AC 2011-635: HIGHER TECHNOLOGICAL EDUCATION IN ENGLAND AND WALES 1955-1966. COMPULSORY LIBERAL STUDIES

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Higher Technological Education in England and Wales 1955 –1966. Compulsory Liberal Studies.

Abstract

Compulsory liberal studies are not usually associated with engineering education in the UK. Yet, between 1955 and 1966 students in colleges in the public sector in England and Wales pursuing higher technological programmes were required to undertake three or four hours per week liberal studies throughout their four year courses. The purpose of this paper is to examine problems and practice in the implementation of those liberal studies on the basis of investigations carried out at the time including those of the author. It is also to consider their relevance, if any, to recent demands for a shift in the emphasis of engineering education from its technical focus to a broader view of what engineering is and what engineers need, as for example in Rosalind Williams critique. A caveat is entered to the effect that these programmes were the outcome of a particular cultural history at a particular time and may not necessarily be transferable across cultures. It may be argued that exclusion of the compulsory dictamen for liberal studies from the education of engineers in universities has its origins in the British social class system.

An account is given of the significance of the period (1955 - 1966) in the history of British technological education. A review of the debates that accompanied the introduction of liberal studies and research undertaken at the time is presented. There was much discussion about what was meant by liberal studies and much of what happened in the colleges depended on how they (individually) interpreted the term. At one end of the spectrum they were considered to be an extension general education, while at the other end, they were considered to be liberal education as traditionally defined. A distinction was made between subjects likely to be useful to the engineer (tool), and those distant from engineering (fringe). Tool/fringe subjects were to be distinguished from 'cultural'subjects. In the context of Rosalind Williams proposals, the social sciences would be tool subjects. In her work there is no discussion of liberal education *per se*. Irrespective of intention they were seen as a means of raising the status of the Colleges of Advanced Technology. There was also a debate about who should teach them and where they should be taught. As with any innovation of this kind not only are student attitudes to them important but so are those of the faculty who teach mainstream subjects. Taking together the research undertaken at the time suggests that liberal studies were somewhat more successful than they might have been.

The system of third level education in England and Wales *circa* 1955 [1]

In the British Isles there are five different education systems that are separately managed. In addition to the republic of Ireland there are four systems in the United Kingdom (UK) viz England, Northern Ireland, Scotland and Wales. For purposes of legislation England and Wales are often taken together and it is with them that this paper is concerned.

The third level system education in England and Wales *circa* 1955 was divided between, a misnamed "private" and "public" sectors. The private sector consisted of small number

of universities and university colleges. The funding of this private sector came primarily from the taxpayer and was distributed by a University Grants Committee (UGC) that acted as a buffer between the universities and government. The public sector consisted of a variety of thirds level institutions managed by Local Education Authorities and financed from local rates and central government funds. They offered an extensive range of courses-from those for operatives to those for university degrees and their equivalents. With some exceptions most of the courses were for part-time evening study, part-time day study or a combination of both. There were some full time courses. Employers would release employees for one day per week to study (commonly called "day-release"), and students would often do a combination of day release and evening study. In the preceding fifty years a system of study for qualifications rated as equivalent to a university degree had been developed. Their purpose was to provide the student with a professional qualification. In the UK the professional institutions, in science, engineering and technology in particular required candidates for admission to have passed examinations set by these societies.

There were (and remain) societies for Biology (Institute of Biology), Chemical Engineering (Institute of Chemical Engineers) Chemistry (Royal Institute of Chemistry), and Physics (Institute of Physics). Similarly, there were, (and remain) a number of engineering institutions that represented a range of specialisms. Principle among them, were the Institutions of Civil, Electrical and Mechanical Engineers, and it is with the Civil Engineers that examining applicants for membership seems to have begun in the nineteenth century. The ability to establish membership requirements using educational qualifications as one of the criteria came from the Royal Charters awarded these institutions. In practice, although they set their own examinations each year, very few candidates entered for them. Instead they took examinations and courses in the technical colleges that comprised the bulk of the third level public sector. These examinations were regarded as equivalent to those set by the institutions. In practice the majority of the students in science and technology took 'ordinary' and 'higher national certificates' that together with 'endorsement' subjects were considered to be the degree equivalent that the institutions required. For purposes of teaching the Ministry for Education regarded them as such.

By 1966 a new composite examination that covered all the recognized institutions led to the award of "Chartered Engineer' (C.Eng) [1]. A person who was entered into membership on the basis of equivalent qualifications was entitled to use the term 'C.Eng' after their name.

The importance of this alternative part-time route to professional qualifications may seen from the fact that in 1957 that of the 5090 persons admitted to the professional grades of the engineering institutions 2057 had higher national certificates and 1900 had university degrees. The remainder (1133) had a variety of other qualifications considered by the institutions to be of equivalent status. In the same year there were 1088 courses in these institutions for degrees awarded by the University of London, and 9285 courses for higher national certificates (8796) and diplomas by full-time study (489).

These figures are given to show the significance of the public sector in producing technologists. To increase the supply of technologists oriented toward industry in 1955 the Government decided to create a council (National Council for Technological Awards (NCTA) for the purpose of awarding a high level diploma to be the equivalent of a degree (dip.tech) [3]. This would be achieved by study over four years on sandwich (cooperative) structured courses (i.e. six-months in industry followed by six-months in college in each of four years). In the year following the Government restructured the public sector so that in the hierarchy of technical colleges there would be 10 colleges at the apex that would only do advanced level work [4]. These were designated as Colleges of Advanced Technology (CATs). Below them would be thirty or so 'Regional' colleges that would offer some advanced work and continue with work at technician level but not work lower than that which would be done in 'area' and 'local' colleges. Both the CATs and Regional Colleges could seek to have courses validated for the award of the dip.tech. It was expected that the NCTA requirements for the recognition of courses could require substantial expenditure by the colleges if they were to raise the standard of some of their facilities as would be required for degree level teaching.

The dip.tech was a success and it led to the CATs becoming universities in 1966. This paper is primarily concerned with the ten year period of their existence and the role that liberal studies played in them.

Liberal education in the technical colleges

A major problem that the CATs and other colleges had in seeking able students for their degree level courses was the "vocational" image that they presented to the public when compared with the universities. They were seen to be the practitioners and not the purists. They were associated with people who got their hands dirty. Their products were seen as the people who did the actual work of technologists, they were not seen as the managers of technology. Worse they did not have the breadth of education associated with that of a university degree holder. Making a diploma (dip.tech) equal to a degree immediately invited such stereotypical contrasts. For its part the government believed that students on these courses should have their education broadened. Following a 1955 report from the Institute of Adult Education on *Liberal Education in a Technical Age* [5] in 1957 the Ministry of Education published three circulars on *Hostels* [6(a)], *Libraries* [6(b)], and *Liberal Education in Technical Colleges* [6(c)]. The concern in this paper is with the circulars on liberal education and hostels.

Circular 323 while recognising that it would be difficult to incorporate more study in day-release courses required that such courses be given and suggested that these might be in human relations. In 1961 a White Paper was to recommend increases in the time allowed for English and General Studies [7] and with this and a pamphlet of the same name came a change of emphasis toward general education in these courses. However, although controversial, the terms liberal education and liberal studies continued to be applied to that component of the curriculum in dip.tech courses. Although the circular recommended a time allocation of between 15 and 20%, The NCTA had already stipulated an allocation of between 10 and 11% or roughly 3 hours of student contact time

per week, and according to Davies it remained at this level throughout the period of this study [8]. These studies were examined and contributed to the student's overall assessment. Accompanying these developments in the Technical College Sector was the rise of an Association for Liberal Education that had its own research officer [9].

It will not have escaped the notice of the reader that no mention is made of university students in technological studies receiving such treatment. Why should a person on a degree course be treated differently? The concept of liberal education has a long history that can be traced back to the Greeks, and Davies provides an all too brief history of the development of liberal education from those times [8.ch 1]. From the Greeks and the Romans we get the notions of being free to learn, and as Davies notes freemen had leisure and time to devote 'to the wider problems of life.' The Greeks had instituted the seven liberal arts divided as they were between the 'trivium' (grammar, logic, rhetoric), and the 'quadrivium' (arithmetic, geometry, music and astronomy). Davies cites Brubacher to the effect that the trivium was supposed to be more liberal than the quadrivium because its subjects were thought to be more "*purely intellectual*" [8.pp 3 & 4 [10]. Thus, in Greek times there is the beginning of a liberal/vocational classification of subjects. Further, Aristotle and his followers contribute to the idea that a liberal education serves no ulterior purpose. In the nineteenth century Newman was to develop this idea in the face of no mean controversy.

The Greeks were not the source of humanism, the Romans were. They continued with the Greek idea of the curriculum and added to it the idea of humanism that "*is the result of a cultura animi, of an attitude that knows how to take care and preserve the things of the world*" (Arendt [11] cited by Davies 8. p5). Inherent in this is the idea of a cultivated person being imbued with the classics. From Roman principles also comes the principle of "*well-rounded development*" this to include physical as well as intellectual development that inspires some to continue to view this as a principle of the curriculum today (*mens sana in corpore sano*). The ideas of the Greeks and Romans still influence our discourse even if there are differences of interpretation. But as Davies points out the concept of a liberal education suffered many transformations and in the high renaissance the regard for the literary heritage had become crystallized [8.p7]. "*Latin prosody, which was later to form the basis of education in most European countries, notably in the English public school ousted the other disciplines in popularity*" [8.p8]. And this state of affairs remained throughout the eighteenth and nineteenth centuries. At the same time university education in England was until 1828 confined to Oxford and Cambridge and more significantly to an élite. The annual intake to Oxford during the first half of the century was about 200 who were distributed among the colleges. The colleges were very small residential organizations. "*By tradition and owing to the expense of residence the undergraduates were drawn almost exclusively from the ranks of the wealthy landed aristocracy, and by statute they were drawn exclusively from the ranks of professing Anglicans*"[12. p 4]. These "gentlemen" were the "freemen" of the age. It is also worth remembering that often students went up to university at the age of sixteen.

No wonder that when Davies sought a definition for liberal education in *The Oxford Dictionary* he found "*liberal (of education), fit for a gentleman, of general literacy rather than of a technical kind*" [8. p 1].

Throughout the nineteenth century there was a considerable debate among scholars about the nature of education and in particular liberal education. Davies does not discuss it in any detail although he draws attention to the merits of a classical education as expounded by Matthew Arnold. He believed that such an education was an antidote to materialism moreover it would preserve the cultural heritage. Acceptance of the benefits of science and technology and the acceptance of a utilitarian education led to the rejection of the classics. Others mentioned by Davies include Pattison, Rector of Lincoln College who was definite in his view that universities were not there to provide a professional degree. As Sparrow points out he would have agreed with the distinction that came to be made between a diploma and degree. Pattison thought like Arnold that the "*prime direct aim is to enable a man to know himself and the world*" (Arnold cited by Sparrow [13, p141]). Pattison's thinking as interpreted by Sparrow was that "*while a vocational education is training for work, a liberal education (if it is to be reckoned a training at all) is training for leisure; it teaches, as Pattison put it, the art to live: it instructs a man how to live and move in the world and look upon it as befits a civilized being"* [13, p 146]. It would seem that a better picture of what is meant by liberal education is given by Newman in his much quoted text on the outcomes of a university education [14 p 157]. What seems to be clear is that that text, contrary to Davies assertion, that there is no social purpose in Newman's exposition, indicates that such an education leads to a particular behaviour in society. As Sparrow says of Pattison, "*it was to teach the art of life to those who ruled the nation*"[13, p146]. The demand that degree level students in technical colleges should have the benefits of a liberal education would seem to be recognition of its value in that sense.

Whereas Sparrow considered that Arnold, Newman and Pattison stood out from the rest of the writers on liberal education because there work remained relevant Davies draws attention to the comments of T. H. Huxley a distinguished scientist who wrote a comprehensive statement of liberal education that argued against neo-classical humanism in favour an appreciation of what science could do for the human state. In so doing a person would have "*learned to love all beauty, whether of nature or of Art, to hate all vileness and to respect others as himself. Such a one and no other, I conceive, has had a liberal education; for he is completely as a man can be, in harmony with nature*" [15, cited in 8 p 8]. This could, in curriculum terms, be conceived as a demand for a broader curriculum, a demand that is inherent in Newman's philosophy of education.

Newman is to be distinguished from Arnold and Pattison in that not only did he have the opportunity to create a university out of a theory, so we can judge the effectiveness of the theory, but he gave to that theory a substantive epistemology. We are asked to accept (believe) that any subject can either be taught in a narrow way or in a 'liberal' way. But it is clear that if a subject is to be taught in a liberal way which is to view every aspect of the subject matter in the search for understanding, a broad education will be required that has that kind of synthesis as its goal. Newman wrote that he had "*no hesitation in giving*

the preference to that university which did nothing over that which exacted of its members an acquaintance with every science under the sun" [14 p128]. He was very much against the production "*of a generation frivolous, narrow-minded, and resourceless intellectually*" [14, p 129]. Clearly he valued an education that was broad.

There is one other aspect of Newman's theory that is relevant to the subject at hand and that is the importance that he attached to the learning that students from different backgrounds (educational and otherwise) acquire from each other. He believed this to be more important than examinations, and for this reason he thought that residence was important [14, p 128 ff]. It is also the reason that universities have argued that they offer a liberal education and it is the reason that in one survey 42% of head teachers of second-level schools mainly grammar believed that the most important aspect of liberal education was mixing with students from a wide range of faculties, yet oddly enough "living together" was not seen to be important [16]. Evidently as Davies (8 p 94) deduced headmasters believed universities promoted some kind of social intercourse that was not present in the CATs.

Whatever else it is, a liberal education is not a specialization. Technology is a specialization so whatever differentiates a university student of technology from a technological student in a technical college it is something other than the study of technology. Whatever it is, it contributes to the student's development as a gentleman irrespective of what he studies. "*It seeks*" as Davies writes, "*to confer on its recipients a freedom of mind which those who do not possess this advantage will not exhibit*." Thus the technical college student is in a certain kind of bondage because his studies do not enable him to gain that freedom of mind that is the outcome of a liberal education. If such students were to be liberalised and obtain a breadth of mind they would have to be given a broader education than they currently received.

It seems evident that there were shades of the British social class system at work in this kind thinking for a liberal education was one that met the needs of a gentleman. A technical education met the needs of work. A person who had received a technical education could not possibly be cultured, and as Davies points out this kind of snobbery is to be found in the writings of Jane Austen and Henry Fielding, and in more recent times T. S. Elliot and Somerset Maugham. Davies commenting on the survey of headmasters asked "*is it possible that headmasters, like many members of the general public, continue to view liberal education in social terms even in class terms*?" [8, p 94]. He notes that the understandings headmasters have of what is done in CATs and universities were based on spurious assumptions. While the documents of the nineteen fifties make no mention of 'gentlemen' and still believe that all technologists are masculine how else can it be explained that university technology students did not require compulsory liberal studies. Or, given that the majority of students studying for the dip.tech had university entrance qualifications which implied that they had attended grammar schools, why was their experience of grammar schools deemed to be illiberal when it was not so for their compatriots at university?

It is against this cultural/historical background that the Ministry of Education detailed its recommendations in circular 323 under the following headings:

(a) The inclusion of additional subjects in programmes.
(b) The broadening of the treatment of technical and scientific subjects.
(c) Increased use of the college library, of seminars, of discussion groups, directed study periods, and projects; and in general the fostering of a tutorial relationship between teaching staff and students on the lines of that used in universities.
(d) The encouragement of corporate life in the colleges, and the development of extra- curricular activities.
(e) The establishment of contact with institutions abroad.

The liberal studies controversy and its evaluation.

It is not surprising that the introduction of liberal studies was controversial. Arguments raged about content and teaching method, whether or not they should be examined, subjects' available to students, compulsory attendance and undue overloading of the students by subjects not thought necessary to their professional career.
At the time there was a growing body of research in technological education and researches on various aspects of liberal education in technical colleges were well represented (see notes 8 & 15). The focus of this study is on a small element of one of these studies that sought the views of diplomates on liberal studies within the more general aim of the evaluation of the structure and function of sandwich courses [17e]. Although limited in focus [18d], because it covered all the diplomates and students in 5 of the CATs, this Birmingham based study taken together with the other studies provided a comprehensive picture of what was happening in the CATs as a whole.

From the political perspective of its sponsors the important question for the Birmingham study was whether the effectiveness of the courses would be improved if the colleges opened all the year round and incorporated two intakes. Was there a sufficient supply of students and were there enough training places to merit a double intake? What were the factors that caused students to select a CAT for study? Were they influenced by their schoolteachers in their choice of institution? And did the compulsory liberal studies component of the dip.tech courses contribute positively to that image? What was the experience of the products of these courses (diplomats), and how if at all could the courses be improved? An important item in the remit was to have "*regard to the role of colleges as corporate academic communities*" which brings in the residential and collegial environment role of liberal education. The Birmingham based study was conducted among students and teachers at five CATs and among the total national cohort of diplomates at the time, headmasters, careers masters, science teachers and their pupils about career intentions, and those concerned with policy making and implementation in industry. So who were the students and where did they come from?

The students and their background

The number of females on dip.tech courses was very small to the point of being negligible. Among the students and diplomates sampled in the Birmingham study 5% and

2% respectively were females [18]. A similar proportion was found in the Brunel study [19] but Davies does not distinguish between the sexes in his study [8]. Politically the finding that there were a significant number of working class students in the dip.tech population was important. Given that only about 5% of the eligible population went to University it is clear that the remainder were middle and working class. It is the working class figures that are of interest here because at the time there was a clear bias in the education system in favour of the middle classes at the expense of working classes. At the time of selection to grammar school from primary school only 12% of those with an IQ of 105 from the working classes entered grammar school whereas 40% of the middle classes did. This disparity disappeared for those with IQ of 127 and above when 80% of the eligible population from both classes entered grammar schools. Unfortunately, for one reason or another, investigators used different classifications for parental occupations. Nevertheless, when allowance is made for all the difficulties in classifying relatively vague data it seems that the CATs followed the trends in university departments of technology in England of accepting between 25% and 40% of male students with fathers in manual occupations [20]. Among the fourth year students interviewed in the Birmingham study 31% were classified as having a manual working class parent. It is clear that the CATs provided a vehicle for full-time higher education for a significant number of students with working class backgrounds, equally significant is the fact that these places were in technological studies. Did they need a liberal education?

The problem of getting more working-class students into higher education and in particular to the élite universities is an issue that continues to be of great concern.

Politically and probably of equal importance was the finding that came from the Robbins Committee in 1963 who reported that the average age of dip.tech students was younger than that of other students in advanced courses of further education a fact that indicated that students were being attracted to these courses directly from their schools [22]. 38% of the students in this investigation and 55% of the students in the Brunel study were 19 years of age or younger [17e, p 762; 19; 23].

It was the grammar schools that were the source of these new students. 67% of the students and 61% of the diplomats had had a grammar school education. There are perhaps two surprises. The first is that 10% of the students and 18% of the diplomates had had either a public or independent school education. The second is that the small number of secondary technical schools produced 11% of the students and 6% of the diplomates [17e, p 766].

The picture is somewhat more complex because in the Birmingham study 42% of the student sample and 40% of the diplomate sample entered with technical qualifications, the majority of which were Ordinary National Certificates. But some of them also had ‘A’ level qualifications. In the sample of fourth year students that were interviewed 77% had ‘A’ level qualifications and 22% National Certificate qualifications [24]. Given the view that second level education was sufficient an education to negate the need for liberal education in the universities it is not without significance that 78% of those in the diplomate sample had five or more passes at the Ordinary level with 41% reporting a pass

in a foreign language, and 15% in two foreign languages. 48% of the diplomates were eligible for university but 19% had had their applications rejected [17e, p769].

Davies reminds us of an important allied study carried about by Richmond who developed a 'culture' test of general knowledge the questions of which spanned the arts and sciences [25]. Twenty or so years later Hirsch was to develop a similar test of cultural literacy for use in the United States [26]. Richmond's work was partially inspired by the two culture theory advanced by C. P Snow and the results of his tests among university student and school populations suggested that there may be something in that theory. But as Davies points out that if a pass mark of 50% is taken as the pass criteris all of the ten groups studied would have failed outright. "*Engineers, however, seem not only to be ill-balanced in their attainments but those attainments tend to be lower than those of their contemporaries in other faculties*" [8, p 100]. But Davies point is that if the test is an acceptable measure of cultural background, and "culture" is at the focus of liberal education then the lack of cultural background revealed by university students merited "*a reappraisal of the role of liberal education in universities*!" [8, p 102]. Without consideration of equivalent qualifications about half the population were similar to those entering universities so the issue of the value that dip.tech students placed on liberal studies was of some significance.

The value of liberal studies

There was plenty of evidence, then as there is now, that students of technological studies have more formal contact time in lectures and laboratories than students following other disciplines [27]. It might be expected, therefore, that the addition of subjects distant from the main disciplines would lead to an unfavourable reaction to their inclusion. However, investigations of liberal study programmes by Peers and Madgwick [28] and Andrews and Mares [29] did not find much hostility to such compulsory study. Peers and Madgwick found that about 13% were hostile to such programmes. But while not recording hostility Andrews and Mares reported that 24% of their sample found no benefit from them. Davies reminds us that most of the respondents were from technical colleges, and only 29% had attended CATs [8 p 82]. Analysis of the diplomates views in the Birmingham study showed that no more than 10% of the total responses could be considered as rejecting the idea of liberal studies. 10% would have liked more liberal studies. There were some who felt that liberal studies were the remedy for specialisation. They saw them not as a means of acquiring additional knowledge but something arising from the desire to learn as opposed to be taught. There were, however, those who felt the pursuit of liberal studies by which they meant "high culture" (music, art etc) was a private matter, and others who thought they should not be formal, after all " *a university offers a liberal education in an informal manner*".

Among the diplomates were those who considered that any liberal study should have relevance to their intended occupation (11%). They valued subjects like economics, human relations, and industrial administration [30]. Andrews and Mares called these "tool/ fringe" subjects when compared with "cultural" subjects. They noted that 50% of their sample who claimed to have benefited from liberal studies three quarters had

referred to tool/fringe subjects and only 5% to "cultural" subjects. Overall 39% of the students and the same proportion of instructors favoured tool/fringe subjects whereas the heads of liberal studies departments favoured both types of subject with a bias in favour of the cultural [8, p 80]. Some diplomates in the Birmingham study suggested that there was great potential for theory learnt in tool/fringe subjects to be explored in practice during the industrial periods and vice-versa. Sir Willis Jackson (Chairman of the British Advisory Council for Education and Industry) had suggested that students could be given day release during the first period, and this writer had argued that the first period should be of one year's duration with only two six month periods in industry during the academic course [31]. Davies found that teaching staff gave consistent approval for the suggestion that integration of liberal studies material with technological work should be attempted. The staff interviewed felt that the larger firms could do a great deal to promote liberal studies but their ideas referred to weekly discussion groups and contact with local cultural organizations [8, p192, p 195].

In contrast to those interested in tool/fringe subjects 11% of the Birmingham sample indicated an interest in the arts and fine arts. Andrews and Mares also interviewed industrialists: those who commented took a utilitarian view of what should be studied. Their results led them to suggest that the syllabus (content) should fall into four main divisions –language and communications, technical studies, social studies and optional. Their model differed little from that proposed by Grinter in his report to the American Society for Engineering Education [32], or Hutton and Gerstl in their report to the Institution of Mechanical Engineers [27c].

Jahoda was interested to establish if the Brunel CAT students wanted to add to their general studies programme [19]. The college scheme focused on the three areas of English, Fundamentals of Science and Social studies. She and her associates found that engineers were more satisfied than scientists in that 88% of them as compared with 57% of the scientists made no suggestions for change. However, 23% of the scientists as compared with 6% of the engineers wanted less general studies. By far the most popular field was Fundamentals of Science – a tool/fringe subject.

About 11% of the diplomates in the Birmingham study thought that the course was overloaded. Peers and Madgwick who first drew attention to this possibility had focused on student interests in two CATs. They found that the pressure of the academic period of study was too much to sustain these interests, which defeats the idea that the pursuit of culture is best undertaken in relaxed conditions. They did not find that the pattern of interests among this group of students differed much from the customary ones for the age group. The wide range of interests revealed by diplomates in interviews in the Birmingham study surprised the interviewer.

Taken together these studies do not suggest that there was any substantial feeling that to quote Davies (8, p 84) "*time for liberal studies is begrudged*". But Peers and Madgwick's study suggests that optimal benefits may not have been achieved in circumstances where they could not be pursued in relatively relaxed conditions. That

said, these studies and especially the extensive written responses in the Birmingham study reveal a great many reasons for satisfaction and dissatisfaction with liberal studies.

Practice and problems in the teaching of liberal studies.

The written responses of the diplomates relate both to the specific experience that they had had of liberal studies as well as to their view of what liberal studies should be or what a liberal education should be [30 a). Thus a demand for greater choice has to be seen within the context of their experience whereas the view that they should be voluntary relates to a more general philosophy. The idea that they should be voluntary was not explored yet a better test of what students really believed about them would have been to have made them voluntary. Experience suggests that in a heavily loaded curriculum many students would have opted out. But making them compulsory does not release an institution or department from marketing them by having a clear purpose on the one hand, and on the other hand by leaving students with an experience that they could value. Re-examining the written comments of diplomats (17e & 30a) after nearly fifty years leaves one with the impression that there was not a clear view among the institutions about the purposes of liberal studies or of liberal education. This meant that their comments were dictated to some extent by their views about what a liberal education was as well as their personal needs and perceptions.

This confusion about liberal studies is also to be found among the technical teaching staff in the Colleges in the Birmingham study. A small sample of teachers across the institutions asked to rank 8 activities that might contribute to liberal education including liberal studies. In order of importance liberal studies achieved fifth place in the list of activities ranked first, and fourth in the list of activities ranked second (17e & 30a). No activity received above 13% of the votes in the first preference. 76% of this sample thought liberal studies were necessary and 47% thought they should have been compulsory. Asked about what these subjects should achieve no preferential treatment was given to any of the areas suggested except what might be regarded as opposition to "*an introduction to the social sciences.*" Assuming this partial analysis is generalizable then no significant majority view about the purposes of liberal education seemed to be held by staff.

What comes over in the diplomates responses is the wide variety of interests among them that suggested that in their personal lives they were in no way narrowly oriented to technology. More focus on this aspect of human behaviour that is, the private nature of culture- the difference between the personal and the professional- by researchers might have been very revealing, as it might be today.

Nevertheless, one way and another, the picture presented by the diplomates was of a new dimension added to the student's knowledge and perception of himself even though for some the most remembered effects were enjoyment and relaxation from the rigours of the major study and for others poor teaching and organization. The benefits were many and various. They ranged from students, particularly those from the working classes, who valued courses in communications and speech training to those who pursued the arts for

the sake of becoming a more balanced human being. That said a curriculum by itself cannot cause a person to become liberally educated. Whether or not they do is a function of many things of which the person is the centre. What can be done, as with any learning, is to provide an environment in which such learning can take place. So how was the environment of the CATs perceived?

The environment

If schools influence the institution of destination of their students the CATs were at a disadvantage. Headmasters, careers masters, and science teachers perceived the CATs to be second class institutions when compared with universities [17. p 819]. This compounded the difficulties that CATs would have in seeking able students from the grammar schools because universities were already experiencing difficulties in obtaining the most able students for science and technology programmes, and science schools were doing much better in this respect than engineering and technology schools [33].

The idea that residence was an important component of liberal education as was "breadth of knowledge" and that these would only be found in universities was deeply ingrained. The stereotype stemmed from the Oxbridge system because of the image that it conveyed of individual tuition exercised through a tutorial system that was based on the colleges and not the university. The idea of liberalisation through mixing with a wide range of students that colleges were thought to cause was evident in several twentieth century writings. For example, several committees had come down on the side of the collegiate conception of residential life [34], and in the sixties there were a number of research studies undertaken of residence [35]. There was also the idea that students should get away from home and that this was helped by the provision of halls of residence. Value was also placed on the provision of personal tutors. As against these views there was a growing body of opinion that thought that halls of residence and colleges were no longer socially desirable or beneficial [36]. Related to this was the view that an institution required a wide range of faculties (schools). Overall the informal attributes of an institution were seen to be as important as the formal.

Given this framework it is easy to see how technological institutions would acquire a non-liberal image because of their concentration on technology. As Davies notes because an institution like a 'red brick' university offers a wide range of studies there is no guarantee that the majority of students mix with a wide range of students from different schools. He argued that headmasters and school teachers did not really know what went on institutions irrespective of whether they were universities or CATs. So what students and diplomates thought about the informal aspects of their education is of some importance since their views contribute to the image that institutions acquire.

In the Birmingham study questions were asked about the extent of difficulty students had in obtaining lodgings every six months, frequency of visits to their homes, and the demand for residence. It is with the latter that these paragraphs are concerned. During the academic period 39% of the students lived at home and 50% of the diplomates had lived at home. 20% of the students and 17% of the students living away from home would have

gone to a local technical college if it had offered an appropriate course. The "pull" of home was very powerful. Jahoda noted the connection with social class –"*a rapid shift from one social class to another presents not only a stimulating change but also a psychological strain*" [19]. But, both Marris [21] and Thody [37] noted that home based students made as many contributions to the life of the university as did those from halls of residence.

In terms of the demand for residence of one kind or another there was a mixed response from students across the five colleges. Overall 26% of the students and 37% of the diplomates would have preferred a hall of residence [17 p 805]. Little was established about the beliefs that students had of the relationship between being in a hall of residence and academic success although Thody reported that at one university 36% put it down as a contributory factor in their success: however, few were prepared to say that choice of companions or discussions with other students were contributory factors to that achievement [37]. It was clear that difficulties in obtaining other types of residence would always create a demand for halls of residence. If mixing with students from a wide range of disciplines is held to be a key factor in liberal education then the problem for the CATs was not so much that they did not have departments in the arts as Davies has pointed out, but the overwhelming number of technological students. No wonder that diplomats when asked to say on the basis of their experience would they be more likely to experience/ acquire the following at a CAT or university the balance of 5 out of 6 items favoured universities. The item that favoured the CATs by an overwhelming majority was "better technological education".

Putting the evidence together it seemed that the problem of the 9 to 5 day and liberal education was not so much the provision of more residence but in the organization of study and non-study periods and buildings to meet the needs of non-residential students.

Today

History does not repeat itself exactly. In this case it could not for from 1966 onwards the CATs became universities and responsible for their own curricular. Liberal studies were not high on the agenda if on the agenda at all. With the decline of much of the industry that had supported these institutions so came the demise of the sandwich course structure and the potential that it had to offer in bridging the liberal-vocational divide. But there are lessons to be learnt.

But what of the history that more or less repeats itself, and were lessons learnt?
The curriculum is subject to change and over the fifty year period since the inception of compulsory liberal studies the engineering curriculum has changed radically. It will be found that similar changes have taken place in all the areas of the higher education curriculum. It will also be observed that generally change comes but slowly, and that different cultures respond to change in different ways.

A sceptic would say of the engineering curriculum that the changes have been driven by changes in technology and that the most prominent changes have been in the subjects that

are offered for study- from computers to bio-engineering. They will note that fashions, as in the real world, come and go. They will also note that some subjects persist notably civil, electrical/electronic, and mechanical engineering, and this persistence suggests that there might be certain fundamentals/principles that are the basis of engineering. They will observe that only occasionally are attempts made to re-think the curriculum on the basis of educational models of the process of curriculum and its design and evaluation. Had the educational thinking that became available in the nineteen-seventies been available to those who developed liberal study programmes in the nineteen-fifties then a different picture might have emerged.

Had different questions been asked about teaching in the surveys the response would have highlighted the need for a student-centred as opposed to teacher centred curriculum. By the nineteen seventies the principles of problem and project based learning were understood and inspection of the written responses suggests that such an approach to liberal education would have been welcomed. It is an approach that if designed carefully could have gone some way to solving the problem of course overload since it demands some form of integrated study. It also demands different approaches to the provision of information (knowledge). In Britain some of the tool/fringe subjects came to be incorporated in the engineering curriculum. The students and diplomats envisaged that they could be related to their work especially if use were made of the industrial periods to this end. Problem/project based learning could have provided a solution to the integration required and it is significant that a key player in English higher education, and an engineer, Sir Willis Jackson suggested that there could be day-release during the industrial period [30a]. Gone is that possibility.

In the United States Williams proposals see the social sciences as necessary to the practice of engineering, and therefore, necessary in the curriculum [38]. But it is difficult to believe that such integration could possibly be achieved without a different approach to learning because if they are taught separately, and teacher centred, the curriculum will remain overloaded. While problem/project based learning may provide a partial solution it will surely be necessary for students to engage in some form of independent study.

Such changes do not guarantee a liberal education but Newman's thesis that it can be found within the framework of the subject, an issue that has been explored elsewhere gives grounds for optimism [39].

There is another ground for optimism in the British Isles. Government policies have been focused on the perceived relationship between a subject and its contribution to the economy. One consequence has been to try and relate the curriculum to manpower requirements. This has ignored the need for a much more flexible workforce that is able to cope with the continuing change brought about by technology. It is contended that such flexibility demands a broad education in the first instance, and that given appropriate circumstances for learning, is a component of liberal education.

Beyond that the ability to converse, develop opinions and engage with society depends in no small way on extra-curricular activities in the everyday discourse on campus. An

indicator of subsequent findings in the US was found in these studies, namely that residence is not a pre-requisite of such discourse. Its effects, report Pascarella and Terenzini are primarily indirect [40]. Where students live is, however, important. If students come from home, attend lectures and return home each day as some did, they cannot gain from campus life. "*But if, as it appears, individual effort or engagement is the critical determinant of the impact of college, then it is important to focus on the ways in which an institution can shape its academic, interpersonal, interpersonal, and extra-curricular offerings to encourage student engagement*."[40, p 602]

These studies found a variety of views among teaching staff, students and diplomats. This is not at all surprising since in any group there will be a wide range of personal philosophies and it is the interplay of these that should cause the reflective behaviour that is at the heart of the liberal endeavour. But they also illustrate how complex the behaviour of groups, let alone individuals is. It is consoling, therefore, to find that many years after these relatively simple pieces of qualitative and quantitative (survey) research, (with the odd bit of psychometrics thrown in), and all its limitations, the research published since 1990 particularly in the US persuaded Pascarella and Terenzini "*more than ever that students' in- and out-of-class lives are interconnected in complex ways we are only beginning to understan.*"[40, p 603].

Notes and references

[1] The description given here is simplified. For a detailed account see Payne, G. L (1960) *Britain's Scientific and Technological Manpower*. Stanford University Press.

[2] In 1964 an Engineering Institution's Joint Council (EIJC) was to establish common standards for professional engineers. In 1965 it became the Council of Engineering Institutions (CEI and the first common examination was set under that aegis. This metamorphosed into the Engineering Council UK.

[3] Announced in Parliament by the Minister for Education when accepting a recommendation in a report of the National Advisory Council for Industry and Commerce.

[4] White Paper. *Technical Education*. Cmnd 9703. HMSO, London. Applied in Scotland,

[6(a)] Circular 320 (March 1957). *Hostels at Technical Colleges*. Ministry of Education, London.
(b) Circular 322 (April 1957). *Libraries in Technical Colleges*. Ministry of Education, London.
(c) Circular 323 (May 1957). *Liberal Education in Technical Colleges*. Ministry of Education, London.

[7] White Paper (1961). *Better Opportunities in Technical Education*. HMSO. Cmnd 1254. London.

[8] Davies, L (1965) *Liberal Studies and Higher Technology*. University of Wales Press, Cardiff. Davies produced the most comprehensive study of liberal education in the Colleges of Advanced Technology. Apart from his own study of Staff and Student attitudes to liberal studies at the Welsh College of Advanced Technology, he includes a detailed account of the origins of liberal education in the UK- some may differ with his interpretation at points, considerable information on the curricular being offered the colleges, and a summary of the principle researches that were completed in the period [18], [17], [18], [19], [20], [21] and [22]. Davies also reports on two unpublished reports given at the 1963 British Association Meeting. One reported on the attitudes of head teachers to the inclusion of liberal studies in the CAT curriculum was

subsequently published [22], and the other related to the views of diplomates which were only available in a private report [23] some of the data from which is given in this study.

[9] Bridger, P (1962) Liberal education and the teenage world. *Journal of the Association for Liberal Education* , 1 (2), 4 -6 . Davies also describes unpublished work by Bridger.

[10] Brubacher, J. S. (1941*). A History of the Problems of Education*. New York.

[11] Arendt, H (1961). *Between Past and Future*. London.

[12] McGrath, F (1962). *The Consecration of Learning. Lectures on Newman's Idea of a University*. Gill, Dublin.

[13] Sparrow, J (1967) *Mark Pattison and the Idea of a University*. Cambridge University Press. Although the CAT's had become universities by the time this was written Sparrow still refers to the CAT controversy in the last chapter of his book.

[14] Newman, J. H (1852, 1873), (1947 Edited with Preface by C. F. Harrold) - *The Idea of a University*. Longmans, Green, London.

[15] Heywood, J and R. Ann Abel (1965) *Technical Education and Training in the United Kingdom. Research in Progress 1962 – 1964.* Occasional publication No 8. National Foundation for Educational Research, Slough.

[16] (a) Heywood, J., Pollit, J and V. Mash (1966). The Schools and Technology. *Lancaster Studies in Higher Education* No 1, 154 – 305. This obtained opinions and attitudes toward science and technology education of pupils in sixth and fifth forms, science teachers, careers masters, and head teachers. 200 of 590 head teachers replied to the postal survey (34%). (b) A short version was given at the British association meeting in 1963 and the paper circulated at the meeting was used by Davies (8) in his commentary.

[17] The overall aim of the investigation was "To assemble facts and opinions on which decisions may be made on the following questions : Whether any changes need to be made in present sandwich schemes/of training, to:
(a) improve the quality of both industrial and college training.
(b)generally to increase numbers attending sandwich courses.
(c) to widen the catchment area of students to include smaller firms.
(d) to mobilise more effectively the teaching and research resources of colleges- having regard to the role of the colleges as corporate academic communities.
A number of papers and reports were published on the findings.
(e)The complete project is reported in Heywood, J (1969) *An Evaluation of Certain Post-War Developments in Higher Technological Education.* Thesis. Two Volumes. University of Lancaster. The project remit is given on p 44 ff. Vol. 1.

[18] (a) *ibid* Vol. 1 p209: Vol. 2 p 763. Total number of student respondents 1063. These were spread across Battersea, Birmingham, Bradford, Bristol, and Welsh CATs. (b) Total number of diplomates at Apri1st 1962 = 1014. No responding to written questionnaire 363 from 8 CATs and 5 regional colleges. Number interviewed 72. % of all diplomates giving information 43%. (vol. 1 p 69)- see also (d).. (c) The Robbins Committee (see note 22) reported that 2.5% of the total population of students on sandwich courses were women.

(d) The diplomates were asked to respond to two questions. The first was a matrix that attempted to obtain views about teaching methods. The second was a statement "This space is for any comments you would like to make on liberal/general studies. %9% of the respondents answered this item, many giving relatively long responses.

[19] Jahoda, M (1963). *The Education of Technologists*. Tavistock, London. A study of the experience of students of dip.tech courses at Brunel College of Advanced Technology.

[20] Ref 18. -% of fathers in manual occupations of male applicants to faculty of technology = 38. Ref 21. % of students at Northampton CAT with fathers who were Foremen or manual workers = 27. Hordley summarised in [15] for Salford CAT – Figures for skilled and semi skilled workers show that the dip.tech courses contains a lower percentage for these two groups when compared with those on HNC Courses: 14.3 and 15. 8%, and 20.1 and 25.4% respectively.

[21] Marris, P. (1964). *The Experience of Higher Education*. Routledge, London. A comparative study of the experience of students in three universities and Northampton CAT in London.

[22] *Higher Education*. (The Robbins Committee Report) Cmnd 2154, HMSO, London – II, p 112.

[23] See also (a) Heywood, J and V. Mash (1968) Secondary education and occupational choice of students and graduates on sandwich courses (dip.tech). Pre-entry factors. *International Journal of Electrical Engineering Education*, 6, 109 – 134. (b) See also note 17 Vol. 2 pp 768 ff and (c) Heward, C, Mash, V and J. Heywood (1968) Student reaction to sandwich courses for the Diploma in Technology (dip.tech). *Bulletin of Mechanical Engineering Education*, 7, 283.

[24] Every other 4th year student was interviewed N = 129. At Brunel 23% of the students, and at Northampton 33% of the students had National Certificate qualifications. See ref 17 Vol. 1 p 215 and Vol. 2 pp 767 & 768.

[25] Richmond, K (1963). *Culture and General Education*. Methuen, London. Discussed by Davies [8] pp 98-102.

[26] Hirsch, B (1987). *Cultural Literacy*. Macmillan, New York.

[27] (a) For example see note 19 p 91. (b) Note 21 pp 66 – 67. (c) Hutton, S. P. and J. E. Gerstl (1964). Engineering Education and Careers. *Proc. I. Mech. E.* 173, Part 3F. (published in a special edition) thought that the ideal course for mechanical engineers should be increased by a year. University courses in engineering were then of three years duration.

[28] Peers, R and P. J. Madgwick (1963) Problems and attitudes in higher technological education. *The Vocational Aspect of Secondary and Further Education*, 15, 69 – 91. Study of the problems and attitudes of students in two CATs

[29] Andrews, H and C. Mares (1963).Liberal Studies in Advanced Scientific and Technological Courses. National Foundation for Educational Research, Occasional Publication No 8, Slough. (See reference 7 pp 79 – 83). A study of the interests and attitudes of students in CATs, Regional and other colleges. 250 students and 80 firms participated. Opinions were also obtained from heads of technological and liberal studies departments.

[30] (a)Heywood, J (1966) The attitudes of sandwich courses students to Liberal studies in the authors first report to the Leverhulme Foundation on his activities 1964- 66. University of Lancaster library. (b) See also note 23c.

[31] Heywood, J (1963) The Future of Higher Technological Education. BACIE Conference. Cyclostyled. Reviewed in *Engineering*, Oct. 1963 (B).

[32] Grinter, L (1955) Final report on the evaluation of engineering education. *Journal of Engineering Education* , 46, (1), 25.

[33] Hutchings, D. G (1963). *The Sixth Former and Technology*. Oxford University, Institute of Education.

[34] Taylor, W (1965) Student culture and residence. *Universities Quarterly*, 19, 325.

[35] Full summary and associated papers is to be found in *Student Residence*. Monograph. Society for Research into Higher Education (1967), London.

[36] (a) Giddens (1962) A Some aspects of the social structure of a men's hall of residence, *Sociological Review*, 9. (b) Warr, P. B (1964) Attitudes and behaviour in a hall of residence. *Universities Quarterly*, 19, 1.

[37] Thody, D (1957) Halls of residence *Universities Quarterly*, 12, 1.

[38] Williams, R (2003). Education for the profession formerly known as engineering. *The Chronicle of Higher Education* 49, (20) p B12. (quotation is from the last paragraph).

[39] Heywood, J (2010) Engineering Literacy: A component of liberal education. Paper 1505. *Proceedings Annual Conference, American Society of Engineering Education*

[40] Pascarella, E. T and P. T. Terenzini (2005) *How College Affects Students*. Vol. 2. *A Third Decade of Research*. Jossey Bass, San Fransisco.