 'Design and Technology' meet the knowledge criteria and all six syllabuses meet the skills common core. This is undoubtedly a sound basis upon which to build criteria.

Examination Structures and Techniques

The examinations structure and techniques of assessment are very important in determining the depth and breadth of a student's experience. It is difficult to categorize entirely the various modes of assessment. For instance, a definition of coursework is difficult to determine. Some would define it as any work done during the study period of the course; however, that is rather a loose definition. If the concept of project work is set by the Board, it is necessary to ask if this is coursework or not. It could be argued that as there is an external agent setting the task, then it is an examination unit. The point can be better illustrated if the example of a design and make project is set over 4 hours or two terms; which is coursework or are they both set examinations? Therefore, in defining what coursework is, and by deduction, that which is not, the following definition may be helpful.

Coursework is that work which is initiated by the candidate or teacher, with no guidance provided by the Examination Board, and developed within the duration of the course.

In looking at Examination Structures it is significant to note an SEC paper in 1985 on 'Principles and Good Practice at Advanced Level' relating to Physics and Chemistry which noted the excessive overloading of syllabuses with knowledge which tended to prevent practical work and where practical work took place, it was rarely assessed, and where assessment took place it had a low value. The criteria established in Chapter 7 referred to overcrowding of syllabuses and in evaluating current syllabuses it is relevant that this is taken into consideration. The following summary provides a starting point for evaluating the syllabuses:-

Syllabus	Examination Description	Time	Weighting
AEB			
CDT: Design and Realisation	Designing Examination	3 hrs	13½%
	Technology	2½ hrs	18%
	Design in Society	2 hrs	13½%
	Coursework 1 Major (33%)		
	1 Minor (11%)		44%
	Oral	30 mins	11%
CAMBRIDGE			
Craft, Design and Technology	Design (Pre-Design)	6 hrs	25%
	Technology	2½ hrs	20%
	Industrial Report		15%
	Coursework 1 Major (24%)		
	2 Minor (16%)		40%
CAMBRIDGE			
Technology	Design	4 hrs	25%
	Common Core Study Folder		15%
	Project		30%
	Modules (2 from 4)	3 hrs	30%
LONDON			
Design and Technology	Design (Pre-Design)	6 hrs	33⅓%
	Technology Core(20%)	3 hrs	33⅓%
	Options(2 from 5) (13⅓%)		
	Coursework 1 Major (22%)		
	2 Minor (11%)		33⅓%
OXFORD			
Design	Theory	3 hrs	20%
	Materials and Design	3 hrs	20%
	Coursework - Major Project + Additional Evidence		60%
WELSH			
Design, Craft and Technology	Problem Solving	4 hrs	30%
	Design and Technology	3 hrs	30%
	Design Study Coursework		40%

The recommendations on the examination format suggested two possible models for covering Knowledge. One model suggested a core plus options approach and the other suggested a core in greater depth. There are three syllabuses which use the latter approach and have no options in relation to set areas. These are the AEB, Oxford and Welsh syllabuses. The analysis earlier in this chapter indicated that, although based on the core, neither the Oxford nor Welsh syllabuses cover the whole core. The other three syllabuses use optional areas. The Cambridge CDT syllabus uses an Industrial Study as an optional area outside the core. The topic is derived by the candidate but worked to a set brief in terms of assessment. The Cambridge Technology uses two forms which could be classified as optional. It has a common core study folder which is from a set theme given by the Board but theoretically based on the common core. It undoubtedly involves many common core aspects but it is somewhat artificial to claim it is a common core study without including most aspects of the common core in the project mark scheme, something which the mark scheme clearly does not illustrate. This Cambridge syllabus also has a specialist optional paper where candidates study in depth two modules from four. This gives the syllabus great depth and is undoubtedly one of its greatest strengths. The modules on offer are Structures, Automation, Electronics and Material Processing. The London syllabus also offers options but not on a separate paper but as part of the Technology paper which incorporates the core. The options offered are Design and Technology in Society, Materials, Microelectronics, Mechanisms and Energy and Computer Aided Engineering. Both these syllabuses provide an opportunity to take specific areas of study in depth while maintaining some breadth. The criteria proposed optional areas should not exceed 25% of the total marks. The London syllabus only allocates 13½% so it is not in conflict with the recommendations. The Cambridge CDT only allocates 15% to its Industrial Study and therefore does not exceed this optional allocation. However, the Cambridge Technology syllabus is in conflict. Its modules represent 30% and therefore are in excess by 5%. It could be argued that many aspects of the modules would fall into the core; however, as the modules are a random selection, it is not feasible to guarantee coverage. The common core study folder is difficult to classify and, although this study could be regarded as a discretionary area, the Cambridge Board would argue equally forcefully that it is a sound method of examining the common core. Although its soundness is in considerable doubt, for the purpose of this study it is assumed to be common core.

The criteria established three compulsory areas in which assessment should take place. The first concerned coursework which involves designing, making and evaluating and it is suggested there is a mark range of 30% to 45%. Fig 9 summarises the allocations and clearly shows that only the Oxford design syllabus is in excess of the recommended maximum for coursework allocation in the proposed criteria and no syllabus is below. The average coursework mark is 41.2% and of those which fall within the maximum and minimum marks it is 37.5%.

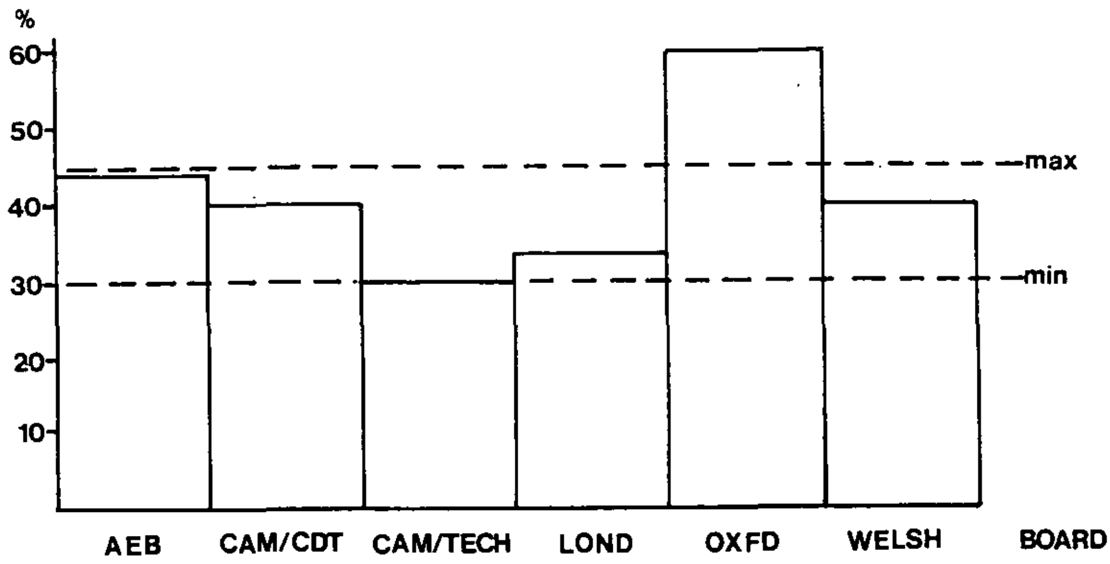


Fig 9 Coursework % Mark Weightings

The coursework is different in nature between the Boards. Some like the Welsh set a theme for the major project, some expect minor projects but do not assess them, some expect additional evidence to the major project but do not weight it and some seek to set minor and major projects. The criteria require evidence of at least two projects. Cambridge Technology is the only syllabus which seeks only one project, but the Oxford Design centres its assessment on one major project. AEB requires one major and one minor project, Cambridge CDT and London Design and Technology require one major and two minor projects and the Welsh Board requires one major project and two coursework pieces.

The second compulsory aspect of the assessment structure concerns the written common core paper which has between 20% and 30% mark allocation. All six examinations have this aspect with AEB and Oxford having two examinations. The Oxford Board would contend that some aspects of its theory papers would fall into the optional area of study and similar arguments could be used by AEB. The Cambridge Technology syllabus has its written study, which has been discussed previously. Fig 10 summarises the mark weighting.

The comparison of time allocation in Fig 11 shows there is little difference between time allocation and marks allocated, with only the 6000 words core study being impossible to have allocated a similar time base. The average common core study mark allocation across the six syllabuses is 26% and average time allocation across five syllabuses is 3 hours 36 minutes. If some aspects of both the Oxford and AEB are deemed optional and the mark allocation and time slightly reduced, there would be a fair degree of

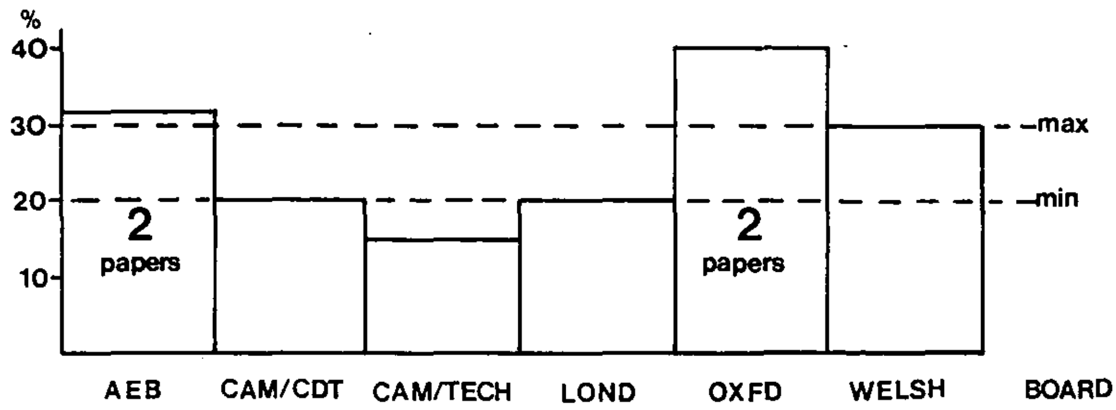


Fig 10 Common Core Written Paper % Mark Weightings

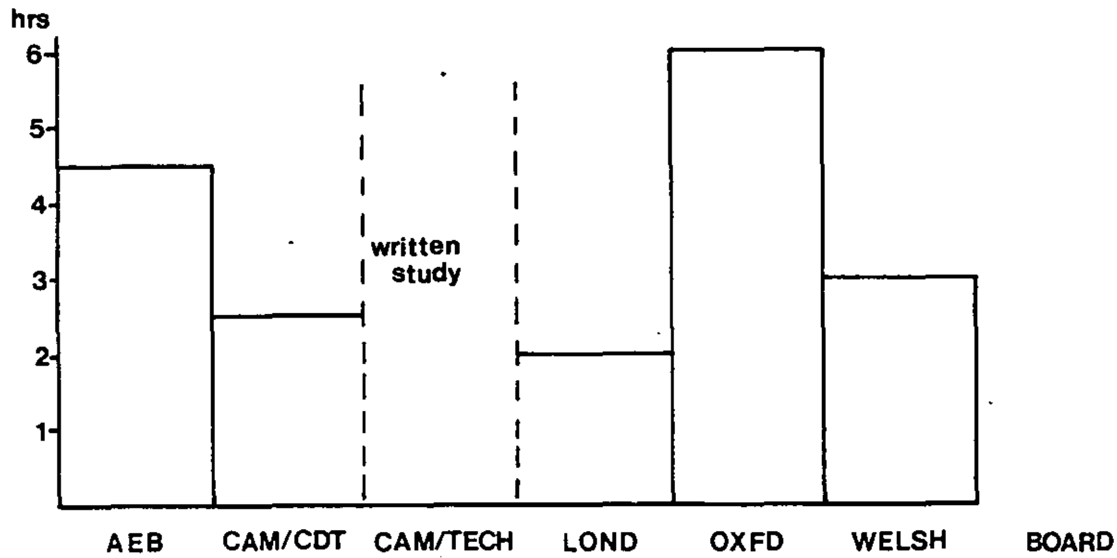


Fig 11 Common Core Written Material Time Allocation

consensus on work and time allocation, but the Cambridge Technology syllabus with its core study remains a doubtful aspect of assessing core material in its present form.

In looking at the third compulsory element which is concerned with the design paper, five out of six Boards use this paper, the exception being Oxford. The proposed criteria in Chapter 7 suggests the use of a pre-design paper. This is used in Cambridge CDT and London Design and Technology but not on any other Boards. Four Boards use the term design or designing in the title of their syllabuses, the Welsh use Problem Solving. In Fig 12 the weighting allocations are shown. When this is displayed against time allocations (Fig 13) considerable fluctuations appear. It is interesting to note that the two examinations giving the pre-design topics also give the longest time allocation for the actual examination. The two Cambridge examinations give the same weighting allocation but have a two hour difference in the time given to solve the set problem.

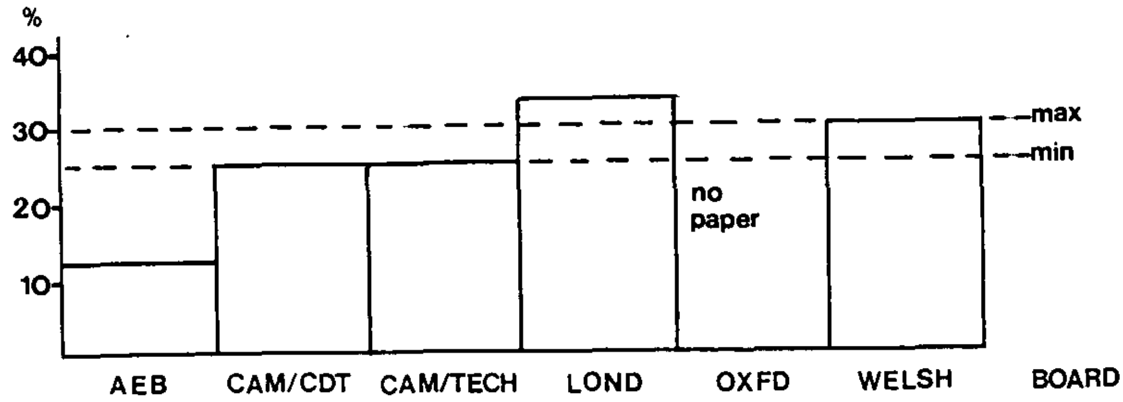


Fig 12 Design Paper % Mark Allocation

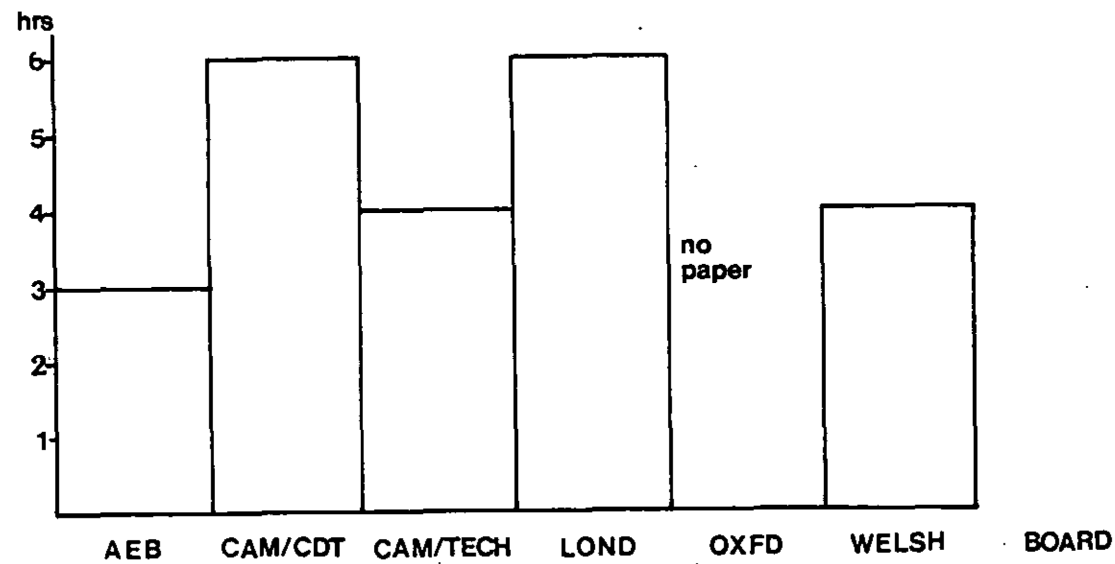


Fig 13 Design Paper Time Allocation

London Design and Technology is slightly above the mark allocation recommended and AEB is well below. The AEB's use of a three hour paper to derive 13.5% of a candidate's final percentage must be called into question. The proposed criteria suggest no individual element which is examined in a separate paper should be under 20% of total marks. AEB fails to meet this aspect on four of its five examined units. However, in respect of the 3 hour Design examination it does appear to be a particularly low mark allocation for this amount of concentrated work, although AEB could argue that its 13.5% allocation for 3 hours is greater than Cambridge CDT's 25% allocation for 6 hours. The average mark allocation, excluding Oxford, is 25.4% and the average time per examination is 4 hours 36 minutes. This average of 4 hours 36 minutes to obtain 25.4% of the marks on a Design paper compares with 3 hours 36 minutes to obtain 26% of marks on the common core. This initially may look disconcerting but there is little doubt that

Design examinations need more time for thinking and allowing ideas to germinate, thus the difference is pleasing to see, as Boards are obviously recognising this fact.

There is one other element of assessment present in examining these 'A' levels: this concerns orals. The AEB has an oral examination lasting approximately 30 minutes that covers the whole syllabus. This examination is worth 11% of the total marks. All other syllabuses have all coursework assessed by visiting examiners, although the London Board uses only the sampling method for visits. There is little doubt that coursework is more effectively assessed by visiting examiners. Unfortunately, the ability to standardise over 230 centres with visiting examiners does cause problems in terms of cost and reliability. This is the problem which confronts Boards the most. However, the value is certainly considerable and it is a good in-service and public relations exercise for many small centres. In the short period in which this assessment can take place, experienced staff who can do this work have found it impossible to give up more than four days, which on average is six centres. This indicates that a Board such as London would require approximately 38 visiting examiners. The average cost per day, excluding administration costs, is more than £70 at 1985 prices and that assumes for many that their current employees do not deduct pay for this examination work. This leads to an average cost of £15 per candidate visited by examiners. Thus it is not surprising that the justification for assessment by visiting examiners needs careful evaluation and strong arguments to substantiate such expense.

The evaluation carried out in this chapter against proposed criteria clearly establishes that on most aspects of the criteria the syllabuses approved by the Keith-Lucas criteria would meet the proposals in Chapter 7. The aims and objectives are undoubtedly very close and as they centre upon designing and making it is understandable that the syllabuses meet the criteria. The common core area begins to highlight some of the anomalies and problems in both the method of assessing and what knowledge is deemed necessary to service soundly the designing and making activities. The examination structure again has a sound consensus but with some notable exceptions. The depth opposed to breadth question is difficult to determine, even when actual examination papers are evaluated. However, the use of option areas does provide syllabuses with the opportunity to obtain some real depth but does not necessarily indicate that other syllabuses are not so rigorous. Table 11 shows that only the Oxford Board Design does not meet all three compulsory elements. However, when we look at Table 12 of those that meet the mark allocation, the picture is somewhat different with only eleven units out of eighteen conforming. This is

TABLE 11 Syllabuses examining compulsory elements

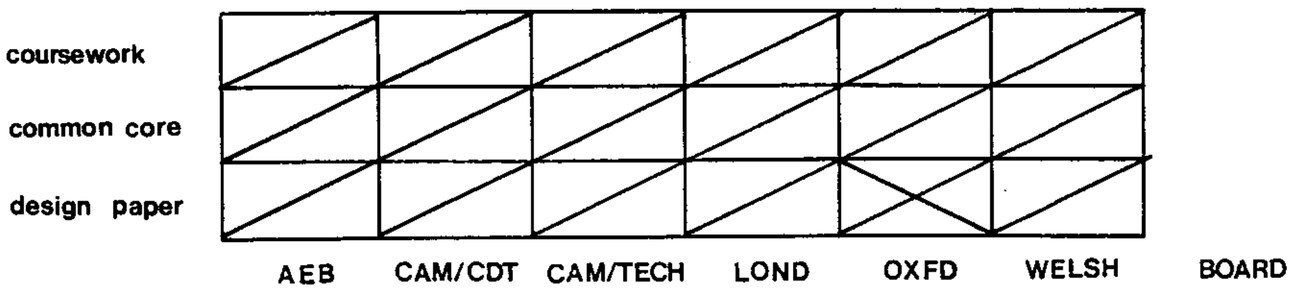
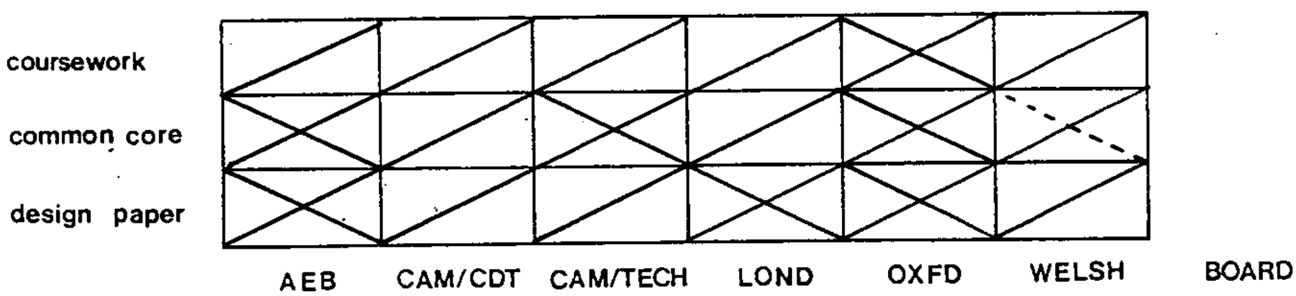
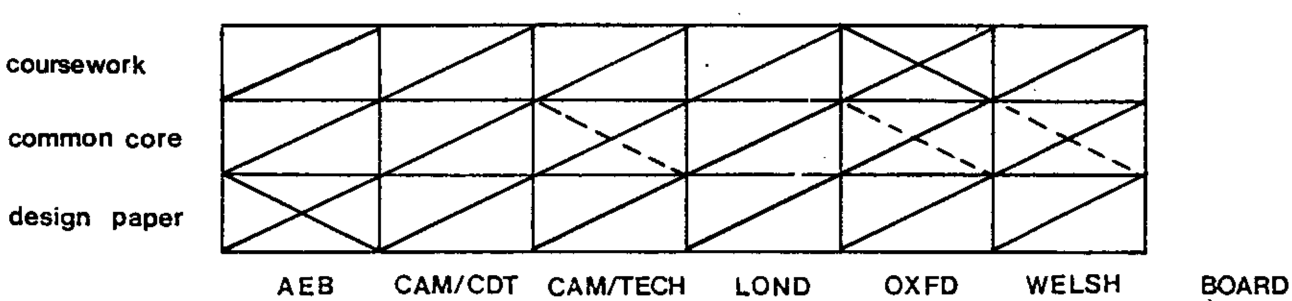


TABLE 12 Syllabuses examining the compulsory elements meeting the criteria mark allocation



also slightly distorted because the analysis of the common core clearly shows that the Welsh syllabus does not meet the common core criteria and therefore it would be more accurate to suggest that only ten elements out of the eighteen or 56% conform. Such an analysis, which is very crude, identifies the Cambridge CDT syllabus as the one which conforms most accurately to the proposed criteria. This analysis is very tight and if the analysis is carried out with a 5% flexibility at the top and bottom of the mark allocation, a different picture emerges (see Table 13).

TABLE 13 Syllabuses examining compulsory elements with a 5% flexibility in mark allocation



This shows considerable conformity with only Oxford and Welsh common cores in doubt over insufficient coverage. There are only four major areas of concern:-

1 AEB has too low a mark allocation for a 3 hour Design Paper.

2 Cambridge 'Technology' has some doubts over its method of examining the common core, but it does fall within the mark allocation.

3 Oxford coursework has too high a mark allocation.

4 Oxford has no design paper.

Having looked closely at these syllabuses there is little doubt that the demands placed upon students are becoming excessive in this drive for acceptance. The notion of the soft option is far from apparent in this study but until a comparison with other subjects is undertaken it is difficult to establish. The analysis has shown some grounds for optimism that the subject area can be examined through the criteria proposed in Chapter 7 and only the Oxford Board would need to reshape its syllabus significantly to conform. This should encourage SCUE/CNAA, SEC and the Boards to work closely to establish this consensus.

CHAPTER 9

COMPARISON OF CRAFT, DESIGN AND TECHNOLOGY 'A' LEVELS WITH OTHER 'A' LEVEL SUBJECTS

The acceptance of 'A' levels in Craft, Design and Technology has many drawbacks to overcome, not least its origin, its lack of numbers, its inability to provide a coherent image and its lack of rigour in the minds of many who have failed to evaluate it at first hand. Previous chapters have sought to identify and give guidance on how to overcome some of these problems. However, the notion of lacking rigour or, to use Professor French's comments at the RSA in 1978, 'Design and Technology is a "soft" option' remains unanswered and this chapter attempts to compare Craft, Design and Technology at 'A' level with other 'A' level subjects to determine the validity or otherwise of such statements.

Firstly, it is relevant to look at current comparative methods both with subjects and between subjects to determine the difficulties and methods which could be useful as part of this exercise. The second part of this chapter will show some statistical comparisons between subjects. This will be followed by an indepth comparison of the proposed criteria in Chapter 7 and those published by the Boards for other subjects in 1983. As this study is intended to be forward looking, this data at least provides a common platform upon which to base some comparison. Finally, the chapter will show past students' views on the subject, comparing the subjects and expressing some of the more intrinsic values the subject has in terms of personal development, a factor sadly lacking in most aspects of assessment for Higher Education.

Throughout this comparison,it is important to recognise that CDT at 'A' level is significantly different from many subjects, testing a wide range of skills and knowledge and uses coursework on all syllabuses as a means of assessment. Such variables will not easily equate with more traditionally assessed syllabuses. It is perhaps also wise to recognise that much of this assessment will be subjective and Malcolm Deere's comments on 'A' level acceptability in the foreword to the Durham County Council publication on 'A' level acceptability is very pertinent to this comparison:-

> 'One of the worst frustrations in education is that it is very hard to prove that you are right, and harder still to prove that the others are wrong.'

Background to comparative methods

The comparison of 'A' level subjects is an immensely difficult task and there is no single method of making a comparison with such a diverse set of skills and knowledge being assessed across a range of disciplines. For example, in 1980 on the London Board,65% passed 'A' level Physics and 75% passed 'A' level Nuffield Physics, yet by 1984 on the same Board 72% passed Physics and 71.7% Nuffield Physics. There may well be good reasons for such changes but it appears strange that the target group has changed so quickly over five years. It could be that the changes are a result of better comparison of performance on the two syllabuses or it could be both syllabuses are working closer towards the SEC recommended pass rates. Thus if differences can exist within one Board on similar subjects, comparison across all Boards and subjects can cause immense problems. In Brian Goacher's book, Schools Council Examinations Bulletin 45, 'Selection post-16: The role of examination results.' he looks at the effects of syllabus, Board and mode or entry to Higher Education. In the book he states:-

> 'The proportions of tutors 'adjusting' the grades required of candidates to take account of the GCE board which administered the examination, the syllabus examined or the mode of examination were small but markedly different in the three types of institution. In colleges of further education less than one in twenty tutors recorded that they made such adjustments and board, mode and syllabus were equally likely to be considered as reasons for modifying the required grades. Similar proportions of polytechnic tutors considered that modification of the offer was required in respect of the candidate's board and examination mode but almost one in five adjusted the required grades to take account of the syllabus followed. Approximately half of these tutors took the specific syllabus studied into account when making the initial offer and half were prepared to amend their offer when results were known. One university tutor, clearly upset at the missed opportunity, responded "I wish we had the information and the resources to do this." Others were less sure.
>
> Objectively, it is probably desirable to adjust grades to take account of known differences in examining boards at 'O' and 'A' level. However, the basis for doing that is, I think, too insecure. Probably no more harm is done by non-adjustment than might be done through adjusting (polytechnic, economics).
>
> University tutors adjusting grades to compensate for perceived curricular differences cited particularly syllabuses in engineering, building construction, engineering drawing, general studies, mathematics and statistics, "mixed" mathematics, modern mathematics, Nuffield physics and SMP mathematics. Polytechnic tutors recorded a similar response in respect of many of these subjects. Two particular boards were most usually seen as the 'hardest' and a third was most often identified as 'more generous'. No evidence was offered in support of these claims which, nevertheless, were often boldly stated:
>
> Board standards vary considerably from subject to subject (university, law) ... the variable standards of the GCE boards are a concern to us - too little is said of this publicly. (university, history).

> Admissions tutors in universities were rather more likely than those in other institutions to adjust grade requirements for these factors. One in twenty modified the grade demanded to take note of the mode of the examination and more than one in ten to counteract the effect of the board. Their main concern was the syllabus of the 'A' level course followed. The proportion of university tutors claiming that they modified the grade demands for this reason reached one in six.

Thus Goacher in his research shows admissions tutors making adjustments not only between syllabuses but also between Boards, yet his research was unable to identify any criteria other than experience for such decisions. This is particularly worrying when D Roes, in his Higher Education Review 1981 entitled 'A levels, age and degree performance' concluded:-

> 'the 'A' level grades achieved by students were of little value in predicting degree performance ... The conditional 'A' level method of selection is simply an administrative convenience to obtain the target number of students rather than ... a scientific method of selecting those students most likely to obtain good degrees.'

This confirms B.Choppin's work in 1973,'The prediction of academic success', published by NFER,which also found a poor correlation.

In this chapter the intention is to compare CDT with other subjects but the difficulty of doing so cannot be underrated. To place matters in context one should look initially at the subject comparisons between Boards. Bardell, Forrest and Shoesmith in 'Comparability of GCE: A Review of the Board's Studies 1964-77', determine three methods of comparing a Board's performance in individual subjects. The first concerned a straight-forward comparison of percentage passes. This, they concluded, could only reflect changes in Board's catchment and so different percentages would be expected. Whether the degree of difference was accurate was open to debate. A second method was to use a reference test, common to all syllabuses, to measure aptitude and then compare across Boards. This has difficulties of bias with syllabuses and does not allow for breadth and depth. A third method is to assess achievement. This third method is of obvious value;however, Hecker and Wood in their 'Report of Cross-Moderation Study in Physics at Advanced Level' 1977 conclude that when due attention is given in cross-moderation study to agreeing the parameters by which the various examinations are to be evaluated, the study 'is bound to turn into an elucidation of the ways in which boards' examinations and outlooks differ' and that 'cut and dried verdicts concerning comparability of grading standards should not be expected.' Thus within subjects, comparability remains doubtful and so to some extent,reliant on personal judgement. Certainly, Schools Council and its successor the Secondary Examinations Council appear unable to do more than keep a watching brief.

The task of comparison between subject would appear more difficult. The methods employed by researchers such as Forrest (1971) and Nutall (1974) and by several Boards today is for all candidates offering a given pair of subjects, the mean grade for each of the subjects is calculated and a comparison made. This can be extended to other combinations to gain a better performance and is known as the internally generated average achievement criterion. Clearly comparison of the relative difficulty cannot proceed by comparison of achievements since these are necessarily subject specific. The internally generated average achievement criterion is therefore treated as an aptitude variable. This assumes that examination results ought to reflect the general ability of candidates and the statistic approach discounts most of the effects of teaching on the realtionship between aptitude and achievement according to Christie and Forrest (1981) in their book 'Defining Public Examination Standards'. The assumption that Nutall, Backhouse and Willmott, (1974) make when developing the internally generated average achievement criterion in their book 'Comparability of Standards between subjects', is that either aptitude is unitary or that, if there are many specific aptitudes, these all occur with the same frequency in any cohort of candidates.

These methods of comparing subjects are very doubtful when used with Craft, Design and Technology as the subject is very different in character from many traditional subjects and furthermore, the cohort is usually too small to make such assumptions. One factor which must not be overlooked when comparing CDT is that most candidates are undoubtedly more highly motivated. The reasons for this are two-fold. Firstly, the project work is student-centred; thus the candidate is able to determine his or her own work pattern and suit it to his/her own abilities and interests. Secondly, most three 'A' level students choosing this subject are doing so despite the traditional advice to take the 'safe' 'A' levels; thus, they often feel they have a point to prove or a strong desire to do the subject. There is also considerable evidence in schools and colleges that pupils are spending a disproportionate amount of time on the subject compared to other 'A' levels. A feature to welcome in the sense that the subject is self-motivating but one which can distort the performance in other 'A' levels.

Statistical comparison of Craft, Design and Technology 'A' levels with other subjects

This is an area which has received no published data and owing to the lack of numbers the subject does not exist in the interBoard statistics published by the Department of Education and Science. Furthermore, comparison with other subjects within Boards is equally difficult to determine as few subjects have a sufficiently large number of candidates to make any comparison statistically significant.

The first aspect to consider is do subjects conform to the guidance given. This guidance was offered by the Secondary Schools Examinations Council and endorsed by the Ministry of Education in 1960. It gives as rough indicators the following percentages of candidates who might be expected to be awarded grades in 'normal' subjects. A - 10%, B - 15%, C - 10%, D - 15%, E - 20%. This gives an overall pass rate of 70%. The concept of 'normal' subjects was not defined and thus subjects like Latin, which in 1984 had a National pass rate of 89% must be considered abnormal, just as the Cambridge 'Craft, Design and Technology' syllabus with a 29% pass rate must be. In Table 14 the statistics of pass rates in schools per subject on the major Boards are shown. This immediately shows that many of the assumptions made by research regarding uniformity are somewhat farcical. It should be noted that the Oxford and Cambridge Joint Board which is not shown has almost all its subjects with a pass rate in excess of 80% and several over 90%. Anomalies are rife in this set of figures but a few examples may show the problems of using statistics. Comparing within a Board, it is difficult to see why on AEB 'English' there is an 83% pass rate but in History only 63% when the subjects are testing similar skills. In Science on AEB, Biology 60%, Chemistry 72% and Physics 64%; the conclusion must be that Chemistry is answered much better than Biology and Physics, but when the three sciences on AEB are compared with the Oxford Board the percentage figures are Biology 72%, Chemistry 73% and Physics 76%. The question must be asked as to why strong chemists on AEB do well whereas on Oxford there is a degree of equality or perhaps to be more brutal, why do good biologists and physicists take Oxford. This could show AEB to be a hard Board or to have weaker candidates and be a 'soft option' in Chemistry. Further analysis of these figures shows AEB to have the lowest pass rate on six subjects but very strangely, the highest pass rate in English. Cambridge has the highest pass rate in Art, Chemistry and French but the lowest in Geography and Music. JMB has the highest in Economics and lowest in Art but has less fluctuation than any other Board, ranging only from 68% to 76%. London has the highest pass rate in Mathematics yet the lowest in English, which is most strange considering that these two subjects are considered as the key markers of ability. Oxford has the highest pass rate in Physics and the Welsh in Music.

When the overall pass rate for the whole subject is determined, there is

TABLE 14 Percentage Pass Rate at 'A' Level of major subjects in schools 1983 (Source: Board Figures)

SUBJECT	AEB	CAMB	JMB	LONDON	OXFORD	WELSH	OVERALL % AND ENTRY	
Art	78	80	71	78	74	75	77	17762
Biology	60	68	72	71	72	72	72	35605
Chemistry	72	77	76	75	73	75	76	33857
Economics	55	69	74	71	70	71	71	32331
English	83	76	74	67	73	75	76	53196
French	73	81	73	70	71	80	75	23669
Geography	72	70	71	74	75	73	74	33521
History	63	71	68	75	75	75	73	36500
Maths P and A	58	71	70	75	71	73	72	43516
Music	75	65	74	78	79	82	77	3918
Physics	64	73	70	74	76	72	72	39534

considerably more agreement than with any individual Board. The overall range is 77% to 71% which is in excess of the rough indicator advised by the Ministry. These figures do however highlight the major problems of comparison of pass marks and to some extent the lottery which exists for 'A' level students.

The overall subject pass rates indicated in Table 14 can now be compared with the performance in CDT syllabuses. In 1983 London Board Design and Technology had a pass rate of 67% in schools, Oxford Board Design had a pass rate of 73%, JMB's Design had a pass rate of 72%. These were the only three syllabuses with over 125 entries. Thus the syllabuses show a remarkable amount of agreement and when the three syllabuses are combined the overall pass rate is 71%.

A comparison with AEB's Electronic Systems shows a 77% pass rate in schools but overall, with FE included, a rate of 72%. Engineering Science, however, has a much lower pass rate: in schools of 65% and overall of 61%. Finally in looking at CDT statistics, some comment on Engineering Drawing would be appropriate. JMB has only a 55% pass rate yet AEB has 76%, Oxford 72% and London 71%. Why 21% fewer candidates pass on JMB compared with AEB leaves room for concern, although the overall pass rate is 71%.

What conclusions can be drawn from these figures. There is no conclusive data to say that design-based 'A' levels are a soft option; in fact, 'Design and Technology' (London) had the equal lowest pass rate with English amongst the other eleven London syllabuses shown in Table 14 and it was some 7% lower than the national norm for all subjects. Oxford and JMB Design syllabuses, although higher than London, are still slightly lower than the national average. Thus it can be argued that CDT 'A' levels are reflecting a good standard and adjusting the pass rate according to the standards displayed.

A more detailed survey of performance was carried out by the Research Department at London University on its Design and Technology in 1983. This stated 'Clearly Design and Technology is not a soft option as an examination.' The report went on to provide some interesting statistics about entry patterns. For instance 243 candidates (40%) completed no other 'A' level, 198 candidates (33%) took one other 'A' level, 129 candidates (22%) took two other 'A' levels and 35 candidates (6%) took three other 'A' levels. These figures of 40% of candidates taking only one 'A' level may immediately lead to the observation that many weak candidates are being entered. However, when the overall Board figures are shown the contrary is discovered. In 1983, 50% of candidates overall took only one 'A' level. To look at this positively, 60% of candidates taking Design and Technology took in total two or more 'A' levels whereas looking at the Boards in general some 50% of candidates took two or more 'A' levels. Thus an assertion that 'Design and Technology' is only taken by weaker candidates who take fewer 'A' levels, is not borne out by facts.

Table 15 shows the popularity of other subject combinations.

TABLE 15 Popularity of subject combinations with 'Design and Technology'

Mathematics	170	28%
Physics	143	23%
Art	79	13%
Technical Drawing	39	6%
Geography	24	4%

In fact some 20% of candidates took Maths and Physics. The Board's own Research department carried out a survey on 253 candidates who obtained a C or less in 'Design and Technology' and took at least one other 'A' level. Using a scoring system of three for Grade C, two for Grade D, one for Grade E and 0 for 'O' or F, the candidates averaged 1.17 in 'Design and Technology and 1.25 for other 'A' levels. This difference may not be significant but one can conclude that the award of a Grade in 'Design and Technology' is not inflated compared to other subjects; in fact, this simple test shows 'Design and Technology' to be slightly harder.

In 1984 the London Board carried out a Pairs comparison as mentioned earlier in this chapter. Pairs could only be significantly made with four syllabuses, Art, Geography, Mathematics and Physics. In this exercise only Geography with a correlation of 0.45 was shown to be more lenient; all other pairs fell within the bounds of test error. Thus again, there was no significant evidence to show the subject is a soft option but rightly holds a valid place amongst other 'A' levels.

The statistics shown in this section indicate there is no evidence to claim that 'Design and Technology' is a soft option; if anything evidence that is available tends to support a contrary view that Design and Technology is a rather stiff subject at 'A' level. Certainly, if admission tutors are applying any factors in a negative sense to this subject, then there is little statistical evidence for such action.

Comparing the proposed 'A' level Design and Technology criteria with the established cores published by the GCE Boards for other subjects

The Common Cores at Advanced level were developed by the GCE Boards in eleven major subject areas, with the objective for each subject of identifying an appropriate common core, which would form a substantial part of any 'A' level syllabus bearing that subject title. It is significant that the eleven major subjects did not include CDT and up to 1985, the Boards have made no attempt to rectify the situation; thus SCUE/CNAA and SEC have taken over the exercise. The subjects for which Boards have developed common cores are as follows:- English Literature, Modern Languages, History, Geography, Economics, Music, Mathematics, Physics, Chemistry, Biology and Geology. It is significant that both Chemistry and Physics had SCUE/CNAA cores developed before the exercise, and Mathematics has Schools Council conference papers on the issue. This common core document had a valuable aspect of gaining agreement on an implementation forecast amongst Boards, although in odd cases total agreement was not achieved. One of the sad features of the common cores document was the lack of any common form of presentation by the working parties thus making comparisons very difficult. Table 16 shows a summary analysis of the common cores and criteria for the eleven subjects established by the Boards compared with the criteria established in Chapter 7 of this study.

Notes for Table 16

Note 1 Endorsement by theme or period.

Note 2 Geography prefered to create a framework rather than aims and objectives.

Note 3 English Literature used skills tested rather than objectives.

Note 4 Chemistry used abilities to be tested rather than objectives.

Note 5 English Literature merely states minimum of six texts.

Note 6 Choice of Boards, schools or individuals not prescriptive.

Note 7 The framework gives great detail which does determine some content.

Note 8 Acceptance, but with some Boards expressing significant disagreement.

The summary analysis in Table 16 shows considerable disarray and clearly shows the GCE Boards are far from explicit in what they are seeking. In terms of subject titles, the majority favour a single title, although some appear to take it for granted. Only History appears to have difficulties due to the many different periods studied so it recommends the continued practice of endorsements to the title 'History'. It can be deduced that these eleven cores believe in some degree of common titling and this highlights for those developing CDT at 'A' level, the need to take this seriously, a factor recognised by the proposed criteria but as yet not by the Boards.

In analysing and evaluating the stated aims and objectives of the syllabuses, it becomes apparent that some subject areas do not see a need for such documentation. This could reflect a confidence in well-established subjects

TABLE 16 Summary Analysis of Common Cores and Criteria compared with Design and Technology proposed criteria

Subject	Title	Aims	Objectives	Common Core	% Breakdown	Boards Accept
English Literature	Yes	Yes	Yes (3)	No (5)	No	Yes
Modern Languages	Yes	No	Yes	No	No	Yes
History	Yes (1)*	Yes	Yes	No (6)	No	Yes (8)
Geography	No comment	No (2)	No (2)	Yes (7)	No	No
Economics	Yes	Yes	Yes	Yes	No	Yes
Music	Yes	No	No	Yes	No	No
Mathematics	Yes	No	No	Yes Content	Min 40%	Yes
Physics	No comment	No	No	Yes Content	50%	Yes (8)
Chemistry	No comment	No	Yes (4)	Yes Content	50%	Yes
Biology	Yes	Yes	No	Yes Content	No	Yes (8)
Geology	Yes	Yes	Yes	Yes Content	No	Yes (8)
Design & Technology	Yes	Yes	Yes	Yes	75%	As yet not sort.

* For numbers 1-8 see Notes on previous page.

that makes such information for candidates and teachers unnecessary. This lack of aims and objectives is contrary to the Schools Council Working Paper 20 'Sixth form examining methods' published in 1968, which clearly states the need for examinations based on aims. Perhaps many subjects have moved very slowly over the last fifteen years.

It is noticeable that the Arts/Humanities subjects have a tendency to reflect aims and/or objectives but without content and the Sciences tend to reflect core content without aims and objectives. It is significant that only Biology in the Sciences sets out aims for such courses. Its aims are very broad and somewhat non-committal:-

(a) 'develop an understanding of biological facts and principles and an appreciation of their significance;

(b) be complete in themselves and perform a useful educational function for students not intending to study Biology at a higher level;

(c) be suitable preparation for university and polytechnic courses in Biology, for biological studies in other educational establishments and for professional courses which require students to have a knowledge of biology when admitted.'

(Source: Common Cores at 'A' Level - GCE Boards 1983)

Aim (a) for Biology seems relevant to every subject and is similar to the proposed aims for Design and Technology in Chapter 7. Aims (b) and (c) are common to all courses including Design and Technology but this leads to problems of breadth versus depth in syllabuses. The breadth has most value to general education and depth is more useful for further study. In the Arts/Humanities area, generalisations are very broad and leave the impression that these subjects can be so varied that their acceptance must be an act of faith by universities. English Literature, for example, has one aim and then goes on to state the skills to be tested:-

'Aim

To encourage an enjoyment and appreciation of English Literature based on an informed personal response and to extend this appreciation where it has already been acquired.

Skills Tested

1 Knowledge - of the content of the books and where appropriate of the personal and historical circumstances in which they were written;

2 Understanding - extending from simple factual comprehension to a broader conception of the nature and significance of literary texts;

3 Analysis - the ability to recognise and describe literary effects and to comment precisely on the use of language;

4 Judgement - the capacity to make judgements of value based on close reading;

5 Sense of the Past and Tradition - the ability to see a literary

work in its historical context as well as that of the present day;

6 Expression - the ability to write organised and cogent essays on literary subjects.'

(Source: Common Core at 'A' Level - GCE Board 1983)

English Literature is a highly accepted and well respected subject in the school curriculum; however, when one places its aim and skills tested against the aims and objectives for Design and Technology, there is no comparison. Design and Technology is tightly specified to increase reliability and thus it is difficult to perceive how it can be deemed a soft option or lacking in rigour. This is not to say that English Literature does not have rigour, merely to show that the stated aims and objectives of Design and Technology are undoubtedly as demanding as those stated for English Literature.

History is another interesting subject because it takes the view that content is variable and the subject is process-based, a view many hold about design education. However, History's stated aims and objectives are not dissimilar from those set out in Design and Technology.

'The aims of the syllabus are to stimulate interest in and to promote the study of history.

(a) through the acquisition of an understanding and a sound knowledge of selected periods or themes;

(b) by consideration of the nature of historical sources and the methods used by historians;

(c) through an acquaintance with the variety of approaches to aspects and periods of history and a familiarity with differing interpretations of particular historical problems;

(d) by promoting an awareness of change and continuity in the past.

The objectives of the examination are to test candidates' proficiency in the following skills:

(a) the ability to make effective use of relevant factual knowledge to demonstrate an understanding of an historical period or periods in outline and of particular topics in depth;

(b) the ability to evaluate and interpret source material as historical evidence and to demonstrate facility in its use;

(c) the ability to distinguish and assess different approaches to, interpretations of, and opinions about the past;

(d) the ability to express awareness of change and continuity in the past;

(e) the ability to present a clear, concise, logical and relevant argument.

(Source: Common Core at 'A' Level - GCE Boards 1983)

The objectives for History deal with the use of knowledge, evaluation and interpretation of material and communication in a clear manner, all in slightly different ways having a similarity with Design and Technology. One could contend that if History is able to use a process-based examination then why have design-based examinations not been developed in a similar manner. Some have, but the criteria development by SEC, SCUE/CNAA and in this study provide more material and a tighter specification because universities and polytechnics require the emerging subject to justify their case more clearly than those established over the years. It is significant that the two subjects with the lowest numbers and the greatest difficulty in establishing an acceptable place in the curriculum area, Economics and Geology, are the two subjects in the core booklet which decided to establish aims, objectives and content and be quite specific in their requirements. Economics, for instance, is the most comprehensive in stating both aims and objectives and like Design and Technology, it is a subject which is striving for acceptance by Higher Education. Its stated aims and objectives are very clear and detailed and can be found in Appendix E. They used Bloom's Taxonomy as a classification of objectives and have a very close association with those for Design and Technology. Whether this increased documentation and justification of the subject that Economics and Geology have produced will assist their development remains to be seen, but it is most interesting to see how those subjects in danger or emerging consider it necessary to work in such a way.

One subject which is interesting to look at is Geography because as a subject, it lies at a bridging point between disciplines. Traditionally considered an Arts/Humanities subject, it is now developing a much more scientific approach. It did not develop aims and objectives but agreed a range of general principles which are quite explicit.

'1 An awareness of certain important ideas in three areas; in physical geography; in human geography; in the interface between physical and human geography.

2 An appreciation of the processes of regional differentiation.

3 Knowledge derived from a study of a balanced selection of regions and environments, linked with a broad understanding of the complexity and variety of the world in which the student will become a citizen.

4 An understanding of the use of a variety of techniques and the ability to apply these appropriately.

5 A range of skills and experiences through involvement in a variety of learning activities both within and outside the classroom.

6 An awareness of the contribution that geography can make to an understanding of contemporary issues and problems concerning people and the environment.

7 A heightened ability to respond to and make judgements about certain aesthetic and moral matters relating to space and place.'

(Source: Common Cores at 'A' Level - GCE Boards 1983)

These principles are then explained in great detail and do, in fact, provide a very comprehensive framework for the subject not that dissimilar from Design and Technology. This clearly shows a subject which bridges disciplines seeing the need to be more explicit than other subjects.

The content is given in great detail in Mathematics and the three principal sciences and it does appear content is the principal concern of these subjects. Mathematics states that the content should be at least 40% of the total and Physics and Chemistry suggest it should be 50%. In SEC papers on 'Principles and Good Practice in Physics and Chemistry at 'A' level' the stated content in the Common Cores at 'A' level booklet has been suggested as 66⅔% of the total subject not 50%. Thus it would appear that Science requires a high percentage of commonality as it directly services future courses. The Design and Technology common core appears even more excessive in its commonality as it establishes 75%; however, a large proportion of this relates to the design process not content. Again the proposed criteria for design and technology appear more detailed and demanding than many subjects, but not quite as detailed as Physics, Mathematics and Chemistry. The conclusion therefore could be drawn that the reason Design and Technology is not acceptable is its lack of a more detailed core of knowledge. However, such an argument has little value when even the critics of design and technology, such as Professor French consider the subject's greatest strength is its design process and not its body of knowledge.

The level of agreement upon the common cores amongst the Boards was high with only a few Boards failing to agree to implement the proposals within the following four years, although Music and Geography did not obtain acceptance. The best level of acceptance was obtained in Economics where those involved appeared to have had a common sense of purpose. It will be interesting to see if the SCUE/CNAA and SEC papers on Common Cores obtain the same level of agreement in the next few years.

The examination demands in terms of time placed on students are another method of comparing subjects. The quality of the examination is obviously more important than the quantity,but an analysis of time will at least satisfy this crude but sometimes useful indicator of comparability. The details in Table 17, which is an analysis of common 'A' Levels on the London Board does not show Design and Technology to be a particularly less demanding subject; in fact, the coursework could be seen as making excessive demands. The excessive demands however, only occur where a pupil becomes very involved in his/her project, or where poor project management occurs and/or unsuitable tasks are undertaken.

TABLE 17 London Board 'A' Level Examination Demands in terms of Papers and Time

Subject	No of Papers	Time(Hrs)	Comments
Art	2	17	P1, 14 P2, 3
Biology	3	8½	P1,2½ P2,3, P3 Practical 3
Chemistry	4	5¼+ 3 or Ass	P1,1¼ P2/P3,2 P4,3 or Internal Assessment
Computing	3	6 + Project	P1 & P2, 3 P3 Project(20%)
Economics	3	6¼	P1,3 P2,2 P3, 1¼
English	3	9	P1/P2/P3, 3
French	3	4¾ + 15 min oral	P1,2¼ P2, 2½ P3 Oral (15 mins)
Geography	4	10	P1/P2, 3, P3/P4, 2
History	2	6	P1/P2, 3
Mathematics	3	6	P1,1 P2,2½ P3,2½
Physics	4	8½	P1,1½ P2,3 P3,2½ P4,1½
Design & Technology	3	9+ projects	P1,6 P2,3 P3, 3 projects (33⅓)

The number of examination papers is the average and only Art and Geography demand more stated time and 'Design and Technology' has, in addition, two minor and one major project. It is significant that French uses merely 4¾ hrs plus 15 minutes oral to assess a student whereas Design and Technology uses 9 hours plus the assessment of coursework over two years, yet reliability of 'Design and Technology' is on occasion brought into question. From the London Board 'Design and Technology' looks equally demanding as other subjects in terms of time allocation.

To conclude this brief comparison of existing cores, there is little doubt that if the proposed core was accepted and implemented by the Boards then few members of Higher Education could argue about its status in comparison with other acceptable 'A' levels, and thus the subject could become more acceptable. The design and technology criteria provide breadth and depth in a comprehensive manner which will ensure rigour and a reliable platform from which students can go on to higher education. Its comprehensive criteria can only be matched by Economics and the remaining subjects are far less detailed in their criteria. However in most cases they appear to have little need for justifying the subject, tradition decrees it is acceptable and rigour has been established through precedent. This analysis does not conclusively prove that Design and Technology subjects meet the criteria any better than other acceptable 'A' levels. However, it does establish that the proposed criteria will be the most comprehensive document for any subject and, in that, it matches other subjects in its demands in terms of breadth and depth on students and will provide as much rigour and reliability as any subject described in the common core document. Thus in comparison with other subjects Design and Technology would appear as acceptable as any subject in the Common Cores booklet and in several cases perhaps more acceptable in terms of the criteria it has to meet.

Some students views on 'A' level Design and Technology

The overriding view gained from interviewing 'A' level students in Design and Technology is that they find the subject more demanding than other 'A' levels but more interesting and rewarding. The demands, however, are not necessarily intellectual, but more often physical in terms of being able to stick at the task and plan, organise, initiate and complete self-generated tasks. However, students generally find the subject integrates well with other disciplines and this provides a purpose for other studies. But the breadth of Design and Technology is very considerable and quite daunting to some students starting a course. (These general views are obtained from the author's experience as Chief Examiner for 'A' level 'Design and Technology' for five years and as a visiting examiner, and from the summary of a team of visiting examiners.)

In looking at published student views of 'A' levels in Design and Technology the first can be obtained from the Design Council Seminar - 'Design Examinations at Advanced Level.' At that important seminar, Mr John Gilby, former pupil at East Barnet School and at the time reading Engineering at Cambridge, stated that of his five 'A' level subjects, Design and Technology had proved the most stimulating and demanding. He was glad that he had been able to take the subject without prejudicing his university entrance requirements and regretted that others who could not take so many 'A' levels were not so fortunate. In his view the subject should be fully acceptable by universities. Subsequently Mr Gilby obtained a First Class Honours at Cambridge with several prizes and in 1984 he obtained a PhD in Robotics at Surrey University.

In Appendix 1 to the Design Council Report - 'Design Education at Secondary Level,' the views of two students are expressed on their experience in 'A' level design courses. The first article by Wendy Allen from Orange Hill School, Barnet, who went on to read Architecture at Oxford and who studied Music and Psychology at 'A' level, states:-

> 'Design for me is an innovative, highly creative, cross-disciplinary tool which must be responsive to the genuine needs of man ....'
>
> 'The 'A' level course can be manipulated to allow one to expand and study in the area or areas related to one's specific interest ...'
>
> 'Design should be equal to such subjects as science and maths; for all design shapes man's products, his environment and by extension, man himself.'

In this article Wendy shows the strength of the subject with its emphasis on personally-identified project work and its cross-curricular capability. The second student's views in the Design Council Report were from John Gilby. John expresses in detail the skills involved in the work he undertook as part of his course. He states:-

> 'The course is far more than mere problem-solving or learning about tools and materials, it revolves around the whole concept of design, its sources and implications. It is a wide ranging and imaginative practical subject that I feel fulfils a very real need in schools, in education and within the academic curriculum.'

This illustrates a mature appreciation of the subject, one which he still holds today.

From 1981 to 1983 Nizam Hamid took 'A' level Design and Technology at East Barnet School and went on to read Engineering at Liverpool University. He wrote the following about his course in 'Studies in Design Education, Craft and Technology' Volume 16.2 Winter 1984.

> 'As an 'A' level option Design and Technology (D & T) can in truth only be compared with the sciences; that is mathematics, physics, chemistry and others. This comparison also applies when considering University applications for engineering and science courses. In relation to other subjects at 'A' level, D & T is unique in offering a wide area of study to suit individual students whilst remaining within the same syllabus. It can introduce topics, from many other subjects, and join them in a constructive manner. Also to successfully complete practical projects one can often employ knowledge from the other sciences, Though this is not a necessity as skills acquired purely through D & T will often suffice.
>
> Perhaps the greatest value of D & T is that it allows one to apply, from other subjects, knowledge that would otherwise have remained as pure theory. This in turn often sparks a reciprocal interest in other subjects. Such a self-perpetuating effect only serves to widen the range of a student's understanding. As a subject in itself D & T represents one of the most enjoyable, character developing and thought-provoking 'A' levels. Indeed its finest aspect is the way that it helps train the mind to develop a logical and directed attitude to problem solving. Such a skill is gradually acquired rather than intuitive yet once mastered it is invaluable and can be applied to problems found in every field. The breadth of study and diversity of the topics covered aid the student's general

awareness of resources and possible solutions to any given task. No other subject can reasonably claim to offer such mental development. D & T helps develop mental flexibility by establishing a form of problem analysis and synthesis that is unparallel at 'A' level standard.

In general the 'A' level D & T syllabus satisfies the majority of students' requirements to enable practical problems to be solved. In conjunction with this it extends the working knowledge of everyday products and processes. Such an understanding of technological concepts and materials aids project realisation. The practical projects, in particular that for the final year, represent true character building processes. Initially when presented with a brief one may shy away from fully examining all aspects of the problem. By learning that only through persistence and thoroughness can really satisfying solutions be achieved, one becomes naturally thorough and single-minded in problem solving. One of the other great values of practical projects is the realisation that failure must be met with renewed vigour to overcome stubborn problems. Even if major setbacks occur regularly a certain amount of determination is instilled in the student in order to follow through the synthesis of a problem. Finally the satisfaction derived from realising a viable solution is a truly rewarding feeling that is only really offered in D & T.'

In Nizam's long article he is able not only to express the undoubted enjoyment he gained from the course but also to identify some of the more intrinsic values which the subject has to offer. His comments regarding the training of the mind to develop a logical and directed attitude to problem solving is very interesting; he perceives virtue in developing persistence and thoroughness as well as developing positive attitudes to tackling failure. His final comment about the satisfaction derived from realising a viable solution must equally not be overlooked as part of a valuable, worthwhile and acceptable 'A' level. If Higher Education is not seeking such virtues as Nazim describes as having gained from his course then it is a poor reflection on the entrance system adopted.

One undoubted value which Design and Technology has at 'A' level is its attraction to Industry, which sees through students' coursework, real capability. This is well illustrated by two articles written for the Lincolnshire CDT Newsletter in September 1984.

'A' level Design and Technology - Kevin McCullough - Lincoln Christ's Hospital School

'I consider myself very privileged to have been able to participate in this course at a school with such wide ranging facilities and helpful and interested tutors. Especially considering the course I intend to do at University (Design and Manufacture) is a direct progression from this course. In fact, much of what I have learnt over the last two years overlaps with the first year of the University course, thus much of the work I have done is directly relevant to my future studies/career as well as the rest of the course giving me a practical, realistic and broadly based design background.

Many of the Universities I attended for interviews commented on how fortunate I was to be able to study such a subject with so many facilities available. Many commented particularly on the use of the CNC lathe/milling machine and computer control which are covered (to a slightly higher level) in the second year of the engineering degree courses. I took both my minor projects and my incompleted major project paperwork to two interviews for graduate sponsorship with Rolls Royce (Aero engines) and the Ford Motor Company. The free time in both interviews mainly consisted of talking about my Design and Technology work since it is so closely connected with what I would be faced with in industry, in fact, at the Rolls Royce interview where they were particularly interested in my major project (because the actual person who interviewed me was an engineer), I was told that I would have to complete an actual realistic project (of similar difficulty and nature to my major project) in my first year with the company, which would actually be put to some use in the company.

After meeting prospective candidates of which there were some 200 chosen from 1800 applicants, I felt certain that many had superior academic abilities but since I have attained a conditional place I am sure that it was my being able to prove, with the use of my project work that I was capable and had had preliminary experience in the work I would most likely be faced with if I worked for them, that secured my place with Rolls Royce.'

Kevin was also offered a sponsorship with the Ford Motor Company who were most impressed with his suspension test rig major project. Kevin was an able student in Design and Technology but was not particularly outstanding at Mathematics and Physics although he obtained a Grade C in both subjects. However, his skills in Design and Technology were considered by Industry to outweigh students with better academic prospects.

Stephen Jolly, a student at North Kesteven School, expresses more positive comments concerning the subject's acceptability and relevance in the Lincolnshire CDT Newsletter - September 1984.

'The course differs vastly from the theoretical subjects, Maths, Physics and Chemistry and as it is more stimulating it becomes more interesting. The project work provides a good introduction to the type of work done on a degree course. The projects themselves never fail to impress admissions' tutors and prospective employers.

Even with an engineering degree there is always some uncertainty of employment and it is very reassuring to know that I will definitely have a job after three years. An industrial sponsorship provides job security and also money to subsidise your grant. Many engineering students are on a sponsored sandwich course and the offer of a sponsorship will further ease the way into college.

Prospective sponsors will look for as much practical as theoretical experience as they will often wish to use the student in a real industrial situation from the beginning. My interviewers at Marconi Electronic Devices were impressed even by the 'O' level project that I showed them and I am certain that my further involvement in 'A' level Design and Technology helped me to clinch

> the sponsorship. The industrial part of the sponsorship provides essential qualifications needed for chartered engineership. The subsidised grant and money earned in the holidays would ensure none of the usual cash problems.
>
> For anyone interested in an engineering career after 'A' level or after a degree, Design and Technology will provide invaluable experience. Over the next few years 'A' level Design and Technology will become more important in the eyes of admissions' tutors and employers. Careers in engineering can be very highly paid but only if you have the right qualifications.'

The students' articles illustrate how they feel about the subject and how they found the nature of the work and its usefulness and relevance to industry. Stephen Jolly applied for one sponsorship and got it and Kevin McCullough applied for two and had two offers. This aspect of industry's delight at seeing what these students can actually do is very relevant and rarely have students who have shown their work to admissions' tutors been turned away because it lacks rigour. These and many more students have taken the courses, benefited and are now studying for their degrees or have received them. Design and Technology does meet a need for many students, in that it enhances their opportunities for university and working in industry. However, lack of understanding, poor information and prejudices based on the past prevent many other students from undertaking such work.

This chapter has shown Design and Technology compares favourably with other subjects whether analysed statistically or by comparing the proposed criteria against other subjects' established common cores. The quotes from students show how difficult they find the subject compared with either the Arts/Humanities or the Sciences, yet are able to enjoy the work and find a sense of purpose and achievement. It is not insignificant that the two Lincolnshire students found an added benefit in the acceptance for a sponsored degree course as a result of their work. There appears to be acceptance for the subject despite many of the comments made in Chapter 8 and its standing with students and industry is growing. Its place, when assessed against the criteria, is sound and well formulated, thus Chapter 10 will show whether the questioning of acceptance and what offers are actually made, correlate or whether prejudices expressed in earlier parts of this study are actually being applied.

CHAPTER 10

ACHIEVED LEVELS OF ACCEPTABILITY

Within the field of Craft, Design and Technology (CDT), more effort has gone into trying to improve the acceptability of the subject than almost any other single task. This pre-occupation has been brought about through the belief that if the subject becomes acceptable in Higher Education, then its growth is more likely to take place in the school environment. This belief may well be correct, although it would be difficult to prove. Various surveys have taken place to improve acceptability, with some limited success, but these have been based on specific local authorities, universities and/or polytechnics, and have not provided comprehensive evidence of the subject's acceptance. Thus confusion still remains with statements in the Press such as 'Blacklist of A-Levels for University Entrance' Daily Telegraph, 18 March 1985. Therefore it becomes increasingly important to determine more detailed evidence regarding the level of acceptability for 'A' levels in Design and Technology. This chapter seeks to provide evidence of acceptability in Universities, Polytechnics and Colleges of Higher Education to counter the various myths which surround the subject's level of acceptability, as well as giving some idea of the subject combinations, course offers, mean scores of offers, career aspirations and levels of sponsorship.

It is important to note that 'A' level Design and Technology is not purely taught for university and polytechnic entry; thus the subject's acceptability to the world of work and Colleges of Art and Design and Further Education should not be undervalued. One striking point which emerges from discussions with staff in schools is the high percentage of students who leave during or at the end of the 'A' level course to take up employment.

In 1984, the London Board 'A' level had 911 candidates in the Lower Sixth yet only 640 took the examination. This is a drop-out rate of over 30%. An evaluation of DES statistics 1984 indicates the Mathematics drop out rate is in the order of 15% although the data is not for quite the same period. There is a range of factors governing the drop-out rate, and having to take up employment is undoubtedly one. Although the emphasis of this survey is placed on Higher Education acceptance, it would be improper to under-value Design and Technology as providing a very worthwhile contribution to the education of students for purposes other than Higher Education.

Strategy for testing acceptability

The testing of acceptability at 'A' level can be tackled in a variety of ways, but certain parameters exist which pose particular problems. The first problem concerns the lack of 'A' level entries in Design and Technology. This low entry provides a 'Catch 22' situation where universities will not state a preference for such a course because it might limit their applications to the course and because of universities failing to ask for the subject, students feel they should not take it as it may be unacceptable. Therefore in establishing a strategy for testing,one key factor must be to obtain as much information as possible from those candidates taking the subject. A second factor would be to determine whether a survey should look at general entry requirements or specific course entry requirements. The general entry requirements for university are always lower than course entry requirements and the Durham County Council survey (1981) clearly showed a fair level of acceptance for general entry requirements. However, the general entry requirements are almost worthless to students applying to universities. Thus a second factor to be used in determining acceptability must be a strategy which looks at specific course entries. A third factor must be to evaluate acceptance with a CDT subject which meets the Keith Lucas criteria,(see Chapters 5-6), otherwise the validity of testing could be distorted and perhaps devalued. In looking at the Keith Lucas approved syllabus in 1984,it was apparent that only two syllabuses had sufficient numbers to justify such testing. They were the Oxford Board's 'Design' and London Board's 'Design and Technology'. Two factors influenced the choice of the London 'Design and Technology syllabus'. The first was ease of access to information and data as Chief Examiner for that syllabus and the second was that in Chapter 8 of this study the Oxford Board syllabus was found to be weak in meeting the new proposed criteria and in fact it did not carry the recommended subject title. The strategy adopted for testing acceptability was therefore to survey offers made to candidates sitting the London University 'A' level Design and Technology which has the largest entry in the subject and closely resembles the criteria not only produced in the survey but also those established by SCUE/CNAA, the Design Council and the Secondary Examinations Council. The use of actual offers increases the amount of data greatly and if accepted by the student becomes a binding contract between the student and the Higher Education establishment. It also provides data against specific course requirements. This strategy, based on offers rather than actual places taken up by students, prevents the large loss of information which could occur when students fail to obtain the grades for a course and therefore do not enter that particular university or polytechnic.

Method and Structure of Survey

Having determined the strategy for surveying candidates, it was then essential to create a method of gaining the information and a structure to the survey, which would elicit as much data as possible without overburdening the teachers who may not then respond. The method that was adopted after discussion with Dr Kingdon, Head of Research, Schools Examination Board, University of London was to write to schools with a letter describing the nature of the research and enclosing the questionnaire which was to be as brief as possible so a good response could be obtained. The letter is enclosed as (Appendix F) and the Questionnaire (Appendix G). The letter was sent out under the signature of the Head of Research as that is the University's policy. It had a section which encouraged teachers to reply by informing them of the levels of acceptability known at the time of writing the letter.

The information was requested on all candidates taking the 1984 examination as well as those entering universities and polytechnics in previous years. The data on all candidates in 1984 was to give an overall impression of the candidates in that year and yet it would be unlikely to give detailed responses on all university and polytechnic establishments with only 640 candidates; therefore the request to identify offers in other years was included. This will distort the overall impression but will provide greater evidence of acceptability.

The questionnaire structure set out to identify the following:-

a) Name of School or College - to identify response to survey.

b) Name of Candidate - to identify individual with school/college.

c) Name of Establishment - this was split into University, Polytechnic, and other Higher Education establishments to ease classification and prevent confusion over, for example, Leicester University and Leicester Polytechnic. Five spaces were provided for university offers as candidates can apply through Universities Central Council on Admissions(UCCA) to five universities. Three spaces were provided for polytechnic offers as this appeared a likely number of offers which would be made and three for other Higher Education establishments.

d) Name of Course - space was provided to enter the name of the course applied for.

e) Points Score - a column was provided where candidates' points score could be entered where offers per subject were not made.

f) Offer Grades - under this section on offers, three subjects were identified to assist completion of the form and because an initial survey showed these to be the most likely combinations. They were

Design and Technology, Mathematics and Physics.

g) Other subjects and grades - in this section three columns were provided to determine what other subjects are studied and what the offers were.

h) Career aspirations - this was included as the survey wished to determine students' future aspirations and also to gain some information on candidates not applying to Higher Education.

i) Sponsorship - this aimed to determine whether sponsorship was being achieved by any students.

j) Additional comments - this gave the opportunity for any other information to be included which the teacher considered relevant.

k) Head of Department's signature - this was used to give authenticity to the survey results.

The questionnaire was only A5 size to ease its use and cut down on the volume of paper. In designing the questionnaire, it initially appeared wise to give those completing it some classification of courses and career aspirations. However, this was considered a limiting factor and it also might have reduced the response, so it was left open.

Response to survey

The questionnaires and letters were sent out to 216 centres registered for the examination in 1984 plus another twenty-five centres known to have had candidates in the previous three years. This gave a total of 241 centres where questionnaires were sent. The return was from 109 centres or 45% of those surveyed. However, out of the 216, 1984 centres, only 87 replied which gives a 40% return. According to Dr Kingdon, such a return is good for such a survey. However, it makes any conclusions about the overall subject combinations and career aspirations somewhat unreliable. It does not, however, affect the reliability of the offers made by establishments to specific courses which was at the heart of the study.

The 109 centres who responded provided data on 425 candidates. This represents 407 boys and 18 girls and it created 769 offers and 833 lines of data. This examination has over the last ten years had between 6% and 8% entry of girls yet the survey only returned 4.25% girls, so the survey is not precise on grounds of sex. This is likely to be a result of many girls taking the course and going on to Art and Design courses which the survey did not emphasise, as offers are usually unconditional for a foundation studies course. The overall survey appears to have gained a better response about student offers to universities than other sectors. This may have been caused by the data from previous years which has emphasised that sector of education. Equally the university and, to a lesser extent, polytechnic offers are the major concern of the staff, who enthusiastically replied to the survey. However, the response has clearly provided invaluable material on the acceptability of Design and Technology and furthermore, it gives some indication of a candidate's profile and the subject's standing with other subjects.

On receiving the data it had to be classified so that it could be processed using a computer. The data was added to a Data Processing Form (Appendix H). This form had eighteen columns of information and they are summarised in Appendix I, which shows the method of data input. Column one gives the centre reference number, column two the candidate reference number and column three the sex of the candidate. Column four gives the establishment codes which are classified in Appendix J - 01 to 45 covers British Universities, 46 to 76 Polytechnics, 77 Institutes of Higher Education, 78 Colleges of Art and Design and 79 Colleges of Education. Column five covers course classification, shown in Appendix K. This was not an easy classification to make but the UCCA Handbook was used to formulate the majority of areas. This still lead to some interpretation, but through analysis of the courses in the UCCA and Polytechnic handbooks or Career Guides, classification was feasible. Columns six, seven and eight covered offers in Design and Technology, Mathematics and Physics. Columns nine to fourteen covered other subjects with their offer, if appropriate. The other subjects are classified as shown in Appendix L. Column fifteen notes any specific rejections, column sixteen sponsorships and column seventeen points offers where these are given instead of specific subject offers. Column eighteen is concerned with the candidate's career aspirations. To aid this classification, the Manpower Services Commission Manual on Occupational Families was used as a guide. This classification can be found in Appendix M. The data was processed using the Loughborough University computer, using a program called 'Minitab' from the statistics department of Pennsylvania State University.

Evaluation of Results

The evaluation of results can be classified into two forms. The first is the factual reporting of results which clearly states the acceptance levels of establishments, courses, etc. and the second, which will be the interpretation of data from which certain conclusions are drawn. The results will be evaluated under seven headings in the following order:-

a) Offers from establishments
b) Offers for courses
c) Subject Combinations
d) Grade Comparisons

e) Reported Rejections

f) Sponsorship Offers

g) Career Aspirations.

However, the reliability of some conclusions must be questioned owing to the size of the survey and the individual nature in which some Admissions Tutors make offers for entry to Higher Education.

a) Offers from Establishments

This is perhaps the most critical single area concerned with acceptance in Higher Education. Many sceptics have been saying that certain universities will not accept Design and Technology; for example, press coverage already mentioned earlier in this chapter. The survey found that from 769 offers made, 461 were for university, 219 for polytechnics, 20 for institutes of higher education, 48 for colleges of Art and Design and 21 for colleges of education. However, analysis of Table 18 shows that in this small survey, every university except three made offers to students taking 'A' level Design and Technology. The three in question are Belfast, St Andrews and Ulster. It may be significant that there are no Design and Technology centres in either Scotland or Northern Ireland. However, a closer look at the courses at St Andrews indicated that it is not surprising that no student in the sample had received an offer from this establishment. It has no specific engineering courses which are by far the most popular courses to be followed by Design and Technology students. The only conclusion one can rationally draw from the lack of offers from Northern Ireland is that London 'A' level Design and Technology students do not apply to this troubled country. It is important to note that this small survey has merely failed to identify students who have received offers from these three universities; there is no evidence that the three reject London 'A' level Design and Technology. The survey produced an average of 10.2 offers per university. The results of the survey indicate clearly, through legally binding offers to students, that all British Universities, with the exception of the three mentioned, have accepted London 'A' level Design and Technology. It is acceptable as a general entry requirement, a prerequisite of any offer and is acceptable for a particular course within that establishment.

The results of the survey relating to British Universities require some further comment. The two most popular universities for London 'A' level Design and Technology students, Brunel and Loughborough, together make up 23% of offers. This is not surprising because not only are they two of the Technological Universities but they are the only two which run university degree courses for prospective teachers of CDT.

TABLE 18 Number of offers from each Establishment

01	Aberdeen	1
02	Aston	25
03	Bath	14
04	Belfast	0
05	Birmingham	5
06	Bradford	19
07	Bristol	6
08	Brunel	52
09	Cambridge	1
10	City	15
11	Dundee	5
12	Durham	1
13	East Anglia	1
14	Edinburgh	1
15	Essex	3
16	Exeter	2
17	Glasgow	1
18	Heriot Watt	3
19	Hull	9
20	Keele	6
21	Kent	5
22	Lancaster	5
23	Leeds	16
24	Leicester	5
25	Liverpool	14
26	London	27
27	Loughborough	56
28	Manchester	9
29	UMIST	4
30	Newcastle	17
31	Nottingham	12
32	Oxford	1
33	Reading	7
34	St Andrews	0
35	Salford	14
36	Sheffield	13
37	Southampton	11
38	Stirling	1
39	Strathclyde	2
40	Surrey	18
41	Sussex	10
42	Ulster	0
43	Wales	28
44	Warwick	14
45	York	2
	Total	461

46	Birmingham	3
47	Brighton	10
48	Bristol	6
49	Central London	2
50	Hatfield	24
51	Huddersfield	6
52	Kingston	15
53	Lanchester	16
54	Leeds	7
55	Leicester	7
56	Liverpool	3
57	City of London	1
58	Manchester	9
59	Middlesex	6
60	Newcastle	7
61	North London	3
62	NE London	4
63	North Staffs	5
64	Oxford	5
65	Plymouth	7
66	Portsmouth	22
67	Preston	2
68	Sheffield	13
69	South Bank	6
70	Sunderland	2
71	Teeside	3
72	Thames	2
73	Trent	19
74	Ulster	0
75	Wales	2
76	Wolverhampton	2
	Total	219

77	Institutes of Higher Education	20
78	Colleges of Art and Design	48
79	Colleges of Education	21
	Total	89

OVERALL TOTAL 769

At Loughborough University the Design and Technology course for prospective teachers represented 27% of offers made by it; at Brunel it was much higher with 44% of offers. Another factor of importance is that many of these candidates' teachers are former students of these establishments and Brian Goacher in Schools Council Bulletin 45 found that teachers' associations with particular universities encouraged their students to apply to such establishments. London University has also made a large number of offers, but it is the largest university and it is from the South-East of England where the London 'A' level 'Design and Technology' has most students. The majority of London University colleges made offers including University College, Imperial and King's.

As may be expected from such a survey, the technological universities tended to be more popular, with Aston, Bradford, City, Salford and Surrey making a significant number of offers. An interesting facet of this part of the survey was the popularity of the Welsh universities. This is difficult to explain but it either shows a desire by London 'A' level 'Design and Technology' students to study in Wales or the universities may well provide courses which are well-suited to such students.

In looking at polytechnics, there were 31 at the time of the survey, although Ulster Polytechnic and University have now combined. The survey discovered 219 offers of which several were in the form of points scores. This represents an average of seven offers per polytechnic compared with the university average of 10. This should not be considered significant as many candidates applied to five universities whereas at polytechnics the data indicated that few applied for more than two. The most popular polytechnic was Hatfield with almost 11% of entries and Portsmouth and Trent were also very popular, each with around 10% of offers. These three had 30% of the total entries. The popularity of Hatfield may be a result of a significant number of London 'A' level 'Design and Technology' students living in Hertfordshire and the North London Boroughs, as well as its well-developed Engineering Design course which attracts design-based students. Portsmouth Polytechnic's high numbers probably result from the highly successful 'A' level London 'Design and Technology' courses which run in the Hampshire Sixthform Colleges. Trent Polytechnic's success may be a result of the high profile this institution gets, through its close association with the National Centre for School Technology and its well publicised training course for teachers of Design and Technology. In addition, Trent Polytechnic's engineering department wrote to all Local Education Authority advisers stating its willingness to accept 'A' level Design and Technology following a Polytechnic Professors of Engineering

Conference in York in 1983 at which they indicated a willingness to support the subject. This was given publicity in many local authorities and may have increased the popularity of Trent Polytechnic. What may be significant is that the polytechnics which offer initial teacher training in CDT do not appear to have any increased popularity, whereas at university they clearly do. For instance, Wolverhampton, Sunderland, Middlesex, Newcastle and Leeds all fall below the average entry per polytechnic.

In the section, 'Institutes of Higher Education, Colleges of Art and Design and Colleges of Education', two factors emerged. The first concerning Colleges of Art and Design was that this was a very popular route for students with 11% being accepted for this type of course. Subsequent enquiries and analysis of visiting examiners' reports show that this is an even more popular route than the survey illustrates; out of the 1984 examiner reports, approximately 17% of candidates went on to Art and Design courses. The figures could be higher as the nature of the survey tended to place less emphasis on gaining this type of data. The second factor which emerged was that sixteen out of the twenty one offers for colleges of education were for those wishing to become CDT teachers.

This survey undoubtedly proves that London 'A' level Design and Technology is an acceptable subject for Higher Education. It conclusively shows, despite the relatively small size of the survey, universities, polytechnics and other institutions of higher education accept the subject. This evidence indicates that the subject has moved forward significantly and could fairly be classified as acceptable.

b) Offers for courses

The analysis of results in this category is extremely difficult because there are so many courses available in Higher Education. As a consequence, only generalisations can be made. To place this issue in context, the following overall figures should assist. B. Heap, in his book 'Degree Course Offers' (An annual publication by Career Consultants) states 'there are more than 500 different subjects available in British Universities.' Furthermore there are approximately 6000 different courses available in British Universities. Thus with so few candidates and only 461 offers from British Universities it is clear that all individual courses cannot be investigated. The survey uses a classification of courses as shown in Appendix K. Table 19 shows the results of the survey of courses in Higher Education. This shows the area of greatest number of offers being in Mechanical Engineering, which had nearly 25% of offers made. This illustrates the close association of Design and Technology with engineering.

TABLE 19 Course Offers - Total and Universities only

		Total	University only
01	Agricultural Sciences	6	6
02	Anatomy, Medicine, Dentistry, Pharmacology, Physiology	6	6
03	Architecture	29	18
04	Art and Design	57	0
05	Biological Science	4	3
06	Business Management, Accountancy, Economics, Law	17	10
07	Chemical Sciences	1	1
08	Computing	29	18
09	Education/Teaching	12	0
10	CDT Teaching	65	38
11	Industrial Design	27	2
12	Languages	0	0
13	Mathematics	10	10
14	Physical Sciences	4	4
15	Social Sciences	6	0
16	Engineering - Aeronautical	17	12
17	- Chemical	0	0
18	- Civil, Mining/Survey	87	67
19	- Control	2	2
20	- Electronic/Electrical	87	67
21	- Material Sciences/Metallurgy	5	5
22	- Mechanical	190	133
23	- Production and Manufacturing	56	42
24	- Science	1	1
25	Geological and Environmental Sciences	10	7
26	Ergonomics	5	5
27	Design/Marketing	3	2
28	Planning	8	2
29	Building Construction	11	2
30	Music/Drama	3	0
31	History	3	3
32	Physiotherapy	1	0
33	Sports Science	5	0
34	Hotel & Catering	1	0
35	Furniture Making	1	0
	Totals	769	461

Other very popular areas are Electronics and Electrical Engineering with 11% of offers, Civil and Mining/Surveying Engineering with 11%, CDT teaching with 8%, Art and Design and Production/Manufacturing Engineering each with 7% and Computing and Architecture had nearly 4% of offers. Architecture is probably the most surprising of these as it is frequently quoted as a subject which does not accept Design and Technology as an entry requirement, yet institutions have made 29 offers for this subject in the survey. This hardly indicates a lack of acceptance.

In looking at the survey more closely it may be appropriate to look at the universities only, in Table 19. This is because they represent 60% of all offers and if Art and Design offers are removed, as they are very specialised courses, often based on Foundation courses, the percentage increases for university offers to 65% of the total.

In the survey, 70% of the offers for Mechanical Engineering were from universities. Aston University has made most offers, almost 10% of total university offers, with Brunel with 9%, Loughborough, Surrey and Wales each with nearly 7% of the total. Bath, Bradford, City, London, Salford and Sussex were also popular, obtaining between 4-5% each.

In universities, Electronic and Electrical Engineering were the second most popular courses in terms of offers. Universities accounted for 77% of offers for these subjects. Those with most offers were Brunel, London, Leeds, Loughborough, Southampton and Sussex, each making between 9% and 6% of the total offers.

Civil, Mining and Surveying Departments in universities made 11% of total offers for this subject. The universities with most offers were Salford, Leeds, Loughborough, Aston, Surrey and Wales, each making between 11% and 8% of the total offers.

Production and Manufacturing Engineering in universities represented 9% of all university place offers and 75% of its offers were at university level. Loughborough University made most offers with 38%, with Brunel and Hull also making a significant number of offers.

There were only two university courses which train prospective CDT teachers. This represents only 8% of total university offers which crushes the view that 'A' level Design and Technology is only of use for prospective teachers of CDT. In fact, these two university courses, although aimed at prospective teachers, are providing graduates, many of whom never enter teaching but go straight from the course into Industry. (Source - Times Educational Supplement letter - August 1985). The letter was factually incorrect but clearly indicates a trend. Brunel made most offers in terms of the survey which does not include Design and Technology. However, despite the much heralded statements by departments of engineering (by Northern University Professors 1979 and 1980 - see Chapter 5) that Design and Technology is not acceptable, in fact, 70% of all 'A' level offers at university came from engineering and this clearly shows that with the correct subject combination, 'A' level Design and Technology is acceptable to universities.

c) Subject Combinations

In making offers to students for Higher Education there are many factors which require consideration. One of the most influential is the subject combinations. Analysis of the Compendium of University Entrance Requirements shows a tight specification of subjects for the science and engineering courses whereas a much greater flexibility is available for the more arts biased subjects. It is within the field of engineering where most Design and Technology students appear to want to study to a higher level and here the subject combinations are more critical.

The nature of this survey and means of surveying did not, unfortunately, provide as much data on subject combinations as had been expected. Out of the 425 candidates surveyed the precise subject combination on only 301 could be determined. This was due to two factors. The first concerned candidates who did not apply for courses, thus, as no offer was made, the teacher did not complete the subject boxes on the questionnaire. This was anticipated at the time of the survey but it was considered more important not to confuse the principal objective of clearly determining offers. The second factor concerned course offers made in terms of points scores; here, unfortunately, the subject combinations were again left out and only appeared where subject grades were made. However, another source of information on subject combinations was made available from an internal survey by London University School Examinations Department, which will be used to put this survey into context. Table 20 shows the subject combinations for the specified subjects.

TABLE 20 Principal subjects taken with Design and Technology

Total Candidates (Each taking D&T)		301
Mathematics		211
Physics		187
All other subjects		162
	Total	861

This gives an average entry of 2.86 subjects per candidate which is high compared to other surveys, but is a fair reflection of candidates applying to university. This can be broken down further:-

Four candidates were shown taking 4 'A' levels.
251 candidates were shown taking 3 'A' levels.
46 candidates were shown taking 2 'A' levels.

Table 21 shows the frequency of other subjects with Design and Technology.

TABLE 21 Other subjects' frequency taken with Design and Technology

01	Art	25
02	Biology	11
03	Business Studies	3
04	Chemistry	11
05	Computer Studies	14
06	Economics	14
07	Electronic Systems	1
08	Engineering Science	5
09	English	9
10	General Studies	5
11	Geography	23
12	Graphical Communication/TD	24
13	History	6
14	Home Economics	1
15	Mathematics 2	3
16	Modern Languages	2
17	Music	1
18	Politics	1
19	Religious Studies	0
20	Sociology	2
21	Textiles and Dress	1

Table 21 shows that Art, Graphical Communication/Technical Drawing and Geography appear with similar frequency in the subject combinations but each is only 15% of the frequency of Physics as a subject combination. It is significant that all subjects except Religious Studies in the study were classified as part of a combination. Mathematics 2 in the survey signifies students taking two Mathematics 'A' levels and two of the four candidates taking four 'A' levels were doing two Mathematics syllabuses. The remaining two were taking, in one case, Mathematics, Physics, Chemistry with Design and Technology and in the other, Mathematics, Physics and Computer Studies. The survey found that 161 out of 301 candidates were doing the Mathematics, Physics, Design and Technology combination which is 53% of candidates for whom data was available.

In comparing these subject combinations with an internal survey of Design and Technology in 1983, London University produced the statistics shown in Table 22.

TABLE 22 'A' Level Design and Technology with Other Subjects 1983 London University

Design and Technology	605
Mathematics	170
Physics	143
Art	79
Technical Drawing	39
Geography	24
Economics	20
Chemistry	12
Biology	11

Plus 10 other subjects each having less than 10 entries.

This gives an average entry of 1.92, however, this is a little low as the survey only included London University's entries and some candidates were taking some subjects with other Boards. Furthermore, the 1983 survey was based on the old London Design and Techmology syllabus whereas this survey includes the more technological syllabus of 1984. It is unlikely that there was a major change in the type of entries and so it would be fair to conclude that the subject returns in the survey for this study were not a true sample of students taking 'A' level London Design and Technology.

The survey shows that the most acceptable combination for entry to Higher Education is undoubtedly Mathematics, Physics and Design and Technology. However, 47% of offers were made without that combination so Design and Technology with a range of other subjects would not prevent entry to Higher Education, although it might limit the choice of course slightly.

d) Grade Comparisons

The comparison of grades seeks to establish whether there are any significant differences in the grades offered for a subject. Whatever the conclusions drawn, they should be treated with great care as often a range of offers is made for the same subject combination, whereas returns to the survey have only shown one combination. For example, one student's offers were for civil engineering and comprised Mathematics (C), Physics (C) and Design and Technology (C) or Mathematics (B), Physics (C) and Design and Technology (D), or Mathematics (B), Physics (D) and Design and Technology (C). The teacher represented these offers in the survey as three C's. The comparison can only be satisfactorily covered for universities,as many polytechnics use a points score for making offers. For universities, the computer registered 450 offers with grades giving a mean score of 2.97 for Design and Technology using a score of one for E, two for D, three for C, 4 for B and 5 for A. For Mathematics the mean score on 384 offers was 3.30, for Physics the mean score on 365 offers was 3.07 and on other subjects the mean score was 2.83.

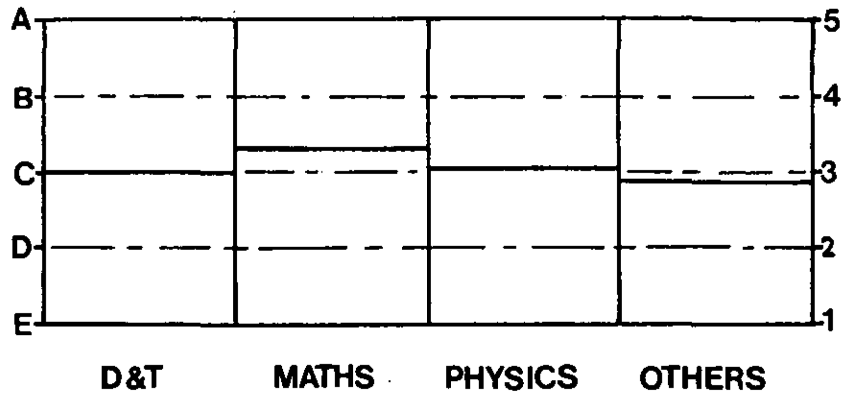


Fig 14 Mean score for subject offers at University

This shows little difference in offers made and although one could conclude that mathematics requires a slightly higher grade it would be dangerous to make that statement too positively owing to the small sample and lack of reliability of data. The standard deviation for Design and Technology was 0.66, for Mathematics 0.74, for Physics 0.64, and for other subjects 0.81.

e) Reported Rejections

With only 70,000 places available in British Universities and some 160,000 students trying to fill these places it is understandable that some rejections will be received. In the survey, teachers were asked to express views on a series of rejections, some stating that they were the result of weak candidates others indicated it was a result of taking Design and Technology. The following comments of relevance to specific courses were received and analysed under the course headings.

Architecture

Liverpool University was stated to have rejected a student based on the fact that 'A' level Design and Technology was one 'A' level offered. From the survey this appears very strange as Liverpool has made three offers for Mathematics, Physics and Design and Technology - combinations for Architecture. The particular students were taking the same combination of subjects so it would appear that other factors than just Design and Technology were affecting the offer. In B. Heap's 'Degree Course Offers', it states 'Creative ability is as important in many schools of architecture and among those insisting on a portfolio are ...Newcastle, Liverpool ...'

'Newcastle University made no offers for Architecture possibly because of taking Design and Technology with Mathematics and Physics.' This is another case which suggests Design and Technology may have caused rejection. However, again, one offer was made for that combination from Newcastle and in this case, Newcastle was fifth choice. This may have been the reason for the rejection as some university departments dislike being fifth choice.

Electronic and Electrical Engineering

The following university rejections were noted by staff, although no specific references were attributed to Design and Technology. Birmingham, Edinburgh, Essex, University College London, Manchester and Sheffield all rejected students applying for Electronic and/or Electrical Engineering. However, the survey shows evidence of all these universities making offers for Electrical Engineering courses. Another claim regarding these courses was that at Newcastle, a student was asked for two B's in Mathematics and Physics with no reference to Design and Technology. This appeared a fair offer but the teacher went on to claim that the lack of acceptance of Design and Technology had lead to an increased offer. However, all three offers from Newcastle in the survey had requested a (C.C.C) combination. Thus, it is difficult to see why the fourth offer rejected Design and Technology. If classified as a points score, the two B's are lower than the three C's.

Mechanical Engineering

There were two rejections from Loughborough, one from Bristol, Nottingham and Reading, in the survey. Again, no specific comment was made as to whether the cause was Design and Technology. The two from Loughborough were surprising in that it made nine offers in the survey and both Nottingham and Reading had made offers. In the case of Bristol, the candidate placed it as fourth choice and this could have affected the university's decision. One school reported that at a Careers Convention, a representative from London Imperial College informed the school that it would not accept Design and Technology. Again an interesting observation, not actually carried out in practice, as Imperial College made two offers in the survey to Mathematics, Physics and Design and Technology students.

No other rejections at university were reported in the survey and it is clear that with the correct subject combination and with a suitable level of ability, offers could be forthcoming from all universities. Rejections, although sometimes attributed to Design and Technology may not, in fact, be the real reason.

The picture in polytechnics is far less clear than in universities. The principal reasons for this are that at polytechnics, 25% of offers made were in the form of a points score with a mean of 5.7 points and many offers were made in the form of two subjects only. These two subjects were frequently classified as Mathematics and Physics, although where that combination was not present, Design and Technology appeared acceptable with Mathematics or Physics. Nine percent of polytechnic offers excluded Design and Technology in three 'A' level combinations, that is 20 offers. However, the survey also showed rejection of other subjects, some of which would normally be acceptable. These included Mathematics, Art, Business Studies and English each rejected twice, Chemistry, Computer Studies and General Studies each rejected three times, Technical Drawing rejected five times and Physics which was rejected six times in the survey. Thus it is clear that rejection at polytechnics, especially under the two subject offer system can occur to almost any subject and in that Design and Technology is no different from all other subjects.

The survey does indicate that where two subject offers are made, Design and Technology is less likely to appear, the preference being for Mathematics and Physics. However, where points scores are offered there appears to be no specific preferences.

The degree of rejection found in the complete survey was very small and it is encouraging that almost all can be answered in a satisfactory manner. The survey clearly indicates that Design and Technology is a widely acceptable 'A' level subject.

f) <u>Sponsorship Offers</u>

In the comments section of the questionnaire, frequent reference was made to sponsors being impressed with the work in Design and Technology, The survey identified 29 candidates who had achieved sponsorship at the time of the survey. This is 7% of the candidates surveyed or almost 10% of university applicants. The following table shows companies and organisations offering sponsorship to 'A' level Design and Technology students.

TABLE 23 Sponsorship offers from Companies

Hopkinsons	Lucas
Marconi Communications	Landrover
English Valve Company	MEDL
British Aerospace	RAF
Marconi Radar	Rolls Royce
Marconi Space and Defence	Marconi Electronics
STC	Army
Baker Perkins	
British Rail	
London Transport	
TI Group	
Austin Rover	

Thus Design and Technology clearly appears to assist students wishing to obtain a sponsorship towards their degree courses. The subject's capacity to show practical capability through its design work and high-order organisational skills does impress possible employers.

g) Career Aspirations

In surveying career aspirations, the intention was to merely gain some indication of the possible outlet students may go into on completion of their education, either straight from school or after university or polytechnic. All returns had this section completed and therefore, it is a true reflection of the sample. Naturally the classification could have been differently arranged but all categories except Chemical Engineering obtained a score. Table 24 shows the result of the survey. (See next page)
Analysis of these career aspirations show 40% of candidates aspiring towards a career in Engineering and 18% in the field of Art and Design in its various forms. In addition CDT teaching covers another 11% of the career aspirations. More specifically Mechanical Engineering was the most popular career with 14%, teaching was a close second with 13.5%. This indicates, with 11% intending to enter CDT teaching, that it remains a popular aspiration, although the result of such courses, especially at university shows that it could lead to less than half that number actually going into teaching. Those intending a career in Art and Design (12%) and Industrial Design (6%) show the popularity of such courses. Electronic and General Engineering each represent about 8% of the total. Electronic Engineering appeared to be increasing with the 1984 data having a much higher percentage than previous years. This may be a result of the 1984 syllabus being the first year this particular examination had a significant part of the syllabus concerned with electronics or it may be student increased awareness of this field of engineering. Despite the decline in civil engineering and architecture, they had 5% and 4% respectively of candidates aspiring to careers in those fields. Perhaps the most significant figure however was that only 3.5% were hoping to enter production engineering. This may well be a result of poor marketing of the profession or lack of understanding by students of the work of the production engineer. Equally, it may be that even students with a background in designing and making do not aspire to be involved in production as they perceive it to be boring or dirty.

This survey shows a vast range of careers which students at the end of their 'A' level courses feel able to aspire towards. They range from Journalism to Banking, Medicine to Agriculture and Engineering to Music. This indicates that Design and Technology does not necessarily narrow career opportunities,

TABLE 24 Career Aspirations of Candidates in the Survey

01	Accountancy	3
02	Agriculture and Forestry	2
03	Architecture	17
04	Armed Forces	15
05	Art/Design	51
06	Banking	5
07	Business Management	11
08	Chemical Engineering	0
09	Civil Airways	3
10	Civil Engineering	21
11	Computing	11
12	Craftsmen	4
13	Electronic Engineering	35
14	General Engineering	35
15	Hotel and Catering	1
16	Industrial Design	25
17	Mechanical Engineering	60
18	Medicine/Dentistry	1
19	Police	7
20	Production Engineering	15
21	Scientific Research	6
22	Social Work	1
23	Solicitors	1
24	Surveying/Planning	12
25	Teaching	57
26	Technician	12
27	Music	1
28	Sales	7
29	Materials Engineering	2
30	Journalism	1
31	Photography	2
32	Physiotherapy	1
	Total	425

it merely focuses those, who wish to aim towards engineering whilst providing a good general education for those with other aspirations.

This survey into the acceptability of 'A' level Design and Technology must be recognised as being a small sample and thus the trends and indications which have been described lack the reliability of a large survey. Unfortunately, a large survey remains impossible while numbers taking the subject are so small. However, some reliable conclusions can be drawn. The first and most important conclusion is that Design and Technology is, with the correct subject combination, an acceptable 'A' level with no evidence of problems of acceptability in universities. At polytechnics which usually require lower entry requirements, Design and Technology's acceptance is not as good when offers are made on two subjects only. However, evidence does not show Design and Technology to be any less acceptable than the majority of other subjects. The survey shows Design and Technology to be an acceptable 'A' level subject for the vast majority of courses, with only Chemical Engineering which could cause problems owing to the stipulation by several courses for Mathematics, Physics and Chemistry. There are no significant differences in mean scores on different subjects in combinations and the few rejections reported can, in general, be explained satisfactorily.

The career aspirations of students, identified by the survey, remain broad. However, as may be expected, there is a strong tendency towards engineering. Design and Technology's capacity to show practical capability during the 'A' level course appears to enhance a student's opportunity to obtain industrial sponsorship for degree courses.

CHAPTER 11

CONCLUSION

This study on the movement towards acceptability of Advanced Level Craft, Design and Technology can conclude that the subject is, at this time, more acceptable than at any time since its introduction. The conclusions of the survey clearly show that despite being a small subject in candidate entries, it is acceptable to almost all Higher Education across a wide range of courses, provided it is taken with the correct subject combination. Although to many teachers this conclusion and the supportive evidence in Chapter 10 may be the most useful aspect of the study, there are, however, many other issues raised which require either further study or some explanation from the education service.

In Chapter 1, the question 'What is an 'A' level?' is raised and research shows that this is very poorly defined and therefore new subjects have enormous difficulty in justifying their existence. This lack of definition is reinforced in Chapter 9, when an attempt is made to see whether CDT is acceptable in terms of its proposed core as compared with other major subjects. Here some alarming results can be seen, whereby some subjects which are by tradition highly acceptable have little or no stated educational rationale for their existence and do not feel the need to provide any. The Joint GCE Boards booklet on agreed cores at 'A' level gives an interesting perception on which subjects are acceptable because of their name and not necessarily through educational justification.

Chapter 2 makes a brief study of the evolution of craft education and in reality defines why the subject has had such a struggle to become acceptable. Higher Education's perception of the subject is deeply rooted in its traditional past and it is not uncommon for this to affect value judgements about current new courses. The contemporary developments of Craft, Design and Technology have been immense and the switch from craft-based work to design-based work and the introduction of technology have been rapid in educational terms. This has been assisted by increased political, educational and industrial support for the subject area. There is little doubt that the tremendous political support for the subject in the 1980's has greatly enhanced the subject's acceptability. It has been encouraging that educationalists within the schools sector have undoubtedly begun to recognise the subject's potential and value to young people and this is beginning to have some effect on Higher Education, although scepticism still remains.

Chapter 5 of the study looks at the current position of the subject in terms of numbers, trends, levels of acceptability and tries to draw some conclusions on how to improve acceptability. It must be recognised that CDT at 'A' level is a small subject in terms of subject entry and this leads it into a 'Catch 22' situation, whereby it needs greater numbers to attract more positive recognition, but without positive recognition from Higher Education, candidates will not come forward to take the courses. However, Chapter 5 clearly concludes the need for the subject area of CDT to reduce dramatically the subjects on offer so that a coherent image can be portrayed to Higher Education. This will require a common title and an agreed common core and it is pleasing to report that considerable progress on this issue has been made during 1985 by the Secondary Examinations Council and the GCE Boards. Chapter 5 also shows the increased acceptability achieved through the work of various organisations particularly the Design Council in association with the University Professors' of Engineering.

Chapters 6 and 7 first evaluate existing criteria for CDT and then propose new criteria and a subject title of Design and Technology at 'A' level. These chapters involve detailed analysis and a realistic attempt to define a common core. The proposed core does not attempt to be idealistic but is intended as a core which the subject area would find sufficiently acceptable to implement, whilst providing enough detail to meet the requirements of Higher Education. In drawing up the final core in Chapter 7 many colleagues from the Standing Conference on University Entrance, Council for National Academic Awards, Design Council and Secondary Examinations Council assisted through lengthy discussions at the Secondary Examinations Council. In Chapter 8 this proposed core is evaluated against existing syllabuses to discover if the subject would require major changes if the criteria were applied. The conclusion is that such action will not be necessary. In fact, the principal changes will concern titles and some rearrangement of marks allocated.

The comparison of the proposed core for 'A' level Design and Technology with cores for other subjects was an interesting exercise. It became difficult to see why CDT was not as acceptable as some other subjects following analysis of the core. Certainly the lack of rigour or rationale as described for some subjects was difficult to understand as these were some of the most acceptable subjects in traditional terms.

The findings in Chapter 10 convey a most promising level of acceptance for Design and Technology and despite the media reports, the subject's standing has grown remarkably to a position of almost universal acceptance. The subject's acceptability has grown because of the sound educational philosophy the subject is built upon, and this is enabling growth in the lower school which should influence take-up post 16. The Committee of Vice Chancellors and Principals and the Standing Conference on University Entrance pamphlet on 'Choosing 'A' levels for University Entrance' stated

> 'Design and Technology is the most acceptable subject for combining artistic ability with the understanding and practical application of scientific principles.'

Although the media did not cover this in a positive light, it clearly shows that the universities are beginning to understand the subject and give it recognition. In July 1985 Professor Ashworth, Vice-Chancellor of Salford University wrote to Vice-Chancellors of other Technological Universities stating his unhappiness at the media coverage of the pamphlet:-

> 'More unfortunately these reports have cast doubts on the value of such subjects as Craft, Design and Technology, at a time when these subjects are gaining intellectual respectability ....'

Professor Ashworth goes on to seek support from other Vice-Chancellors to make AS level Design and Technology a vital part of the curriculum for all engineers. The concept of this level of support indicates how the subject is overcoming its social prejudice and is moving rapidly towards becoming a fully acceptable 'A' level. The opportunity has never been greater for CDT and with careful, but firm, management and fair publicity, the movement towards acceptability should be realised by the end of 1986 when the Vice-Chancellors publish their next pamphlet on choosing 'A' levels for university entrance.

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'EDUCATION FOR CAPABILITY' STATEMENT 1980

'We, the undernamed, believe that there is a serious imbalance in Britain today in the full process which is described by the two words 'education' and 'training'. Thus the idea of the 'educated man' is that of a scholarly leisured individual who has been neither educated nor trained to exercise useful skills. Those who study in secondary schools or higher education increasingly specialise, and normally in a way which means that they are taught to practise only the skills of scholarship and science, to understand but not act. They gain knowledge of a particular area of study, but not ways of thinking and working which are appropriate for use outside the education system.

We believe that this imbalance is harmful to individuals, to industry and to society. Individual satisfaction stems from doing a job well through the exercise of personal capability. Acquisition of this capability is inhibited by the present system of education which stresses the importance of analysis, criticism and the acquisition of knowledge and generally neglects the formulation and solution of problems, doing, making and organising - in fact, constructive and creative activity of all sorts.

The resolution of this problem in Britain has been vitiated by discussing it in terms of two cultures: the Arts and the Sciences. It is significant that we have no word for the culture that the Germans describe as 'Technik' or the mode of working that the French describe as a 'Metier'.

We consider that there exists in its own right a culture which is concerned with doing, making and organising. This culture emphasises craftmanship and the making of useful artefacts; the design, manufacture and marketing of goods and services; specialist occupations with an active mode of work; the creative arts; and the day-to-day management of affairs.

We believe that education should spend more time in teaching people skills and preparing them for life outside the education system; and that the country would benefit significantly in economic terms from this re-balancing towards education for capability.'

UNIVERSITIES OF
BELFAST MANCHESTER
BRADFORD NEWCASTLE
DURHAM SALFORD
LANCASTER SHEFFIELD
LEEDS UMIST
LIVERPOOL

(Addresses enclosed)

NORTHERN UNIVERSITIES PROFESSORS IN MECHANICAL ENGINEERING

14/12/79.

Dear Headmaster,

A Levels in 'Engineering/Design' for University Entry Qualification

There has been a strong upsurge of interest in recent years in the teaching of engineering design and related topics in secondary schools. I have been asked to write to you as a representative of the Professors in Northern University Schools of Mechanical Engineering to give our views on this important subject as a contribution to the national debate and in the hope that you and your staff will find these helpful and constructive.

We are in sympathy with the motivation for the development of teaching in this subject and are keen to help ensure that the best and simplest system is developed by the Examining Boards, which takes full account of the many constraints.

Clearly, introducing children in the 11–16 age group to studies of engineering technology/ design in general can be very educational and help to develop creative and other abilities which are not necessarily developed by other subjects. In this respect aspects of technology and design should form an integral part of a modern general education for all students, not only for those interested in Engineering as a career.

For the 16–18 age group however there is the additional requirement to lay a sound quantitative foundation in mathematics and engineering science to form a basis for future university studies whilst at the same time ensuring that performance grades give an indication of ability to cope with the demands of an engineering degree course.

Our present degree course entry requirements are generally for three A levels and that the first two A levels shall be Mathematics and JMB Engineering Science or Physics.

I would like to emphasise some further important background points:

1. Any A level course to be recommended as a basis for selection for entry to our degree courses in the same way as JMB Engineering Science, must satisfy the following demanding criteria:

(a) Provide intellectual challenge via quantitative applications of Engineering Science.

(b) Provide Breadth of education.

(c) Encourage creative and other abilities, avoiding over-traditional, unimaginative approaches.

(d) Avoid too much choice of topics in examination papers. It is important for us to be able to rely on a defined core foundation being covered because of the short length of the British Engineering degree course.

(e) Avoid grading systems in which a large proportion of the marks is obtained from 'seen' course-work'. We do of course recognise the important educational value of open-ended project work.

2. We have scrutinised the available A level syllabuses and their examination papers in Engineering/Design and find that there are none which can be accepted as an alternative to JMB Engineering Science or Physics as the second A level.

3. Any A level Design syllabus proposed must clearly recognise current constraints on time, resources and expertise available within schools. Very few secondary schools in our view have staff professionally trained in and capable of properly teaching and assessing, Engineering/Design at A level. This leads us to be cautious when considering the various current syllabuses as possibilities for approval as third A levels. We ourselves regularly enlist aid from industrial companies for our design teaching.

P.T.O.

4. The broadest possible education at A level should be encouraged for future professional Mechanical Engineers, within the constraints of the typical three-subject A level curriculum. Thus an important point of view is that if students offer Mathematics and JMB Engineering Science as the first two A levels there would be considerable merit in taking a third A level in, say, a foreign language or Economics as an alternative to Design. Our Undergraduates study eight subjects typically in their first year at University ranging from Mathematics to Business Studies to Engineering Design so there is some limited scope for us to accept students with differing academic backgrounds.

5. If however a third A level subject in Engineering Design is taken then for it to be of adequate standard and to ensure maximum educational benefit is obtained, this must be studied alongside A level Mathematics and Physics. In our degree courses, design teaching is integrated with the teaching of a variety of supporting subjects.

In the light of the above points I would like to offer you our conclusions as follows:

A. There is an excessive number of A level Engineering/Design syllabuses available, many having misleading titles. A reduction in number and clarification of the aims would allow more effective concentration of syllabus development, avoid confusion and maximise the utilisation of scarce teaching resources. Action by the Examining Boards appears necessary here.

B. We have found four A level subjects which seem to pose an adequately tough challenge and therefore have potential to be recommended as third A levels together with Mathematics and Physics. We would however like to encourage further imaginative syllabus development by the Examining Boards concerned. These subjects are:-

1. AEB 'Engineering Drawing' 622
2. JMB 'Geometrical and Engineering Drawing'
3. Oxford and Cambridge 'Applied Mechanics'
4. Cambridge 'Elements of Engineering Design' – with a reduction to 20% in the percentage of assessment derived from coursework

C. We would recommend for serious consideration as a possible alternative to A level General Studies for all students, for their general educational value, the following two A level subjects:-

1. Oxford A83 'Design'
2. Oxford A82 'Engineering'

These appear wide ranging, up to date, and imaginative and we feel quite sure that all students would enjoy and benefit from them. However, the assessment methods and syllabuses are such that these cannot be regarded as potential third qualifying A levels for entry to our courses.

I apologise for the length of this letter but in view of the importance of the topic and the complexity of the various issues it did seem important that the background arguments for our conclusions were clear.

If you or your staff would like to comment on the various points made I should be very pleased to pass your comments on to my colleagues.

Yours sincerely,

J Parnaby.

J. Parnaby,
Professor of Manufacturing Systems Design
University of Bradford

UNIVERSITIES OF
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LIVERPOOL
(Addresses overleaf)

NORTHERN UNIVERSITIES' PROFESSORS OF MECHANICAL ENGINEERING

July 1980

A-levels in 'Engineering/Design' for University Entrance Qualification

Dear Headmaster/Headmistress,

In December last, a circular letter was addressed to you on our behalf by Professor J. Parnaby, who has since left the University of Bradford to return to industry.

The response to this letter has proved to be considerable. Some of our respondents agreed with the views expressed on Engineering and Design, but others have expressed disagreement and criticism. To add that a degree of misunderstanding has also arisen is by no means to criticize any of our respondents, many of whom have taken much trouble in putting their own points of view.

The response to our letter was discussed at length at a meeting of the Northern Universities' Professors of Mechanical Engineering, and it was agreed that, although Professor Parnaby had acknowledged and given a preliminary response to some of the correspondence, the situation required a full and revised statement of our admission requirements, taking account of the many points put forward to us. As Chairman of that particular meeting I undertook to co-ordinate our response, and I am pleased to enclose our agreed revised statement.

I would be most grateful if you and appropriate colleagues would spare time to read this statement, which we trust will remove such misunderstanding as may have occurred.

Yours sincerely,

B. N. COLE
University of Leeds

Northern Universities' Professors of Mechanical Engineering
A-Level Courses in Engineering and Design

1. In December 1979, Professor J. Parnaby wrote a letter to schools, on behalf of the Professors of Mechanical Engineering in the Northern Universities, to express interest in the teaching of engineering design and related topics in secondary education. Many headmasters and teachers have replied and there have been representations from Education Authorities and Examination Boards, some agreeing with the views expressed in that letter, some expressing disagreement with the assessment of the Oxford A82 Engineering course and others asking for clarification on particular statements. The Professors of Mechanical Engineering discussed the replies from schools and Examination Boards at their meeting in March and it was agreed that a further statement should be prepared to provide a considered response to the questions which have been raised.

2. Admission Requirements for Degree Courses in Engineering

2.1 The A-level admission requirements of most courses leading to an honours degree in engineering can be summarized as:

(a) a good pass in mathematics;
(b) a good pass in physics or engineering science; and
(c) a good pass in a third subject.

Most Engineering Departments accept a very wide range of subjects for the third A-level.

2.2 It is essential that engineering students should have acquired a thorough understanding of A-level mathematics and have confidence in its application before starting on their degree courses. Within any scheme of sixth-form studies, it must be recognized that there are groups of students, such as those intending to follow a professional career in engineering, for whom mathematics is the very basis of their university studies. For these students, a good pass in A-level mathematics is essential.

2.3 The majority of Engineering Departments require that students should obtain a good pass at A-level in physics or engineering science. When combined with A-level mathematics, this provides a sound foundation for a degree course in engineering.

2.4 During the past fifteen years, A-level courses in Engineering Science have been developed as alternatives to A-level physics. Several professors of engineering have been closely involved with the development of these new courses, and A-level Engineering Science is recognized by Engineering Departments as equivalent to A-level Physics for the purpose of admission. In evidence submitted in 1978 to the Finniston Committee, the Engineering Professors' Conference stated:

> The development of Engineering Science should be supported in schools which have the proper facilities for project work and where there are staff with the ability and enthusiasm to be successful in teaching this subject. Universities, Polytechnics and the Engineering Institutions should phrase their guides to admission to make it clear that Engineering Science at A-level, with a syllabus similar to that of the J.M.B., London or A.E.B. Boards, is regarded as being equal to A-level in Physics and not merely a subject which is accepted in lieu of physics.

The Professors of Mechanical Engineering in the Northern Universities have supported this statement on A-level courses in Engineering Science and regret any misunderstanding which may have arisen through the use of the generic term 'J.M.B. Engineering Science' in the 'December' letter.

2.5 Most Engineering Departments are willing to accept a very wide range of subjects for the third A-level. In practice, many engineering students choose a second mathematics subject or chemistry as the third A-level. However, a recent survey of almost 5000 engineering undergraduates has shown that in 1977 – 78, 25 per cent had taken their third A-level outside the traditional area of mathematics, physics and chemistry. The corresponding figure for 1968 was 13 per cent, so that there is evidence of increasing breadth in the sixth-form education of engineering students. Engineering Departments follow an admissions policy which places very little restriction on the choice of subject for the third A-level.

2.6 At entry to the sixth form, many students may not be certain about their future career, but may be able to specify a general area such as science or engineering. To leave open as many career opportunities as possible, students may choose a combination of subjects such as mathematics, physics and chemistry which can form an entry qualification for degree courses in mathematics, engineering, physics, chemistry, geology, metallurgy, medicine, etc. The choice of A-level subjects is influenced not only by the admission requirements of universities, but also by the desire of many students to leave open the possibility of entry to a wide range of careers. When discussing the choice of mathematics and physics, the Finniston Committee has arrived at the conclusion 'that this combination of subjects is in fact one of the least limiting choices since it allows entrance to a greater range of technological and non-technological occupations than a sixth-form specialization in, say, humanities'.

2.7 When combined with mathematics and physics, the third A-level provides evidence of a student's ability to study a range of subjects simultaneously. The third A-level may be in a subject which is related directly to engineering, or it may be in a different field such as English, modern languages, economics, etc. It is important that sixth-form students should understand that a good pass in the third A-level subject is normally considered as part of the over-all admission requirement for degree courses in engineering. Engineering Departments may be unwilling to admit a student who has a poor performance in the third A-level, even when this subject is not directly related to engineering.

2.8 There are several Departments of Engineering which state their admission requirements as A-level in mathematics, together with A-level passes in two other subjects. These departments will admit a student of high ability who has not taken A-level physics or engineering science, but they look for evidence of a strong motivation towards engineering and a high grade in O-level physics. A department which admits students who have not taken A-level physics will probably be unwilling to admit students who have failed in A-level physics. The admission data indicate that the number of students who have not taken A-level physics and wish to enter a degree course in engineering is very small, only a few per cent of the total intake.

2.9 The Standing Conference on University Entrance has formed working parties to consider various subjects which are available at A-level and to make recommendations on the minimum syllabus content that is desirable as a starting point for degree courses. The examining boards must decide to what extent this material can be incorporated in their A-level syllabuses, and individual universities must decide whether or not a particular subject at A-level will be accepted for the purpose of matriculation. Within the universities, each department can define its own entrance requirements, subject to the condition that these also meet the minimum requirements for matriculation. The admission requirements of each department are related to the degree course, and the A-level grades which may be specified are influenced by the number and quality of the applicants. It is therefore difficult to provide guidance on admission which is an accurate statement covering the requirements of Engineering Departments in many universities.

3. Engineering/Design at A-level

3.1 In 1978, the Professors of Mechanical Engineering in the Northern Universities formed a small Working Party to consider A-level courses in engineering, design and related subjects. Members of the Working Party obtained details of the current syllabi and copies of recent examination papers. The Working Party had been asked to consider whether the existing courses might be acceptable as a second or as a third A-level.

3.2 The Working Party recommended that in order to be accepted as an approved subject for the purpose of admission to a degree course in engineering, the A-level course should satisfy the following criteria:
(a) provide intellectual challenge via quantitative applications of engineering science;
(b) contribute to breadth of education;
(c) encourage creative ability, a matter felt to be of great importance;
(d) contain within the syllabus a clearly defined core which is to be covered by all students and is examined without too much choice of topics;
(e) avoid grading systems in which a large proportion of the marks is awarded by internal assessment.

3.3 When the Working Party examined the A-level courses in engineering/design, it concluded that none could be recommended as an alternative to physics or engineering science as the second A-level for students who intend to enter degree courses in engineering. This conclusion does not imply a criticism of the engineering/design courses which aim to cover different topics, with a different emphasis and develop other abilities in the student. The engineering/design courses were regarded as subjects which might be offered as the third A-level, to be taken along with mathematics and physics, and not as subjects which might be taken in place of mathematics or physics.

3.4 The courses in engineering/design must compete alongside further mathematics, chemistry, biology, English, modern languages, economics, etc, to be chosen as the third A-level. These other subjects have a high status in schools because they are listed as essential or preferred subjects for certain courses in higher education, whereas the Working Party did not recommend engineering/design as an essential or preferred subject for engineering students. If engineering/design were listed as an essential or preferred subject for engineering students, then with mathematics as essential and physics as preferred, this would place a serious constraint on the choice of A-level subjects. The Working Party therefore decided that each course should be examined to determine whether it could be recommended for acceptance as a third A-level.

3.5 In replying to Professor Parnaby's letter, several teachers have drawn attention to the merits of the Oxford A82 'Engineering' course. This subject is unusual in that the Examination Board has stated that it is intended to be taken alongside mathematics and physics and that it is not an alternative to physics. The Working Party considered that the syllabus and style of this course were satisfactory, but that the assessment perhaps gave too much emphasis to the project and course work. While, in fact, some of our departments already accept this paper as a third A-level, we would welcome some change of emphasis from project and course work to the written paper itself.

3.6 The replies to the December letter show that the titles of some A-level courses can lead to misunderstanding. The courses which were described in that letter as suitable for consideration as a third A-level included Engineering Drawing (AEB) and Geometrical and Engineering Drawing (JMB). These two courses include a substantial amount of mechanics, although this is not mentioned in the title. Similarly the Applied Mechanics (O and C) course does not indicate that it includes engineering drawing and that the examination paper may include questions relating to design. It would be helpful if the title of a course indicated more clearly the content of the syllabus.

4. Conclusion

It is hoped that in answering some of the questions which have been raised, this note may help to explain the background to admissions and the reason why the Professors of Mechanical Engineering in the Northern Universities have expressed their views on A-level courses in engineering/design. It is important that schools should appreciate the special position of sixth-form studies in mathematics and physics for engineering students; mathematics is an essential subject and physics, or engineering science, is the preferred second A-level. The Professors of Mechanical Engineering do not specify a subject for the third A-level but wish to encourage further development of courses in engineering/design which must then compete to be chosen as the third A-level.

Out of regard for separate discussions which have taken place in Northern Ireland, it should be recorded in particular that the Northern Ireland A-level in Design and Graphical Communication is acceptable to Queen's University, Belfast.

July 1980

SCHOOLS COUNCIL

Craft Design and Technology Committee

SUGGESTED CRITERIA FOR "DESIGN AND TECHNOLOGY" A LEVEL SYLLABUSES

1.0 INTRODUCTION

The CDT Subject Committee decided that it would be necessary, for their function of overseeing the provision of 'A' level GCE examinations, to establish some criteria and guidelines for the content and the methods of assessment of 'A' level syllabuses in the CDT field.

The committee has taken account of five factors in the preparation of this paper:-

i) the need to assert and make self-evident the intellectual validity of engagement in the designing, planning, organising and making activities and subsequent evaluation.

ii) the general tendency towards a convergence of opinion and expectation about the content of CDT as a school subject area from the Design Council, HM Inspectorate, the LEA Advisers in CDT, the Standing Conference on University Entrance, the Council for National Academic Awards, the School Technology Forum, the Engineering Council, the Conference of Professors of Engineering in Universities and the departments of Mechanical and Production Engineering in the Polytechnics. The Design Council's statement on Design in Secondary Education, post age 16, is particularly helpful in this matter.

iii) the trend for numbers of candidates in the more specifically craft-based subjects to fall while those in design-based subjects are rising.

iv) the present proliferation of examination titles and syllabuses, relative to the number of candidates, which leads to confusion and uncertainty in the minds of those who use the evidence of candidates' performances in 'A' levels for selection purposes, and who, therefore, do not readily recognise these subjects for such purposes.

v) the apparent current lack of any consistent criteria being used for this purpose.

The committee believes that in order that national recognition of the strengths, validity and importance of the subject area might be established and consolidated, it is a pre-requisite that there should be a recognised and common set of criteria for the knowledge content, for the skills expected, and for the methods of assessment of the subject. Ideally a single title should be used. The committee also believes that all the "materials based" subjects in the CDT field have the potential (if they do not already do so) to be developed to meet the criteria listed in this paper and thus become eligible to use the single title. It might be considered inappropriate for certain "materials based" syllabuses or engineering science types of syllabus to move towards this title and criteria. In such cases, it will be very important that the committee or its successor should establish equally rigorous criteria.

2.0 SUBJECT TITLE

The committee accepted that a conflict existed between, on the one hand, the need for the title to reflect adequately the content and aims of the syllabus and, on the other hand, the need for the title to gain general acceptance outside the teaching profession as well as inside it.

Details, in this paper, of the criteria for content and methods of assessment make it clear that the heart of this subject is the whole process of designing, making and testing. But it has also been recognised that in the eyes of the outside world the word "craft", at 'A' Level, does not readily gain acceptance in parts of higher education and the presence of the word seems to imply to many that such subjects are only concerned with craft work.

In order to take account of both these factors, and in the face of the apparent impossibility of finding a single word to meet both needs, the committee would prefer to use the title "Design and Technology", but titles similar in meaning should also be acceptable.

3.0 PURPOSES FOR WHICH CERTIFICATES OF 'A' LEVEL PASSES IN DESIGN AND TECHNOLOGY ARE USED

'A' level GCE certificates are used, along with other evidence, as indicators of levels of competence and fields of knowledge possessed by the holder for the following purposes:

a) direct entry to the professions which require further training.

b) entry to TEC and other courses in Further Education, e.g. DATEC.

c) "matriculation", for general entry to university and polytechnic degree courses.

d) evidence of possession of specific pre-entry requirements to individual degree courses.

e) evidence on which to base competitive selection to degree courses.

f) entry to industrial training programmes and industrial sponsorships.

g) evidence of vocational preparation and hence for selection directly to employment.

'A' level syllabuses in "Design and Technology" should be designed with a view to their being used for any of these purposes. The required intellectual and physical skills, capabilities in the practice of designing and making, and the concomitant intellectual resources of knowledge will need to be made explicit in such syllabuses as will the integrity of the methods used for assessment.

4.0 GUIDELINE CRITERIA FOR SYLLABUSES IN DESIGN AND TECHNOLOGY

Syllabuses in Design and Technology at 'A' level should be gauged against the following criteria.

4.1 Criteria for the intellectual and physical skills and the practical capabilities needed for "designing and making".

Does the syllabus require students to

- research, identify and draw up a precise specification to be satisfied by the solution to a problem which calls for the application of knowledge and design skill?
- generate a variety of solutions to such problems and discriminate against clearly defined scales of values (technical, aesthetic, economic etc) in the identification of an optimum solution?
- plan, taking account of available resources and the pressures of constraints, a programme of operations to bring about the chosen solution to the problem?
- create, using appropriate materials, components and equipment to a sufficiently high standard, the chosen optimum solution?
- evaluate the created solution to the original problem against the prepared specification, including quantification of values in terms of time, resources, efficiency, economics etc?
- communicate throughout their activities, their ideas, thinking processes, reasoning and conclusions to other people, using properly developed techniques and skills of graphics and other forms of presentation?

4.2 Criteria for the knowledge and understanding needed for "designing and making"

Does the syllabus require students to

- acquire detailed knowledge of a discipline, or disciplines, incorporating the technological concepts of energy, control and materials, which provides a resource for use within the processes of design?
- acquire an awareness of relevant human, economic and environmental factors?
- acquire a practical knowledge of processes used in working with materials and of techniques of construction, appropriate to the students' fields of design activity?
- identify the range and types of knowledge needed in arriving at possible solutions to their specific design problems and to seek such knowledge for themselves?

- make quantitative use of technological concepts (of energy, control, materials) in arriving at decisions during the processes of design in their own project work?
- investigate specific aspects of a design problem or its possible solutions and create new knowledge for the individual to aid the processes of design?
- conceive the design problems as a whole, thus interrelating the disciplines of technology in arriving at optimum design decisions?

5.0 GUIDELINE CRITERIA FOR SCHEMES OF ASSESSMENT

Student performance in 'A' level "Design and Technology" should be measured strictly against the objectives of the syllabus.

The intellectual and physical skills of designing and making at this level should be measured in the context of the real activities of designing and making, i.e. through the assessment of performance in appropriate projects.

The possession of disciplined knowledge within the concepts of technology should be measured both by examination and by evidence from the project.

The ability to investigate and acquire necessary technological knowledge should be identified in evidence from the project but a practical examination could also be used for this purpose.

The ability to apply technological concepts to design decision making should be in evidence in the project but an examination should also be used for this purpose.

The balance in assessment is very important and in order to maintain this balance it is recommended that the weighting given to project work assessment and to Examination should normally lie within the range of proportion 6:4 and 4:6. Ideally the project work should be externally examined.

SYLLABUS AIMS AND ASSESSMENT OBJECTIVES COMMON TO THE ADVANCED LEVEL ECONOMICS SYLLABUSES OF ALL BOARDS

A. THE AIMS OF THE SYLLABUSES

The purpose of the syllabuses in A-level Economics is to enable centres to devise courses which will provide candidates with an adequate knowledge and understanding of the tools of economic analysis and of the problems to which these tools are applied. The syllabuses are intended first to provide the basis for a broad understanding of economics and second to provide a satisfactory basis for further study of the subject.

More specifically the syllabuses are intended to encourage courses which will

(a) provide a basis of factual knowledge of economics,

(b) encourage the development in the student of

(i) a facility for self-expression, not only in writing but also in using additional aids such as statistics and diagrams where appropriate,

(ii) the habit of using works of reference as sources of data specific to economics,

(iii) the habit of reading critically to gain information about the changing economy in which we live,

(iv) an appreciation of the method of study used by the economist and of the most effective ways in which economic data may be analysed, correlated, discussed and presented.

B. THE OBJECTIVES OF THE EXAMINATIONS

This statement is intended to provide a general indication of the abilities which the examinations in A-level Economics will be designed to test in conjunction with the subject matter listed in the syllabuses. The detailed breakdown shown under each heading is intended to amplify the type of ability included under the general heading. It is not suggested that such clear distinctions can always be drawn in constructing examination questions and a particular question may therefore test more than one skill.

KNOWLEDGE AND ABILITIES TO BE TESTED

(a) *Knowledge*

(i) Knowledge of the terminology of economics.

(ii) Knowledge of specific facts relating to economics and economic institutions.

(iii) Knowledge of general and specific methods of enquiry and of the main sources of information about economic matters and ways of presenting economic information.

(iv) Knowledge of the main concepts, principles and generalisations employed within the field of economics and of the major economic theories held.

(b) *Comprehension*

(i) The ability to understand and interpret economic information presented in verbal, numerical or graphical form and to translate such information from one form to another.

(ii) The ability to explain familiar phenomena in terms of the relevant principles.

(iii) The ability to apply known laws and principles to problems of a routine type.

(iv) The ability to make generalisations about economic knowledge or about given data.

(c) *Application*

The ability to select and apply known laws and principles to problems which are unfamiliar or presented in a novel manner.

(d) *Analysis and synthesis*

(i) The ability to recognise unstated assumptions.

(ii) The ability to distinguish between statements of fact, statements of value and hypothetical statements.

(iii) The ability to make valid inferences from material presented.

(iv) The ability to examine the implications of a hypothesis.

(v) The ability to organise ideas into a new unity and to present them in an appropriate manner.

(vi) The ability to make valid generalisations.

(e) *Evaluation*

(i) The ability to evaluate the reliability of material.

(ii) The ability to detect logical fallacies in arguments.

(iii) The ability to check that conclusions drawn are consistent with given information and to discriminate between alternative explanations.

(iv) The ability to appreciate the role of the main concepts and models in the analysis of economic problems.

(f) *Expression*

The ability to organise and present economic ideas and statements in a clear, logical and appropriate form.

APPENDIX F

University of London
School Examinations Department
Stewart House
32 Russell Square
London WC1B 5DN

Telephone
01-636 8000 Ext

Telex

Your ref
Our ref GC/JMK/EA

Date 12 April 1984

Dear Head Teacher,

London Advanced Level - Design and Technology

Mr. A. Breckon, one of the Board's Examiners in Design and Technology, is researching into the acceptability of the subject as an entrance qualification for courses of Further and Higher Education. To assist him in his work he needs access to some personal details of candidates who will be sitting the examination in June this year, and if possible, those who sat the examination in earlier years.

The University of London School Examinations Department is assisting Mr. Breckon in his researches and your co-operation is requested. I am well aware that this is a busy time for all centres but I am confident that, when completed, Mr. Breckon's researches will be of value to the Department, teachers and ultimately the candidates.

Mr. Breckon writes:

> *"The acceptability of 'A' level Design and Technology has grown rapidly since its introduction ten years ago. I am pleased to report that the Design Council is recommending to the Universities' Professors of Engineering that it meets their criteria and is, therefore, an acceptable 'A' level for entry to Engineering courses. The Professors of Engineering in Polytechnics were equally impressed by the syllabus and have accepted it for entry requirements. Over the past ten years some 4000 students have taken the examination and many have gained places in Higher Education. During this period, much time has been spent in writing and talking to Universities and Polytechnics and I am pleased to report that the general level of acceptability for all courses seems very high.*
>
> *For 1984 the entry is nearing 1000 and it is now appropriate to produce some evidence to show how students studying 'A' level Design and Technology fare in their quest for places in Higher and Further Education. Through the responses to the enclosed questionnaires, attention will be paid to the grades required by the Universities, Polytechnics and Colleges and how the grades vary for different subject combinations and courses. The results of this research will*

/continued......

be fed back to the School Examinations Department of London University and I am sure they will also be of benefit to schools and colleges.

I would appreciate it if you could pass the enclosed questionnaire to your Head of Design and Technology for completion. Questionnaires should be completed for all students entering the examination in 1984 as well as for those entering Universities and Polytechnics in previous years, for whom data is available. I would appreciate it if the questionnaire could be returned to the Research Section, School Examinations Department by early June 1984. If further copies are required, please do not hesitate to photo-copy the form. Your replies will be treated in confidence and no centre or candidate will be identified in my report.

In anticipation, may I thank you and your staff for your co-operation in this research."

If you are able to help Mr. Breckon, please complete a copy of the attached sheet for each candidate who will be taking the examination in June 1984 and also, if records are easily available, for those who have taken it in recent years.

The Research Section of the Department will receive the responses on Mr. Breckon's behalf.

Yours sincerely

Dr J M Kingdon
Acting Head of Research

CCEPTABILITY QUESTIONNAIRE

DESIGN AND TECHNOLOGY (LONDON) ADVANCED LEVEL

entre Number ....

chool/College .... Candidate Mr/Mrs/Miss ....

	Name of Establishment	Name of Course	P	Offer Grades						Other Subjects + Grades					
	1			D&T		Maths		Physics							
	2			D&T		Maths		Physics							
	3			D&T		Maths		Physics							
	4			D&T		Maths		Physics							
	5			D&T		Maths		Physics							
	1			D&T		Maths		Physics							
	2			D&T		Maths		Physics							
	3			D&T		Maths		Physics							
	1			D&T		Maths		Physics							
	2			D&T		Maths		Physics							
	3			D&T		Maths		Physics							

P - If points score only.

Career Aspirations (For All Candidates) ....

Details of any Sponsorship received ....

Any Additional comments

Head of Department Signature ....

ACCEPTABILITY QUESTIONNAIRE

DESIGN AND TECHNOLOGY (LONDON) ADVANCED LEVEL

Centre Number ....

School/College .... Candidate Mr/Mrs/Miss ....

	Name of Establishment	Name of Course	P	Offer Grades						Other Subjects + Grades					
Universities	1			D&T		Maths		Physics							
	2			D&T		Maths		Physics							
	3			D&T		Maths		Physics							
	4			D&T		Maths		Physics							
	5			D&T		Maths		Physics							
Polys	1			D&T		Maths		Physics							
	2			D&T		Maths		Physics							
	3			D&T		Maths		Physics							
HE	1			D&T		Maths		Physics							
	2			D&T		Maths		Physics							
	3			D&T		Maths		Physics							

P - If points score only.

Career Aspirations (For All Candidates) ....

Details of any Sponsorship received ....

Any Additional comments

Head of Department Signature ....

APPENDIX H

LUT/AMB. A' Level Data.

Processing Form No

Sch/Col	Candidate	Sex	Est co	Course	DT	M	P	Sub	G	Sub	G	Sub	G	R	S	Points	Career	
1 1 1	2 2 2 2	3	4 4	5 5	6	7	8	9 9	10	11 11	12	13 13	14	15	16	17 17	18 18	

CLASSIFICATION - PROCESSING FORM - DATA INPUT

Column No	Data Input	Form of Input
1	School Number	001-999
2	Candidate Number	0001-9999
3	Girls or Boys	G or B
4	Univ/Poly Establishment Code	01-99
5	Univ/Poly Course Code	01-99
6	Design and Technology Grade Offer	A-E *
7	Mathematics Grade Offer	A-E *
8	Physics Grade Offer	A-E *
9	Other subject	01-99
10	Other subject Grade Offer	A-E *
11	Other subject	01-99
12	Other subject Grade Offer	A-E *
13	Other subject	01-99
14	Other subject Grade Offer	A-E *
15	Rejection of Design and Technology	R
16	Sponsorship	S
17	Points Score	01-15
18	Career Code	01-99

* At these points 'X' means no offer made for Design and Technology

DATA OUTPUT

1 Offers to each University/Polytechnic
2 Offers to each Family of Courses
3 University/Poly with course and offer data together
4 Frequency of subjects taught with Design and Technology
5 Grade comparisons
6 Course rejections because of Design and Technology
7 Mean Score of offers of Design and Technology
8 Classification of Career Aspirations in families
9 Number of girls

CLASSIFICATION - ESTABLISHMENT CODES

01 Aberdeen
02 Aston
03 Bath
04 Belfast
05 Birmingham
06 Bradford
07 Bristol
08 Brunel
09 Cambridge
10 City
11 Dundee
12 Durham
13 East Anglia
14 Edinburgh
15 Essex
16 Exeter
17 Glasgow
18 Heriot Watt
19 Hull
20 Keele
21 Kent
22 Lancaster
23 Leeds
24 Leicester
25 Liverpool
26 London
27 Loughborough
28 Manchester
29 Umist
30 Newcastle
31 Nottingham
32 Oxford
33 Reading
34 St Andrews
35 Salford
36 Sheffield
37 Southampton
38 Stirling
39 Strathclyde

40 Surrey
41 Sussex
42 Ulster
43 Wales
44 Warwick
45 York

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46 Birmingham P
47 Brighton P
48 Bristol P
49 Central London
50 Hatfield
51 Huddersfield
52 Kingston
53 Lanchester
54 Leeds
55 Leicester
56 Liverpool
57 City of London
58 Manchester
59 Middlesex
60 Newcastle
61 North London
62 N E London
63 North Staffs
64 Oxford
65 Plymouth
66 Portsmouth
67 Preston
68 Sheffield
69 South Bank
70 Sunderland
71 Teeside
72 Thames
73 Trent
74 Ulster
75 Wales
76 Wolverhampton

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77 Institutes of Higher Education
78 Colleges of Art and Design
79 Colleges of Education

CLASSIFICATION - COURSE FAMILY CODES

01 Agricultural Sciences
02 Anatomy, Medicine, Dentistry, Pharmacology, Physiology
03 Architecture
04 Art and Design
05 Biological Science
06 Business Management, Accountancy, Economics, Law
07 Chemical Sciences
08 Computing
09 Education/Teaching
10 CDT Teaching
11 Industrial Design
12 Languages
13 Mathematics
14 Physical Sciences
15 Social Sciences
16 Engineering - Aeronautical
17 " - Chemical
18 " - Civil, Mining/Surveying
19 " - Control
20 " - Electronic/Electrical
21 " - Material Sciences/Metallurgy
22 " - Mechanical
23 " - Production and Manufacturing
24 " - Science
25 Geological and Environmental Sciences
26 Ergonomics
27 Design/Marketing
28 Planning
29 Building Construction
30 Music/Drama
31 History
32 Physiotherapy
33 Sports Science
34 Hotel and Catering
35 Furniture Making

CLASSIFICATION - OTHER 'A' LEVEL SUBJECTS CODE

01 Art

02 Biology

03 Business Studies

04 Chemistry

05 Computer Studies

06 Economics

07 Electronic Systems

08 Engineering Science

09 English

10 General Studies

11 Geography

12 Graphical Communication/TD

13 History

14 Home Economics

15 Mathematics 2

16 Modern Languages

17 Music

18 Politics

19 Religious Studies

20 Sociology

21 Textiles and Dress

CLASSIFICATION - CAREER FAMILY CODES

01 Accountancy
02 Agriculture and Forestry
03 Architecture
04 Armed Forces
05 Art/Design
06 Banking
07 Business Management
08 Chemical Engineering
09 Civil Airways
10 Civil Engineering
11 Computing
12 Craftsmen
13 Electronic Engineering
14 General Engineering
15 Hotel and Catering
16 Industrial Design
17 Mechanical Engineering
18 Medicine/Dentistry
19 Police
20 Production Engineering
21 Scientific Research
22 Social Work
23 Solicitors
24 Surveying /Planning
25 Teaching
26 Technician
27 Music
28 Sales
29 Materials Engineering
30 Journalism
31 Photography
32 Physiotherapy