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Educational Aims in the Technological Society

Introduction
In the last issue of this journal I concluded an article by asking what were the aims of CDT.[1] The difficulties to which I drew attention are made worse to a stranger to the CDT scene who hears enthusiastic pleas being made for education for the technological society through computers and the like, without mention being made of the specific role of CDT. Such a stranger may indeed discover that a number of many so-called CDT workshops appear to differ very little from the school craft shops of the past. He recognises however that the subject has become up-graded in status partly because of its association with technology but he may not be clear exactly what this is. He is therefore concerned with two major questions:

a. What are the aims of education in a technological society?
b. What contribution does CDT make of such aims?

In order to come to grips with these questions I intend to examine the nature of educational aims, the distinguishing marks of technology and the unique features and problems constituent of the technological society.

A. The Nature of Educational Aims
Aims denote intentions or policies, with the possibility of either success or failure. There is always a danger that statements of educational aims will be regarded as platitudes or will operate at such a level of generality that everyone will tend to agree with them, though they may be interpreted in various ways. Everyone wants children to be morally good, but everyone does not want the same thing. Similarly an education in or for technology may be widely supported as an aim but not in the same way by every one, therefore it is important that the aims are given enough detailed exemplification and precision so that their unique character is clear.

For such statements to be effective there must also be a general commitment to the aims and a will to implement them. Research on areas such as mixed ability has shown that where individual teachers disagree with the general school policy, their apparent conformity can conceal different attitudes.

The concept of the hidden curriculum makes the same point. It may be the stated school policy to seek to get all pupils to think for themselves – but some teachers by their general attitudes and authoritarian methods may fail to support this policy. Even if the teachers never apparently think about the aims, nevertheless their practice presupposes particular intentions or attitudes, for teaching must logically be an intentional activity. School policies can only work if staff are prepared to modify their own activities in the light of them. However, some educational aims are of such a general character that they can only succeed if the whole of society supports them. Aims denote priorities, the concentration of effort on the achievement of certain values and a longterm concern with improving pupils in some stated direction, therefore, educational success depends upon the general conditions of society. If we genuinely want individuals to think for themselves then we must be prepared to support individuality and to accept the social consequences of non-conformity.

It is important to make these points because if we want children to be equipped for the technological society, then the school must be backed financially in its provision of appropriate materials, and children must be helped generally, through the mass-media and in the home, to have the necessary experiences. Similarly within the school, as it has been realized that language is too important a matter to be left solely to the English teacher, so it will have to be realized that the same may be true about technology. Furthermore this cannot just be recognized at the head-teacher level commitment must be general for the aims to be achieved. This may require changes in the core curriculum, changes in school architecture and changes in teaching organization, and commitment by all involved staff.

Historically there have been three main categories of aims 1. Liberal or Intrinsic. 2. Child-Centred or Individualist and 3. Social.

1. *Liberal or Intrinsic* aims have, since Greek times, stressed the pursuit of knowledge for its own sake and rejected the idea of activities taught for their usefulness or as means to extrinsic ends. This view has tended to create a hierarchy of activities with the arts being regarded highly and craft or technology being ascribed lowly status. Craft was regarded as largely vocational and practical (for the Greeks this meant using the body rather than the mind) and lacking a coherent structure or form of theoretical knowledge. On this view a technological education could not be liberal.

2. *Child-Centred or Individualist* aims may not be explicitly stated, for they are concerned with the development of the individual and his needs, interests and happiness, as he may see them. Such aims are often closely associated with creativity, problem-solving and project-work where openness is the main feature and the end cannot easily be determined. With its use of problem-solving some writers have seen CDT as operating with a process model of the curriculum and a form of child-centredness.[2]

3. *Social* aims stress the importance of schools in shaping society. Some social aims have been *conservative* being primarily concerned with creating obedient citizens – good Christians or Communists. In contrast, some teachers have

attempted to use their position to create attitudes of *reform* or radical change in society. A more *democratic* view has supported aims concerned with individual autonomy and integrity based on rationality and social and moral responsibility. It is the democratic view of education that has modified the traditional liberal elitism. While the conservative may seek an unquestioning acceptance of the technological society, the modern liberal educator, pointing to the narrowness of a technology that is concerned with means-to-ends and mere efficiency stresses the need for wholeness and a general education. Liberal education and social democratic aims are concerned to develop an individual who is both able to understand technology and its related disciplines and can evaluate its moral, social and political effects.

B. The Nature of Technology

Before we can comment further on the way technology affects educational aims we need to examine the nature of technology and in particular the way that it is thought that technology has uniquely shaped modern society.

There is an ambiguity about the term 'technology' because historically it is a general term covering many different types of pre-scientific human invention, fabrication or operation as well more recent, scientifically-based innovations, processes and products. It is not surprising that Kai Nielsen has said that 'there is no such thing as technology, but different, often closely interlocked technologies, developed and utilized for different purposes by different classes with different and typically conflicting interests'.[3] At times in society and in education 'technology' is used as a 'hurrah' word. An invocation of it seems almost a justification of some activity; though, in contrast, for some writers, big brother stands behind every technological innovation threatening individual freedom and the quality of life. The concept of technology may imply many different types of human invention. E.G. Mesthene defines technology so broadly as to include 'not only hand tools and machines, but also the spectrum of intellectual tools, from language, to ideas to science, and to such latterday techniques as computer programmes, systems analysis and programme planning and budgeting systems'.[4] In some analyses it is difficult to distinguish technology from other activities such as art in so far as both imply transformation of some material form.

The first use of the term 'technology' was in 1706 when it was employed to describe the Arts, particularly the Mechanical Arts. By 1831 it is used to describe those arts concerned with the application of science.[5] Some writers place the origins of technology, as a unique set of disciplines, about this time, for the first engineering schools were established at the end of the eighteenth century and during the nineteenth century, with London and Glasgow Universities offering engineering degrees in the 1840's. The students of engineering had an initial training in science and maths but they also studied more specific areas such as the strength of materials and hydraulics. Many writers claim that certain essential developments were occurring about this time to make the arts and crafts into modern technologies. There was a growth of the systematic studies of materials and material processes, and appropriate empirical research was being carried out. Theory was underpinning practice and conclusions were being communicated and critically evaluated. Up until the Industrial Revolution there was a long and exciting history of crafts and tools, artifacts and mechanical ingenuity, slow, painful advances and sudden, rapid diffusion. But these often involved isolated events, seen only by the historian, as forming an inter-related set of technological events.

Technology, then, is not just one thing but it implies a number of conditions, aspects or structures.[6] Amongst its constitutive elements are the following: 1). tools, apparatus, machines, 2). products such as material goods of some sort, 3). methods and processes of production, 4). knowledge, both practical and theoretical. Technology also occurs within 5). certain socio-cultural traditions and institutional settings 6). it also assumes and affects certain beliefs, attitudes or values.

To elaborate 1). *Tools* Man is not unique in making or using tools but he is unique in the degree to which his life is shaped by tools. These are expressions of human purposes. By means of such tools or machines man creates new materials or transforms natural and synthetic substances.

2). *Products* The products of technology tend either to improve some capacity, performance and environmental control or to increase the possible expression of human power. It has enabled us to do more than previous generations in the fields of food, health and comfort. It has increased our ability to systematize information and extend our thinking capacities. It has improved our potentials in communication and transport. In short, it has both facilitated human adaptation to a potentially threatening environment, and has increased man's power beyond that needed for mere survival. Besides these outcomes of capacity and material product, there have also been unintended bi-products of technological innovation and production, such as pollution.

3). *Methodology* Technological methodology can be seen as either the limited methods of making material goods or the more general concern for rationalizing and making efficient all aspects of life. With regard to the latter Roszak says 'Politics, education, leisure, entertainment, culture as a whole, the unconscious drives, and even . . . protest against the technocracy itself: all these become the subjects of purely technical scrutiny and of purely technical manipulation'.[7] With regard to the former, technology can be regarded as the search for efficient methods and successful

outcomes irrespective of whether the success can be explained adequately or not. On this view electro-therapy as a method of treating depression may be regarded as part of medical technology, although it lacks a scientific theoretical underpinning. Historically crafts and technologies changed slowly because they were communicated by demonstration from a master, with subsequent guidance and practice. Innovation occurred through individual insight and trial and practice. Such methods were employed without a supporting theoretical explanation. Indeed practical activities must precede the setting down of recipes or those empirical generalizations which arise from practice; as 'knowing how' procedes 'knowing that'.

4). *Knowledge* This leads us to the question of what kind of knowledge is technology. Does technological innovation necessarily require a knowledge of science and a mastery of mathematics? The historical answer must be 'No', and on this basis it is said that 'science owes more to the steam-engine than the steam-engine owes to science'.[8] While it may be thought that this can no longer be true and that modern technology must employ tools derived from science, such an answer is not completely accurate. Several studies have shown that with more recent technological innovations, scientific theory lags behind.[9] Furthermore some of the advances made in pure science have emerged from industrial and technological research, e.g. such discoveries as those concerned with the diffraction of electrons, radio astronomy and information theory.[10]

This is not to deny that pure scientific theory may have formed the basis for technological innovation – as Maxwell's physics paved the way for radio engineering. However there are problems here. Some writers claim that modern theories of physics contain such a degree of mathematical abstraction that it takes an intermediator – or applied scientist – to concern himself with the applications of pure theory. Feibleman see the biochemist who explores the physiological effects of some new drug as such an intermediator. He is the applied scientist, with the doctor who prescribes the drugs for particular patients as the technologist.[11] Similarly the work of the engineer in building bridges or designing instruments is supported by theories of applied science. 'The methods peculiar to technology: trial and error, invention aided by intuition, have merged with those of applied science: adopting the findings of pure science to the purposes of obtaining desirable practical consequences. Special training is required as well as some understanding of applied and even of pure science. In general, industries are based on manufacturing processes which merely reproduce on a large scale effects first learned and practised in a scientific laboratory. The manufacture of gasoline, penicillin, electricity, oxygen were never developed from technological procedures, but depended upon work first done by pure scientists. Science played a predominant role in such physical industries as steel, aluminum, and petroleum; in such chemical industries as pharmaceuticals and potash in such biological industries as medicine and husbandry'.[12]

Technological knowledge involves the knowledge of how to make or transform material objects, together with such knowledge as that concerned with the operation of control systems or the way that energy can be employed. It also involves the practical mastery of appropriate methodologies and the organisation of data. One may employ such technological knowledge on the basis of observed models or demonstrations, supported by generalisations from practice, recipes or empirical laws. As the APU report *Understanding Design and Technology* says 'Children in schools can be observed applying technological concepts at a variety of levels, particularly when working empirically towards design solutions. It is not necessary, therefore, for these concepts to be *CONSCIOUSLY* possessed by pupils before they can be used'.[13] At a higher level, however, it is necessary for the modern technological innovator to be able to do his own empirical research and analysis as well as to have some training or awareness of the areas of mathematics, applied and even of pure science. But he has to judge the efficiency of his products by their actual outcome or effects not by theoretical possibility alone.

5). *The Socio-cultural Environment* Technology takes place and is shaped by the sociocultural environment. thus the needs and demands of the society, the values of those in power and the interests and funding of various groups within society will affect the nature of the technology that is produced (Witness the debate on the cost of certain types of medical treatment and nuclear missile). Also technology is developed within the specialized institutions of society – the hospitals, factories, laboratories, armies, communication and transport systems. Through such institutions technology has come to affect the organization of work-forces and leisure activities and thus to have an overwhelming influence on the life of the general population. That there are many technologies can be seen in the various institutional settings with military technology, medical technology, agricultural technology, transport technology, space technology etc. in which particular skills, tools, methodology products, etc., are chosen according to specific sets of purposes and applied to particular areas of life.

6). *Values* Contrary to what many people declare, technology is not value-free. It both assumes and influences certain attitudes and values. That it, like science, did not develop in any systematic and empirically-researched form until modern times, needs some degree of explanation. The non-serious nature of Chinese technology despite its great inventions is sometimes ascribed to the values incalculated by its powerful bureaucracy, the low esteem in which utilitarian motives were held and the real lack of incentives

to economic activity. On one view it was the existence of slavery that accounts for the ultimate failure of Greek science and technology. Amongst the theories put forward to explain the actual impetus and development of modern science and technology are those stressing the ending of taboos about nature through acceptance of the doctrines of creation and incarnation as expressed in the radical wing of Puritanism. It is argued that secularization – the belief that the world is not sacred but is open to analysis – and with it capitalism, science and modern democracy are bi-products of the Reformist faith. While technology like science in some of its forms is to be found in all societies – in the tools and products that supply the primary needs as well as in some of the specific techniques of religion or culture – the attitude that seeks the rational investigation of all aspects of life, the optimistic view that holds that the human condition can be ameliorated for all and the belief that the material basis of nature is subject to human control and responsibility – these imply a peculiarly modern set of values. To say that technology is value-free is to say in part that for the technologist everything is possible. As technologist, man is free to exploit human and natural resources to express his superiority to the rest of nature, to develop weapons and to transform human and animal genetic make-up without moral, religious or aesthetic restrictions. Technology is concerned with means-to-ends and its battle-cry is efficiency. I hasten to point out that man is not just a technologist and technological innovation needs therefore to be accompanied by political and moral discussion. However, it is partly this purer aspect of technology and partly its apparent consequences that makes certain third world countries want modern technology without the associated Western values. Their hopes may be short-lived. While technology may be used to reduce and eliminate human poverty and misery, it also may have untold consequences for future generations of men through its exploitation of nature.

C. The Technological Society

The French writer Ellul defines the technological society as centrally concerned with efficiency of methods rather than choice of goal; it is causally directed, and possesses mutually related parts so that changes in one sphere quickly affect other spheres. Modern technology is not an isolated factor in society, but a total attitude or comprehensive mode of existence. We are all aware of the way that its products have affected our lives, within both our homes and our work-places, in our leisure as well as in our jobs. Employing the word 'Technique' to mean 'technical operations' or 'technological processes' Ellul writes 'It is incorrect to say that economics, politics and the sphere of the cultural are influenced or modified by Technique; they are rather situated *in* it, a novel situation modifying all traditional social concepts. Politics, for example, is not modified by Technique as one factor among others which operate upon it; the political world is today *defined* through its relation to the technological society . . . The ideas, judgments, beliefs, and myths of the man of today have already been essentially modified by his technical milieu'.[15] In this situation with innovations creating rapid change – intended or otherwise – Ellul believes that the major question to ask is whether or not man is able to remain master in a world in which technology's own imperatives determine social direction.

Sometimes we confuse technology and non-technological factors. Technology, for example, affects the issue of work and unemployment but so has the development of competitive industries in the developing nations. Bell writing of the post-industrial society notes the growth in white collar jobs and professional, managerial and technical positions. The new elite, he argues, are the mathematicians, industrial executives and engineers. The picture presented is of workers who have gradually come to find their jobs meaningless because of the fragmentation and de-skilling of tasks. They lack control over their working lives and feel alienated. While there may be further distribution of work to the service and leisure industries, automation could bring further unemployment. In such a situation, it must be asked, what can be done to prepare children for a world without work and what can be done to find a satisfactory quality of living for us all?

Many writers have come to be critical of the role of experts in the technological society. Manheim, in looking at technological projects with social consequences, argues that the public is now questioning the role of the highway engineer and urban planner. For a long time there was the 'belief by the professional, and the public, that, because of his education and training, he was uniquely qualified to adjudge what was best for society in his domain of competence'.[17] J.C. Jones in his analysis of design methods points out the dangers of insulating socially important decisions from public discussion. We must also be aware of the powers of the mass media and the advertisers by which consumers are influenced into accepting and understanding the advantages and disadvantages of new products and systems. The danger is that the public becomes almost conditioned into accepting change without a consciously-made choice being involved. Rational choice must avoid both running away from technology or rejecting new design products because they are new, and accepting or even welcoming the new without considering the consequences. Once our ways of living are affected by a new technology it may become too late to act. An awareness of this has caused 'a growing demand that all the people who are affected by a new design participate in the making of critical decision, either through the intermediate action of user research or directly through organisations formed to protect the interests of those who could gain or lose as a result of planning and designing'.[18]

Change has taken place so rapidly and with such large-scale effects that it is only gradually that we have become aware of the pollution of rivers and lakes, of acid rain, of lead and other forms of air pollution, and of the problems of noise. Innovation occurs so fast that we are often unconscious of what is happening until its effects have become felt. Alvin Toffler points to the peculiarity of a graph that would measure the historical changes in the speed attained by man. It took millions of years for the human race to reach a speed of a hundred miles an hour. It took 50 years to quadruple that limit. It took 20 years to double that again; and by the 1960's rocket planes approached speeds of 4000 mph and men in space capsules were circling the earth at 18000 mph. 'Whether we examine distances travelled, altitudes reached, minerals mined or explosive power harnessed, the same accelerative trend is obvious . . . Milleniums or centuries go by, and then, in our own times, a sudden bursting of the limits, a fantastic spurt forward. The reason for this is that technology feeds on itself. Technology makes more technology possible. It is not merely true that 90 per cent of all the scientists who ever lived are now alive and that new scientific discoveries are being made every day. These ideas are being put to work much more quickly than ever before'.[19] The effect of modern technology is global rather than local or even national.

It is against this background of rapid change with unintended effects that the cries come for more public control over events.[20] We have left too much to chance. We cannot just accept pollution and the like as the price we pay for technology. There are alternatives. We can use less of the technology that has these effects. We can try to restore the environment by concerted effort. We can make sacrifices to find alternative technologies that pollute the earth less or that consume up our fixed energy resources at a slower rate.

In short the technological society seems qualitively different from previous societies. It is grounded in modern science and technology and as such is secular, materialist and optimist in character, being concerned with efficiency and the conquest of nature. On the one hand, it holds the promise of alleviating poverty, starvation and human suffering. It opens doors which we can choose to go through and in this way gives us greater power and freedom of choice than we have had before. On the other hand, we cannot leave its various developments to chance or we will find that the machine has come to rule man and that man is no longer free. Each decision we make lessens our future freedom of action, for its effects seem global and almost irreversible.

D. Educational Aims and the Technological Society

This brings us to the question of what role education has in the preparation of the young for the technological society. Certain things will now have become clear. We cannot isolate children from technological change and its consequences. At the same time it would be foolish to aim at social conformity and the uncritical acceptance of technology. It is difficult to assume that traditional religious and moral values are not being challenged by the technological emphasis on means-to-ends efficiency. It is also important to establish that if technological innovation and socially important design require public debate, then the school must cater for political education within a participatory democracy. Design and technological awareness must be part of that political education; indeed these are but elements of a general education required for life in society. To take the subject of geography, design and technology must, in some senses, form an important part of that subject. Think only of discussions about urban and motorway planning, industrial change, energy resources and technology in the developing countries and you must realize the importance of geographical knowledge. The same must be said about many other subjects. Preparation for the technological society cannot be left entirely with departments of technological or science subjects.

In this context the traditional liberal criticism of a technological training cannot be ignored. Blanshard argues that a man may be technically proficient but remain uneducated – ignorant, bigoted and provincial. He may even enjoy solving puzzles about how iron or hydrogen behaves when compressed or frozen or heated to a million degrees, or enjoy harnessing the more mulish forms of matter and make them work for us. But even at this level he is essentially pushing physical things about, and not experiencing a liberation of the spirit which liberal education seeks to achieve. 'The ideal technologist is an infinitely subtle brain at work on an infinitely subtle puzzle. He needs curiosity and endurance; but any appreciation of human goodness or artistic beauty, of what is funny or tragic or sublime, any sense for music or religion or justice would be for him, simply as a technologist, superfluous baggage'.[21]

Of course Blanshard is just pointing to the danger of a blinkered technological education, but it need not be like that. I have argued for the need to relate technology to moral and political education and a long time ago A.N. Whitehead[22] pointed out that the antithesis between technical and liberal education can be reconciled. We cannot afford the mutual incomprehension and hostility between the science and art cultures that C.P. Snow found.[23] We all live in the technological society and we must all be educated for it. The products of technology can be used in Music (with music centres and electronic keyboards) or English (with work-processors), and indeed there are few subjects that may not use the computer. It is essential to remove the fears the uninitiated sometimes experience and render the young competent in the tools of the new technology. In this way technology

pervades the arts; and the arts – or at least some of the arts – can contribute to our understanding of the technological society. The virtue of the liberal aims is that they draw attention to the needs of man to be truly human in this context. H. S. Broudy[24] looks both to society and education to help the individual find the power, the freedom and the individuality to render himself morally responsible, socially significant and aesthetically aware. For this, education must include a knowledge of the workings of the technological society – industrially, commercially and politically.

One of the key issues that rises here is how to prepare children for work in the technological society – an issue raised by the great debate about education. The problem is complex.[25] It must be acceptable to give children an understanding of the general factors affecting industrial development and the availability of jobs in society. It is also important to have careers advice and careers education in school. But vocational training in terms of training for specific jobs or an education that is limited by choice of career, cannot be acceptable educationally especially in the kind of changing situation I have described. At this moment many jobs are fragmented, repetitive and boring, requiring little education for them. In the future it is suggested that only a minority in the manufacturing industries may require highly-developed analytical technological positions, while the rest might find themselves replaced by robots. Hence a high standard of general education or even of technological training will not be necessary for the majority as work preparation. Somehow we have to be prepared to give up the Protestant work ethic and find a substitute for work as a central force in determining our social identity. We have to prepare children for a world without work.[26] Our educational aims must therefore be directed beyond work.

E. Educational Aims and CDT

The foregoing arguments have suggested that the first preparation for a technological society is moral, political and social education, conceived as an open approach to the question of what kind of society do we want. I have argued that technological awareness, which is a condition for such preparation, requires social knowledge rather than practical skills. This is how the DES booklet *Technology in Schools* interprets the phrase technological awareness' (p.15) and similar considerations are offered in the APU booklet *Understanding Design and Technology* (pp.6/7).

For many writers training children in technology means simply training children in the use of computers or giving them an understanding of and practice in electronics. In neither of these areas does CDT have the monopoly. Clearly an education for technology must involve technology across the curriculum.

What then should be the position of CDT? It must be noted that the subject I am focussing on is Craft, Design and Technology and not Technology. Both Craft and Design have something to offer for the technological society. M.W. Thring in considering a future in which robots are developed to do all the routine repetitive sub-human work, argues that our education system must be adaptable to cater for the self-fulfilment of individuals. 'An entirely new system of education will have to be offered, so that a range of creative arts and crafts are taught which people can enjoy doing for their own sake'.[27] Craft, then, has a part to play in our homes at the creative as well as the do-it-yourself level. In this respect craft may be compared to music, painting or literature as a source of enjoyment for many children and adults.

The phrase 'design awareness', as we have seen, is sometimes used to describe a general social attitude towards issues of social planning. Such a notion implies that beyond every individual act of pupil design work, there must be an attempt to develop aesthetic sensibility and a general understanding of design criteria. Getting children to design products is partly an attempt to get them to think about the making of material objects and to consider the various technical and aesthetic factors that are involved, and it is partly an attempt to encourage them to be creatively involved in some craft or technological planning. For this they require some prior knowledge of the material being used as well as the appropriate skills to be employed in the making of the object. One principle of such teaching is that since there is insufficient time for a logical and sequential course in all the necessary skills and knowledge, children must learn how to find things out for themselves. This principle, encapsulated in the phrase 'learning how to think rather than what to think' – is sometimes supported as a necessary procedure to be adopted in a world of great change. As a preliminary to making, involving some research and creative planning, designing has its place, and it may, as *Technology in Schools* indicates, involve some technological work.

This brings us to the element of technology in CDT. We have noted throughout that one may manipulate technological hardware and even innovate in technology, without supportive scientific explanation of why something is happening, though more recent technology involves a closer relationship to science and maths. Sometimes it is said that there are four areas of technology that need to be taught in CDT – control, materials, energy and communications. What is learned within these areas can vary from concrete specifics to the abstract general. Energy may be exemplified in the various forms of propulsion or power that may be employed in specific products. It may also be quantified, measured and used in relation to theoretical problems. It is to be noted that the DES acknowledges a deep concern of CDT teachers that technology should involve practical activities in manipulating mechanical, electrical and related physical aspects of technology. There might be a

place for a more theoretical course in technological analysis, involving studies in applied science and in the solving of theoretical problems related to, say, engineering, but such courses which would compete with subjects like physics at 'A' level, might only have minority interest.

The aims, then, of a technological education must be primarily that of preparing children, morally and politically, for understanding and being critically aware of the social issues of technology. Secondly it must involve learning how to employ technological devices, wherever appropriate. Thirdly, in relation to CDT, it must include some involvement in and understanding of the areas of technology that can be related to designing and making.

Such technological awareness would need to be taught through a concerted effort within school and an openness to public debate generally in society. But it could only be adequately catered for, by understanding and learning to operate technological tools and products. This can be done in several subjects.

In so far as CDT is a holistic subject weaving craft, design and technology into one piece, then it can never be regarded as solely technology. Technological concepts are taught operationally whenever an appropriate issue arises in design. Similarly the craft skills of wood and metal are taught whenever the occasion arises in the realisation of the appropriate design product. On this view, technology is taught through the act of designing and making, insofar as tests of material efficiency are employed, considerations of specific types of energy are involved, control devices and methods e.g. electronic devices, are used or computer graphics are utilized. But the emphasis is practical rather than theoretical: it involves the attempt to create a product and any research or theoretical analysis must be related to that end. With this emphasis, however, both design and technology may provide pivotal points whereby the student can be taken beyond some immediate process or product to an act of analysis and research in order to improve the design. Within an integrated curriculum involving team-teaching, such analyses and operational understanding can be developed further through teaching of a more scientific nature.

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