Sandwich courses
An integrated education?
Alan G. Smithers
Dedicated to Frank Musgrove
for Inspiration and Guidance
and Continuing Friendship
Sandwich courses: an integrated education?

Alan G Smithers

NFER Publishing Company
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ACKNOWLEDGEMENTS

I am very grateful to Dr David Hambler for help in collecting the data of Chapter 3.

To Miss Monica Taylor, Brian Moore and Dr Bruce Choppin of the NFER for comments on early drafts.

To Mrs Sheila Dann for research assistance 1969-72.

And, not least, to my cousin, Miss Edna Meyers for her excellent typing.
PREFACE

The then Government’s acceptance, in 1963, of the Robbins Report led to the setting up of seven completely new universities and the transformation of ten colleges of advanced technology into technological universities or university colleges. The universities created de novo were an extension of the established university tradition, but the colleges of advanced technology had grown up in the public sector of post-school education which has been characterized by Burgess and Pratt (1970) as ‘responsive, vocational and comprehensive’. When the CATs became universities they brought with them some of the accretions of their history: a vocational ethos, a heavily technical curriculum alleviated to some extent by general studies classes, and courses organized on the sandwich principle. As we shall see, this latter arrangement, whereby periods in college are alternated with periods of work, is claimed to have a number of advantages over conventional three-year full-time courses.

One of the technical institutions to achieve university status following the Robbins Report was the Bradford Institute of Technology. This had its origins in the Bradford Technical College formed in 1882 from a School of Weaving and two other small schools organized in the local Mechanics’ Institute. At first, the College managed on private subscriptions and students’ fees, but it later turned to the City Council for support, and from 1892 to 1899 the local authority made a grant of £3,000 per annum. The City Council was authorized to do this by the Technical Instruction Act of 1889 which permitted local rates to be used to supply or aid the supply of technical or manual instruction’. But the amount that could be used in this way was limited to one old penny in the pound, and it was really the Local Taxation (Customs and Excise) Act, 1890, that yielded the money - ‘whisky money’ - which was to give an immense boost to technical education. Between 1890 and 1902 revenue from this source paid for some 25 new technical schools and colleges, and it enabled the Bradford City Council, in 1899, to assume full responsibility for its technical college.

Almost from the start the new institution began to press for university status, these early efforts reaching their climax in the 1920s in an energetic campaign led by Alderman Michael Conway who was to become Lord Mayor of Bradford in 1927. In a series of articles in the Yorkshire Observer, later brought together as a privately published pamphlet, University Status for Bradford Technical College, Alderman Conway argued that ‘Bradford has a college which can claim to be a university in everything but name and status’. The City Council approached the University of Leeds, in 1923, with a proposal that the technical college should be accepted as a constituent college, but the University was unwilling even to enter into discussions. Seeing that ‘status’ was likely to elude him Alderman Conway turned somewhat desperately to ‘name’ and suggested that proper recognition demanded that the institution be re-titled forthwith ‘University College, Bradford’. But this proposal for unilateral action did not find favour and, in the increasingly severe economic constraints of the time, the drive towards university status gradually died away.
It was not for another 40 years that Bradford was to have its university. In the meantime, the energies that might have gone into ‘University College, Bradford’ found some outlet in preparing a small number of students for external degrees of the University of London. The post-war Further Education and Training Scheme for ex-servicemen, especially, gave the college a taste for higher level work.

The Second World War, during which technological expertise literally became a matter of life and death, also set in train a number of policy arguments about higher technological education culminating, in 1956, in the Ministry of Education’s Circular 305. This re-organized the technical colleges into a hierarchy, at the apex of which were eight (later increased to ten) colleges of advanced technology. One of these was the college in Bradford. In 1957, the Bradford Institute of Technology was inaugurated to take over the advanced work of the Bradford Technical College. (A new Bradford Technical College was budded-off on the same site to continue with the lower-level work, and, following the process of academic advancement, which Pratt and Burgess (1974) have dubbed ‘academic drift’, seems destined itself, after amalgamation with various other local colleges, to become some kind of institute of higher education.) In 1963, came the Robbins Report and, in October 1966, after serious and somewhat acrimonious deliberation within the institution, the new University of Bradford received its charter of incorporation. This proclaims its purpose as ‘the advancement of learning and knowledge and the application of knowledge to human welfare, and in particular (although without prejudice to the foregoing) study and research in science and technology and collaboration for the furtherance of these objects with industry, commerce, the professions and other institutions’ (author's italics). One of the ways of maintaining close links with industry to which the newly established university was to attach great importance was the sandwich principle.

Thus, although university status had long been hoped for, when it came, it came with something of a rush, bringing with it a number of major administrative, structural and curricular changes. As a technical college the institution had been directly responsible to the local authority; as a college of advanced technology it had passed to the Ministry of Education; as a university it was granted autonomy and funded through the University Grants Committee. The institution suddenly had to cope with the opportunities and responsibilities of self-government; the principal of a technical college, a servant of the local authority, suddenly found himself elevated to be the Vice-Chancellor of a university.

The institution gradually expanded into new buildings. A high-rise college of advanced technology was opened by Mr. Harold Wilson, in 1965, and since then a university campus has been sporadically developed. In 1957, there were only 124 students enrolled on degree-level courses and 56 academic staff, but, by the time the Charter was granted, there were some 2,000 students and over 350 academic staff.
Now, in 1974/5, there are over 500 academic staff, 3,168 undergraduate and 658 postgraduate students. The range of subjects has progressively increased. The erstwhile general studies department flowered as the new Board of Social Sciences, one of the four Boards of the new university (in the process embracing some unlikely subjects, English among them, as social sciences). New schools -- not departments, which were thought to be too restrictive - were added: Applied Social Studies and Education, and more recently, Industrial Technology, Human Purposes and Communication, Environmental Studies, Peace Studies, Archaeology, and Science and Society. John Vaizey (1973) writing about the expansion and development of the polytechnics which have similarly expanded mainly in fields other than science and technology commented that they really ought to have been called the ‘polyartnics’!

Not only were there many more students, but they were also more intellectually demanding. Staff who remained from the old technical college found that, as university lecturers, their timetables were slashed and they were under obligation to do research; new staff had to adjust to the ways of the emerging institution.

All these changes contributed to a mood of uncertainty and concern with behaviour appropriate to a university. This was also the time of the post-Robbins enthusiasm for research into higher education which led to several higher education research units being set up, those at Essex, Lancaster, and the London School of Economics prominent among them. Thus when the idea of a School of Education at Bradford was mooted, it is perhaps not surprising that it should have been seen as an opportunity for getting some research going to monitor the progress of the institution. (The fact that the Department of Education and Science held out no hope of establishing a conventional university education department with responsibility for the training of teachers also had to be reckoned with.)

Dr Frank Musgrove from the University of Leeds was appointed as the new Professor, significantly Professor of Research in Education, and, in October 1965, he submitted to the Senate of the University a memorandum, Learning to be a Graduate of Bradford University, setting out a basic research plan for the study of the university. This would be a longitudinal study attempting to chart the progress and development of students. They would be contacted on entry to the University to establish a baseline from which to measure change and they would be followed up at various stages during their courses. Attempts would be made to relate any changes to the various experiences which the students underwent, ‘to different aspects of formal course provision and informal relationships’. The special importance of the sandwich course system to the University was recognized by singling it out for detailed study. Such was the enthusiasm of the University for educational research at this time, that in October 1967, the Senate passed a motion requesting Chairmen of Schools of Studies to provide time (up to four hours per student per year) for the School of Research in Education to carry out its research projects.
After one or two false starts, Professor Musgrove, in 1967-68, recruited the staff - Dennis Child, Lou Cohen, Tom Derrick, Derek Toomey and myself - who were to help him carry through the longitudinal study of the 1966 intake for which the Bradford School of Research in Education has become noted (although, it is fair to say, not always with enthusiasm). When I came to Bradford I was without experience in educational research. My ‘apprenticeship’ was to be served studying sandwich courses, and a dissertation on Students’ Reactions to Sandwich Courses was eventually submitted. This book has grown, in part, out of that dissertation and some of the material in it has already been published in research papers (Musgrove and Smithers, 1969; Smithers, 1969, 1971, 1973a; Smithers and Hambler, 1969). However, this is the first time that the various Bradford studies of the sandwich course have been treated as a whole and in bringing them together the data have been analysed anew.

The Bradford longitudinal study was begun at a time of great optimism for educational research. The systematic study of higher education was fairly new to this country, and American experience, particularly The American College, Sanford, 1962), seemed to set an example which might be followed. The limitations of scientific approaches to the study of education were not yet apparent, and such alternative approaches as there were did not seem compelling enough to challenge the basic research perspective. Nor were various other problems in educational research fully comprehended. In the circumstances, the Bradford study could have been remote and merely numerical, and have missed the vitality and complexity of the sandwich experience. But looking back, admittedly with not an entirely unbiased eye, it seems to stand up rather well. Although firmly in the scientific mode, the early phase of the work was what would now be called ‘illuminative’ (Parlett and Hamilton, 1972): ‘The first job of members of the unit will be to get themselves inside the situation. This will be done by simply talking to people, more systematic participant observation and a programme of intensive interviewing. These experiences should generate precise hypotheses which we shall be concerned to test’ (Musgrove, 1965).

These early observations, interviews and discussions led the research team to suppose that, although the students’ experiences were very varied and diverse, there were some identifiable common features which were capable of measurement. As some kind of gauge of the students’ overall and particular reactions a Likert-type scale of attitude to industrial training was constructed out of the interview material, and used as the main instrument of exploration. Attempts were made to classify the experience in various ways and scales were found, or developed, to measure such things as the students’ experience of bureaucracy and time-span of discretion. The attitude-to-industrial training scale was given to students on entry to the University, and before, and after, periods of industrial training along with other measures as appropriate.
This part of the work is reported in Chapter 2 where an attempt is made to describe and illuminate students’ reactions to sandwich courses and to relate these to various features of their experiences. One of the findings was that the School of Applied Biology emerged as something of a special case, and in Chapter 3, industrial training as part of university biology courses is looked at in more detail.

Two of the things often claimed for sandwich courses are that they help students to prepare for, and make up their minds about, possible future careers, and that they contribute to the student’s personal development, for example, they help him become more ‘mature’. In Chapter 4, we look at some aspects of the students’ career plans and try to decide whether, in fact, the students do become clearer about what they want to do, and whether they do become more inclined to work in industry. In Chapter 5, we turn to the difficult topic of personal development and examine both how different personalities react to industrial training and how far industrial training appears to affect personal characteristics.

Then, in a final chapter, we attempt to draw these various threads together and weigh up the educational contribution of sandwich courses and try to set them in context. But first it is necessary to see how it was that the sandwich course came to be so firmly established in the colleges of advanced technology and how it came to occupy a special place in the affections of those staff who were with those colleges in their rapid transition from ‘techs’ to universities. We begin with the history and development of sandwich courses.
I. THE SANDWICH PRINCIPLE

Courses organized on the sandwich principle of alternate periods of academic study and industrial training have a long history, but it was only with their adoption by the National Council for Technological Awards, in 1955, that they became introduced in Britain on a wide scale. Through its award, the Diploma in Technology, the NCTA exerted considerable influence on the development of the Colleges of Advanced Technology, and its successor, the Council for National Academic Awards has carried over this influence to the Polytechnics. With the ex-CATs and Polytechnics comprising about half the major institutions of higher education in this country, a substantial proportion of our science, engineering and technology undergraduates are now being educated on sandwich courses.

In 1971, the latest year for which statistics are currently available, there were 7,998 students on undergraduate engineering and technology courses at British universities and a further 7,572 reading for engineering and technology degrees validated by the CNAA. Together they comprised about 40 per cent of the total. For science, the respective figures were 2,636 and 3,816, about 12 per cent of the total. In all, in 1971, there were 28,805 undergraduate sandwich course students at university or on CNAA courses (Statistics of Education, 1971, vol. 3, Further Education, and vol. 6, Universities, published in 1974).

The early development of sandwich courses was slow and fragmentary. There have been a variety of claims for the first sandwich course, but it seems generally agreed that it was probably put on in either Bristol or Glasgow (Venables, 1959; Liepmann, 1960). The Calendar of University College, Bristol shows that the Department of Civil and Mechanical Engineering and Surveying offered what was, in effect, a sandwich course in 1878:

The course for Engineering is such that students can pursue it during the six winter months of each year, and the Council of the College have arranged with the following Civil and Manufacturing Engineers to receive in their offices and workshops, during the summer months, students whose position relative to the firms would be that of articled pupils. Engineering students can obtain a statement of the premium required, and any further information on application to the following firms.

The course was popular with students and, by 1891, when the number of places had to be limited to 40, oversubscribed.

It has also been suggested that ‘the sandwich course was started in Glasgow Royal Technical College in 1880’ (J.G. George in the House of Commons, 1956), but an article in Technology, in 1958, which repeated this claim drew a caustic response from James Small, James Watt Professor of Mechanical Engineering in the University of Glasgow:
The sandwich method of training has characterized the engineering school of the University of Glasgow since it was set up in 1840 and it was there that the term ‘sandwich system’ was first used. Only since 1913 when, by the ordinance of affiliation, classes at the Royal College were recognized by the University of Glasgow for the purpose of its degree has the interest of the College in the sandwich system for graduating courses had any relevance.

But the truth of this assertion is somewhat obscured by the fact that Scottish universities until the early part of this century operated a one-term session lasting a full 26 weeks from early November to early May with only a short break at Christmas. Staff and students were thus freed for the rest of the year to earn their livings. The *Cornhill Magazine*, in 1903, commended this arrangement:

> At the Scottish universities an engineering student may alternate the six months’ “winter session” in each year with six months’ practical training in the office, the field, or the workshop. No inconsiderable number of young men are attracted to those universities by the facilities thus afforded them of acquiring a fair degree of practical training, as well as of qualifying for a degree in science, within a period of, say, five years.

But this practical experience was not an integral part of the university courses; for most students it was a pecuniary necessity.

Nevertheless, it does seem (somewhat surprisingly in view of subsequent developments) as if it was the universities rather than the technical colleges which pioneered the sandwich system. Technical colleges grew up around the demand for industrially useful knowledge and have always catered mainly for the part-time student. Various ways of organizing study time have evolved in order to accommodate the students’ employment - evening only, day release, block release, and, since 1903, sandwich courses. In 1903, heavy engineering and shipbuilding industries in Sunderland tried an arrangement whereby apprentices were released to the local technical college for six months each year over a period of several years. A few other technical colleges took up the idea and, by 1926, the Government’s *Survey of Technical and Further Education in England and Wales* showed ‘that 57 firms (including 37 engineering, six shipbuilding and four vehicle and rail carriage building) take part in ‘sandwich schemes’.’ This seemed to involve just four technical colleges in England and Wales (i.e. not including the Glasgow Royal Technical College), those at Sunderland, Cardiff and Wolverhampton, and the Northampton Polytechnic in London. When the National Certificate and Diploma Schemes were introduced during the 1920s as national examinations in technical subjects, it was possible to study for the full-time award, the Diploma, by sandwich course, and for the next three decades the main advance in sandwich courses was in connection with this scheme.
However, as Hordley (1964) and Burgess and Pratt (1970) have shown, the modern growth of sandwich courses really dates back to the recommendations of the Percy Committee which was set up during the Second World War and reported in 1945. The Committee argued that the education of advanced technologists required more sustained study than day-release allowed, and recommended the adoption of the sandwich course principle. It also suggested that a number of technical colleges be selected for special development, that an award of degree standard be instituted, and that a National Council of Technology be established to administer the new award.

In fact, none of these recommendations was taken up at the time, but after wavering for a while between the contradictory advice of the National Advisory Council on Education for Industry and Commerce (1950), which pressed for advanced technical education to be located in the technical colleges, and the Advisory Council on Scientific Policy (1949), which argued that its development should be entrusted to the University Grants Committee, the Government decided to implement, in 1955, what were, in effect, the proposals of the Percy Committee. Cotgrove (1958) has suggested that the eventual decision was sparked off by ‘the publication of a study of the Soviet system of scientific and technical training’ and the great significance attached (by Sir Winston Churchill among others) ‘to the political implications of the fact that Britain was being threatened in the scientific and technical field’. Sir David Eccles, then Minister of Education, said in a speech at the time that Russia as producing 320,000 technologists a year compared with only 17,000 in this country. The universities could not suddenly be increased to significantly narrow this gap and therefore ‘it was better to expand the technical colleges and to perfect the successful principles of earning and learning’ (MacLennan, 1961). The importance of the Soviet comparison was subsequently played down (see, for example, Bray, 1956), but, for whatever reason, the impasse had been resolved and in a White Paper in February, 1956 the Government was to come out boldly for a major expansion of the technical colleges and sandwich courses: ‘The Government believe that for the highest technological qualifications sandwich courses will become more and more appropriate.’

In the meantime, the National Council for Technological Awards had been set up in 1955 to ‘create and administer technological awards of high standing having a national currency and available to students in technical colleges who successfully complete courses approved by the Council’ (NCTA, 1956). The award which the NCTA instituted was the Diploma in Technology, and, while much was left to the discretion of individual colleges, there were certain requirements one of which was that the courses should contain at least one year’s integrated industrial training. The leading technical colleges were ready for this development. The supply of ex-servicemen which had given them increased opportunities of degree-level work was beginning to dry up and the colleges faced uncertain futures (Robinson, 1968). A large number of courses were submitted to the NCTA for approval. Most, but by no
means all, of these came from the colleges which were to become colleges of advanced technology, and most were in the fields of engineering and related technologies. But the pure sciences and mathematics were also being reorganised on the sandwich pattern, and renamed as, among others, applied biology, industrial chemistry, and applicable mathematics (there was, of course, a prior claim on applied).

The ten colleges which finally emerged as colleges of advanced technology developed rapidly within the framework of the NCTA and greatly reduced their low-level and part-time work, raised their entry standards and chafed at being under the control of the local authority. When the CATs were designated it was not intended that they should eventually become universities, but, by the time the Robbins Committee reported in 1963, it seemed natural that they should. The sandwich system had been carried firmly into the university sector of higher education, and the DipTech had become a degree. But the new technological universities could not collectively decide what kind of degree. Some like Bradford and Brunel made the direct transition to BTech while others opted for the established prestige of the BSc perhaps with some additional award, like Loughborough’s Diploma in Industrial Studies, to certify the successful completion of industrial training. Within those universities offering the BTech the degree enjoys high official status (so much so that students who fail certain examinations are ‘punished’ by being transferred to BSc courses), but elsewhere its standing is less sure, and there has been intermittent pressure from students to have it re-styled.

Burgess and Pratt in their studies of technical education (Burgess and Pratt, 1970; Pratt and Burgess, 1974) have shown that it is possible to make out a process of striving for academic advancement or more accurately, from their point of view, a process of ‘academic drift’. The colleges, they say, ‘have aspired to an increasing level of work, to a narrowing of student intake, to a rationalization of course structure, and to a more academic course content’. The colleges’ ultimate aim (no matter how hidden this may be - from themselves even), is to achieve the status and conditions of universities. Perhaps this can be seen most clearly in Manchester where first Owens College, then the College of Science and Technology, then the Royal College of Advanced Technology in nearby Salford, all became universities, and most recently, the John Dalton College has become a polytechnic.

The former colleges of advanced technology (except perhaps Chelsea where the events of the 1950s enabled it to take its place as a college of the University of London) feel, not without some justification, that sandwich courses were the key to their elevation to university status. Because of this, industrial training in the university curriculum has acquired for them a significance beyond its assumed educational and other advantages. It has acquired an almost talismanic quality.
Co-operative Education

Arrangements similar to sandwich courses are also a feature of higher education in a number of other countries. In the Soviet Union, for example, ‘several continuous periods of work in factories and workshops’ form an essential part of the courses at the technical institutes (Grant, 1964). In a five-year engineering curriculum industrial practice is divided into three sessions of four to eight weeks each, beginning in the third year with the longest session on ‘diploma practice’ immediately preceding the final part of the course (Korol, 1957).

However, although comparison with Russia may have jolted the Government into taking a decision about the future of technological education in this country, the actual form of that education has probably owed more to America. In the United States there is an arrangement which, because it depends on the co-operation of colleges and industry, is called co-operative education. This appears to have started with Herman Schneider, an assistant professor of civil engineering at the University of Cincinnati in 1906 (Tyler and Mills, 1961; Co-operative Education Handbook, Northeastern University, 1966/67). Schneider thought that the need of most Americans to work their way through college could be turned to positive advantage, in vocational studies at least, by assimilating work periods into courses and using them to provide relevant and professional experience. He put his idea into practice with a small group of engineering students who, alternately, studied for two weeks and worked for two weeks. Co-operative education (but not the bi-weekly rotation) caught on. Northeastern University (then the Boston YMCA) introduced a co-operative programme in 1909, the University of Detroit in 1911, and the Drexel Institute of Technology in 1920. In 1921, Antioch, a liberal arts college, took up-the idea. A National Commission for Co-operative Education was formed in October, 1962 to promote the growth of co-operative education. At that time ‘some or all students in 63 colleges and universities were on the co-operative plan, majoring in engineering, business administration, the liberal arts and other fields’ (Tyler and Mills, 1961).

Co-operative education has spread beyond the United States. In 1957, the Faculty of Engineering at the University of Waterloo in Canada was formed with courses organized in a co-operative basis and by 1967, with an engineering enrolment of 2,076, it claimed to be the largest undergraduate engineering school in the country (Holmes, 1970). According to the Co-operative Education Handbook (1966/67) of Northeastern University, the major co-operative institution in the United States:

There has been a continuous stream of foreign educators from many nations in Europe, Asia, Africa, and South America, visiting Northeastern for the purpose of examining the Co-operative Program. At present, programs are known to exist in Colombia, South America, for students in business administration, and in England.
Objectives
The introduction of industrial training into degree-level courses was thus a pragmatic
decision. In the United States, it was partly a rationalization of the fact that most
students have to work in order to pay their way through college, and it was given
impetus by the economies apparent in the dual use of plant; in this country, it was
partly a way of organizing periods of continuous study for trainee technologists in
full-time employment who would otherwise have had to study in the evening. But the
arrangement is also claimed to have educational advantages. These were set out
formally and explicitly in the United States long before the matter was given much
thought in this country (cf. Venables, 1956), early efforts culminating in this list1
from the two-year national Study of Co-operative Education (Tyler and Mills, 1961):

1. By coordinating work experience with the campus education program, theory and practice are more closely integrated and students find greater meaning in their studies.

2. This coordinating of work and study increases student motivation. As students see connections between the jobs they hold and the things they are learning on the campus, greater interest in academic work develops.

3. For many students, work experience contributes to a greater sense of responsibility for their own efforts, greater dependence on their own judgments and a corresponding development of maturity.

4. Because the work experiences involve the students in relations with co-workers who come from a variety of backgrounds, and because success in these jobs requires constructive relationships with colleagues, most students in cooperative education develop greater understanding of other people and greater skills in human relations.

5. Cooperative education helps markedly to orient college students to the world of work.

In Britain, the value of industrial training in the education of advanced technologists
was taken as self-evident. Its main movers, the NCTA, simply took it for granted ‘that
exposure of the student to industrial conditions will inevitably result in the acquisition
of some knowledge, wisdom, and “experience” ’ (NCTA, 1964). But, although there
was general agreement that student engineers should have practical experience in
industry, there was considerable confusion over its precise role. Heywood (1967) in
an inquiry among the first diplomates, and staff, at five CATs found that the
diplomates thought that industrial training was intended to give them some idea of
what jobs were available; staff saw it mainly as the application of theory to practice,
and as a general introduction to industry. Jahoda’s (1963) exploratory case study of
industrial training at Brunel College of Advanced Technology revealed that the

1 Italics original, 4 and 5 abbreviated.
teaching staff and industrialists tended to view the experience somewhat differently: the former as education, the latter as an induction into industry.

Rather belatedly (in fact, just before it gave way to the CNAA), the NCTA undertook an investigation of its own. Members of the Industrial Training Panel visited a number of firms along with college staff and submitted a report (NCTA, 1964), which was later widely circulated for comment. They found that ‘the purpose of industrial training as an integral part of courses leading to the Diploma in Technology is far from clear in the minds of either college or industrial staff’. This they conceded was not altogether surprising ‘in view of the uncertainty which has existed within the Council’ (author’s italics). In attempting to put this right, the Panel declared the following objectives:

1. The training should illustrate the application in practice of the scientific principles which the student has been taught in college, should give the student experience in handling engineering materials, and should provide him with experience and knowledge of modern plants and processes.

2. Practice should be given in the solution of some problems in the form they are met in industry. Such problems will invariably go beyond the field of the problems which the student solves in his academic examinations in that they are often indeterminate and their solution a compromise frequently involving a judgment/opinion factor and sometimes arising from considerations other than technological.

3. The training should make the student aware of the social, economic, and administrative considerations which influence the working of an industrial organization.

In other words industrial training was to be that part of the student’s education concerned with ‘the application of science and scientific method to the solution of the complex problems of industry’. The Panel’s view was that current practice fell far short of this: ‘in many cases the main part of the training is something of a ritual based on modified craft training concepts.’ But the Panel thought it could see the way forward. As regards the first objective it recommended that a determined attempt be made to replace the craft training by a manufacturing technology based on ‘fundamentals’ and it devised a syllabus. It did not specify who should do the teaching, but it stressed that it should be done by someone - too often, in the Panel’s view, the student was expected to learn from industry by simply being there. Towards the second objective the Panel suggested that students should be given more practice in problem solving, and it would be particularly appropriate if the student’s project work could be made to span the academic and industrial parts of the course. As for the third objective the Panel could offer little more than that the students should be encouraged to ask lots of questions about the functioning of the particular firm in which they found themselves. The Panel thought that 64 weeks in industry would be the optimum time to accomplish what it had in mind compared with the 48 to 95
weeks of the then existing courses. But present day sandwich courses still vary within this range.

More recently, the study of the objectives of curricula, courses, and teaching and learning experiences of all kinds has become a favourite field of inquiry. At the Institute of Industrial Training, Brunel University a major study of the objectives of industrial training is in progress, and the results of a preliminary survey have already been published (Glassborow, 1973). Students, university staff, the Training Boards, the Professional Institutions and industry have all been approached and their views, collected through semi-structured interviews and questionnaires, used to produce a list of 17 objectives of ‘varying levels of specificity and mutual exclusiveness’. These emphasize the integration of the two parts of the course (‘to reinforce learning acquired at university by practical application in the work situation’), learning about engineering (‘to prepare the student for the status and responsibility of a practising Professional Engineer - by providing sound practical training’), learning about organizations (‘to provide a basic knowledge of the functions within an engineering organization...’), learning about people (‘to promote an awareness of the importance of teamwork and good human relations by working with a team, motivating and managing a team’), career choice (‘to allow the student to find where his particular “niche” lies in Engineering’) and personal development (‘to speed up social maturity and the ability to communicate with people at all levels’). Not everyone was satisfied with the list as it finally emerged. In a follow-up study of 20 firms about half felt the list was sufficiently comprehensive, but the others thought there should have been ‘a greater emphasis on the importance of cost, and impressing the students with the economic factors when making an engineering decision’.

Glassborow’s objectives were compiled partly as a basis for making some comparisons between the various groups with a direct interest in industrial training - for example, the students, the students’ industrial tutors and the senior and middle management of firms. The preliminary results already reveal considerable differences in emphasis along the lines of Heywood’s (1967) and Jahoda’s (1963) findings.

The technological universities themselves have also taken to specifying objectives as part of the way they present themselves to prospective students. The University of Bradford has prepared a booklet, Integrated Sandwich Courses at University, ‘to explain quite generally the nature of university integrated sandwich courses, how their special advantages can be obtained, and to provide students with information about such courses at this university’. And, although it was not available at the time the studies reported in this book were being planned, it can be taken as a good indication of the official view of these courses at Bradford. It gives the objectives as:

1. To provide students with practical experience in the application of the theoretical concepts gained at university. Ideally, this will involve the solution of real problems under authentic conditions rather than those
which can be simulated at university. It should give a sense of reality to the students’ work and demonstrate the interdisciplinary character of most industrial problems.

2. The extramural experience should have an interaction with the succeeding academic period, giving an appreciation of the relevance of the theoretical work covered and its possible application.

3. Since students gain practical experience in the application of theory under the most authentic conditions possible during the extramural periods, staff at the university should be able to concentrate on the fundamental principles of the subject. Hence, integrated courses can provide an ideal solution to furnishing the balance between fundamental theory and practice necessary during a formal education. This balance is important in determining the rate of obsolescence and degree of technical flexibility of the graduate.

4. The course should give an appreciation of the organization and purpose of industry, ranging from an insight into management techniques to a social awareness of the impact of a particular industry on society at large.

5. The extramural periods promote the personal development of students (maturity, self-reliance, ability to communicate, etc.) through the experience they provide of working with a variety of people in multidisciplinary teams in a range of locations.

6. The extramural periods can provide a supplement or even substitute for university laboratory work, also enabling students to learn additional practical skills.

7. Sandwich courses should clarify and enhance career prospects through showing students the possible range of employment of graduates and introducing them to a range of possible employers.

Thus, the assumed advantages of incorporating industrial training into degree courses have been expressed in a variety of ways, but, in essence, as far as education goes, they are claimed, through the integration of theory and practice, to promote scientific and technical learning and learning about firms and the people in them, to help the student towards a future career, and to contribute to the student’s personal development. These refer mainly to potential benefits to students, and by extension to the firms which will employ them, but it is also possible to see sandwich courses in a wider context. It has been suggested that the introduction of regular work periods into university courses alters the relationship between higher education and society in important ways: that, for example, it makes for a more socially and industrially responsive form of higher education (Burgess and Pratt, 1970), or that it opens up higher education more to students from working class backgrounds (Sandford, Couper and Harris, 1965), or again, that it keeps students more in touch with the real
world (Marris, 1964). We shall consider these various possibilities in Chapter 6 when we attempt a general evaluation of the sandwich system.

**Different Types of Sandwich Course**

The NCTA did not prescribe the form in which industrial training was to be incorporated into DipTech courses, and a number of variants have emerged. At first, the term ‘sandwich course’ was restricted to courses in which periods in college and industry alternated at intervals of about six months. Courses where all the industrial training was taken at once, usually in the third year of a four-year course, were regarded as full-time. But by 1961 both were being classified together, (*NCTA Report for the Period April 1961 to March 1962*), becoming known as the ‘thin sandwich’ and the ‘thick sandwich’, respectively. Several other patterns, for example, with two terms of industrial training in the second year and one term plus the long vacation in the third year, have also become established. (In addition, there is a 1-3-1 arrangement which is really a conventional course with a year’s training in industry either side; confusingly, this is also sometimes called a ‘thick sandwich’).

Both thin and thick sandwiches are passionately supported, and each is claimed to have advantages which the other lacks. These are often in the same terms. Heywood (1968) has rehearsed the arguments. The thin sandwich is claimed to promote the better integration, because it is the more balanced and both college staff and employers see the students each year; the thick, because the level of work possible in the third year is said to be more compatible with college studies. Both are claimed to be the less disruptive: the thin sandwich because the pattern is regular, the thick because it permits students to spend three whole years in the university (but with a gap of some 15 months between the second and third years). The thin sandwich is claimed to make possible a greater variety of experience and to provide students with opportunities to consider a wider range of jobs. But, to those who favour the thick sandwich, much of this experience is inevitably low-level and routine, and it could well put students off possible future careers unnecessarily. In any case, so the argument goes, the whole year does not have to be taken at just one place.

Some thin sandwich courses are arranged ‘end-on’, that is, there are two complementary intakes of students each year so that places in college and industry are continuously occupied. This has obvious economic advantages, but it does mean that some thin-sandwich students do have to ‘go out’ into industry before taking up their places at university.

**Industry-Based and College-Based**

Sandwich course students are paid while in industry, but usually not very much (it has sometimes been claimed that their earnings in industry are below student grants, Ballard, 1969). Most students are college-based and the university takes responsibility for arranging the work placements, but some students are industry-
based, that is, they are under contract to a firm. At one time, they received a salary throughout their studies, but since the introduction of mandatory grants it is more usual for them to have to seek a local authority support for the time they are at university. The former arrangement does still exist, however, and these are the ‘true’ industry-based students; the others, that is those receiving local authority grants while at university, are sometimes distinguished as ‘the industry sponsored’.

When the DipTech was first introduced, industry-based students were quite often employees of long standing who had been given time off to improve their qualifications. They often had ONC qualifications which were usually unacceptable to the universities at that time. But, by now, this older group has had its chance, and it is usual for the industry-based, like the college-based, to be recent school leavers. In practical terms, the distinction means little more than that the industry-based students usually return to their own particular firms for each training period, while the college-based move around.

**Varieties of Industrial Experience**

The industrial training places, themselves, are very varied; the experiences, diverse. In fact, it is important to realize that, in sandwich courses, ‘industrial training’ does not necessarily mean training in industry as such, it is just a convenient label for the periods in employment (see also p. 25). The firm or organization may be large or small, near or far, and it may take just one student or many.

The level of work varies considerably. The student could find himself with craft apprentices, simply ‘a pair of hands’, or doing something repetitive and routine; or he could find himself designing equipment, a member of a research team, or making decisions involving thousands of pounds. He may be closely, or casually supervised; his supervisor may come from the shop-floor, or be a senior man; his privileges may be those of worker, or ‘staff’. A lot probably depends on how long he has been at university. Students who go out into industry during their first year, perhaps even before going up to university if their course is ‘end-on’, are more likely to find themselves learning basic skills and doing low-level work than those who go out later. Students on thick sandwich courses are generally given a fair measure of responsibility, but their two years at university is not always recognized. Some firms treat their students well, but others are less good. The trouble is that, with training places at a premium, it is not always possible to eliminate the bad ones, even if these are known.

Where the student goes out into industry several times during the course, the experience may be graded or a virtue may be made of variety. In some branches of engineering and technology, there is a prescribed programme of training spanning the whole of the time allotted to industrial experience, but in the biological sciences and the social sciences the provisions are more hit and miss.
We shall look at the training programmes in electrical and mechanical engineering again when we consider the requirements of the Professional Institutions and the Industrial Training Boards, but, for the moment, we can take as an example Hanson’s (1970) description of a typical progression of experiences for chemical engineering students at Bradford University. The first two periods are normally concerned with basic skills: the first in a ‘laboratory situation’ the detail of which ‘can vary from a control laboratory associated with a production plant to the pilot plant laboratory of an equipment manufacturer’; the second in a workshop ‘engaged on either plant fabrication or maintenance’. Then, for the third, the student moves on to the level of full-scale plant, but ‘suitable experience can rarely be found in a production environment since most modern plants are highly automated. Suitable situations have been found in technical sections “trouble-shooting” on existing plants or during the commissioning of new plants’. Finally for the fourth period, when the student may already have taken his final examinations (but not officially know the result) he may ‘spend this period working for a contractor or in the design office of a major chemical manufacturer’ or ‘in a research and development environment’.

Role of Professional Institutions and Training Boards

The form of industrial training in engineering and technology is constrained by the Professional Institutions and the Training Boards. The Professional Institutions have come to be accepted as the guarantors of professional engineering competence in this country, and whilst it is not absolutely essential for a would-be engineer to join, he must obtain membership in order to be able to call himself a chartered engineer. The importance of this varies between the different branches of engineering. If we take electrical engineering as an example, without being chartered a suitably qualified person can practise as an engineer, can work for large companies and rise as high as his luck and abilities permit, but only when he is chartered can he be a consultant and act in a private capacity. In the case of civil and mechanical engineers there are no legal limitations on the qualified but non-chartered, but, in all branches of engineering, election to the parent body is an important mark of professional recognition.

Originally, the Professional Institutions were learned societies. According to Hordley (1964) the Institution of Mechanical Engineers held its first meeting in Birmingham in 1846, and the Institution of Electrical Engineers evolved from the Society of Telegraphy in 1887. At first, the requirements for admission were not rigorous, but in 1912 the Institute of Mechanical Engineers introduced several grades of membership and established its own examination scheme. They were followed a year later by the Electrical Engineers. The control that the Institutions were coming to exert over engineering training was increased still further after the First World War when the Board of Education joined with them in setting up the National Certificate Schemes. At the outset, the Higher National Certificate gave exemption from
membership examinations, but from 1934 there were certain additional requirements and subsequently these have been raised still higher.

In addition to examination qualifications, professional experience is taken into account. In order to obtain full membership of the Institution of Mechanical Engineers a person must have an appropriate degree or degree-level equivalent, have had approximately two years’ approved professional training and about three years’ further experience leading to a post of responsibility for about two years. The Electrical Engineers have similar conditions and, in addition, hold what is, in effect, an oral examination based on a project submitted by the applicant.

Periods in industry as part of sandwich courses can count towards the necessary industrial training providing of course the Institution’s requirements are met. These can be detailed and rigorous. The Institution of Mechanical Engineers has progressively revised its recommendations on practical training and the latest version (IME, 1970) outlines the content of an approved programme under five headings - induction, engineering practice I, engineering practice II and work organization, design appreciation and directed objective training. Specimen syllabuses are provided and the Institution assesses individual organizations on the suitability of their arrangements. The Institution of Electrical Engineers is similarly specific.

Since 1964 the influence of the Professional Institutions has been augmented by the Training Boards set up under the provisions of the Industrial Training Act of that year. This had as one of its purposes ‘to improve the overall quality of industrial training and to establish minimum standards’ (Ministry of Education, 1962) and it was designed to achieve this by entrusting all training within an industry to a single statutory body, the Industrial Training Board for that industry. The Boards were given teeth by a levy-grant device. Although training is seen to be the responsibility of individual employers (and not the educational system!), no firm is compelled to carry out any training, but it does have to pay a levy which goes towards financing approved training programmes.

A firm can earn back part of its levy by taking on sandwich course students - either industry-based or college-based – providing the training they are put through conforms to the Board’s requirements. The Engineering ITB has set out its conditions in considerable detail (EITB Pamphlet No. 5). It has identified five elements of training – induction, engineering practice, design appreciation, work organization, objective training – and provided some example programmes. It has even gone on to show how these elements of training can be fitted into postgraduate courses and thick and thin sandwich schemes of various kinds.

Although the Engineering ITB gives a nod towards integration – ‘active steps should be taken to integrate the academic and industrial aspects of the training as far as possible’ – it is clear that the demands of the Professional Institutions and the Training
Boards mean that the engineering and technology schools of universities and colleges do not have much control over the content of the industrial training part of their sandwich courses.

‘Industrial’ Training in Other Fields of Study
Although in practice, there is variation from firm to firm, the interest of the Professional Institutions and Training Boards has done much to ensure that in the various branches of engineering and technology a fairly coherent picture of job-related training has emerged. But as the sandwich concept has been transposed to the natural and social sciences – it will be remembered that this occurred first during the general scramble to have DipTech courses approved by the National Council for Technological Awards - it has been changed considerably. It had to be; there weren’t always directly associated industries!

In the social sciences, for example, the justification for sending the students away for regular periods is no longer in terms of technical learning, but, as the Brunel pamphlet, *Industrial Training for Degrees in Technology*, has it: ‘the essential component is that the student should have real experience of human affairs in an appropriate setting, to illuminate and temper his academic studies. Such a setting may well be found in the various departments of local authorities, in government or private research establishments, in schools or other educational institutions, in hospitals, in the prison service, in social work, in consultant or market research organizations, in commerce and in industry itself.’

Burton (1971) has given us some insight into the kinds of question that a group of sociologists at the University of Bath raised when faced with the problem of setting up a sandwich course in sociology:

Where to look for appropriate placements? How to define appropriate placement in this field? How to integrate practical work and academic teaching? How to evaluate student performance in placement? Field work is intended to enable a student to practise a craft, as an apprentice, under supervision, and with a background knowledge of theory and occupational ideology. Can this process be applied usefully to the teaching of sociology? Are there techniques and vocational skills in sociology that might be best acquired in the field? What field? Can theories of society be understood, illuminated and explored in the light of practical experience in social organizations, in social problem settings? Can a bridge be built between the theoretical and practical aspects of sociology? And finally, is there not a danger that the student on his practical placement will adopt methods of impressionistic empiricism, totally opposed to the vigorously scientific methodology presented to him as desirable by his teachers?
For the Bath group these questions resolved themselves into the search for relevant placements which they found in a wide range of locations rather similar to those mentioned in the Brunel booklet. Burton came to the view that sandwich courses have a number of advantages over conventional courses. ‘The student is provided with an opportunity for a job rehearsal at a stage in his life when he can switch direction with the minimum of disruption ... There is a romantic glamour surrounding a number of jobs, particularly research and social work, that may usefully be dispelled during a placement experience.’ ‘The teaching is, or can be, enormously reinforced by the student’s own experiences.’ ‘Sociological studies of institutions used in social control acquire a new significance when they are studied in the context of experience of working in such institutions.’ ‘Much of the factual element of teaching in subjects like social administration and criminology can be passed over.’ ‘Even the pastoral care of the students before, during and after placement, has its pay-off, both in terms of staff student relationships, and of student oriented teaching.’ But, of course, these are the impressions of someone with a personal stake in sandwich courses, and they need to be checked by systematic inquiry.

In the biological sciences too, there seems to have been a post hoc realization (and rationalization?) that ‘industrial’ training could be beneficial. Onions (1968), for example, has extolled its value in university level biology courses. ‘Its effects are twofold. Students return from industrial periods noticeably more mature than when they went’, and it allows ‘the undergraduate to see at an early stage the relevance of his academic studies and their application in real life situations and to work alongside more senior biologists’. He gives as examples of well-chosen industrial placings ‘a marine zoology station, a pharmaceutical firm and a hospital research department’, and envisages the possibility of one student going to all three during the industrial training part of his sandwich course.

‘Industrial’ training has thus been introduced into university-level courses in the biological sciences and the social sciences, and indeed, into courses of all kinds insofar as they are represented in the technological universities. The period abroad which has traditionally been part of modern language courses has, in the ex-CATs, moved in the direction of industrial training with the time being spent with some commercial or industrial organization rather than at a university or as an ‘assistante’ in a school (Willis et al, 1976). As courses in Human Purposes and Communication, Environmental Studies, and Peace Studies have been introduced at the University of Bradford these too have been organized on the sandwich pattern. Indeed, if one doesn’t hold to a rigid definition of the purpose of extramural experience, but consider it generally to be a ‘good thing’, then there appears to be no limit to the range of subjects into which it can be introduced. Thus, as Buchanan (1966) has remarked, from its modest job-related beginnings the sandwich pattern has been elevated to an educational principle applicable to the whole spectrum of subjects whether they be technological, or imaginative and speculative like the traditional
humanities. It is in this claim to provide valuable educational experience that its main weakness may lie.

**Integration of Study and Work Periods**

The major reason for including industrial training in undergraduate courses instead of relying on pre- or post-graduate, or vacation experience is that the academic and industrial parts are *integrated*. The view of the NCTA that ‘a student following a course leading to the Diploma in Technology is educated partly in an academic and partly in an industrial environment’ (NCTA, 1964 - author’s italics) is yearly reiterated in the prospectuses of the technological universities. Thus the University of Bradford’s claims: ‘The integrated periods of industrial or professional experience facilitate close collaboration between the academic and industrial staff in directing the students’ work, and experience has shown that the significance of these periods is that they give the student the widest opportunity both to exercise his developing critical ability in a non-academic environment and reciprocally to give him a better understanding of the application of fundamental scientific principles.’ Surrey’s says: ‘We are firm believers in sandwich courses and there are few students who have not benefited immensely from a period of practical experience directly related to their studies’ and ‘We run them because they enable a student to see how the subject of his study is applied in practice. The year is planned in such a way that it is an integral part of the course’. Bath’s: ‘The majority of our courses therefore include periods of practical experience as integral parts of the students’ education’.

There are various formal arrangements designed to promote integration. The student in industry has both an academic tutor appointed by the university and an industrial tutor appointed by the firm. The academic tutor visits the student several times while he is in industry. He also talks to the industrial supervisor and together they may be responsible for assessing the student’s progress. This may be done informally, or as at Brunel (See Urry, 1970b) marks may be given which count towards the final degree result. The student may also be set written work while he is in industry, and he may have to return to college periodically to meet his tutor and participate in seminars (Chippendale, 1970). Although these arrangements may seem comprehensive, there are, as we shall see in the final chapter, reasons for supposing that they may not be all that successful in bringing the two parts of the course close together.

The upsurge in sandwich courses, initiated by the NCTA and carried on by the CNAA, occurred in a favourable economic climate. But, as the current recession intensifies, their existence is increasingly being brought into question. The claims for this type of education are relatively untested and there is comparatively little documented research. In the ensuing chapters some empirical studies are reported and these are taken as a basis for an evaluation of sandwich courses or, as it is now fashionable to call them, integrated courses.
II. STUDENTS’ ATTITUDES TO INDUSTRIAL TRAINING

Surveys of opinion in the former colleges of advanced technology suggest that the objectives for sandwich courses have not always been met in practice. In particular, the students often did not appear to see much connection between the academic and industrial parts of their courses. Jahoda (1963), for example, found that about half the engineering and science students at Brunel CAT, whom she interviewed after the first period of industrial training, said that they saw ‘very little relation’ between the two experiences, and this was significantly linked to their overall ratings. Of the students at Northampton CAT interviewed as part of Marris’ (1964) comparative study of five institutions, only 28 per cent indicated that their industrial periods were successfully co-ordinated with their college courses and most thought that there was little practicable that could be done about it. In Heward, Mash and Heywood’s (1968) inquiry among final year diploma students at four CATs and the Woolwich Polytechnic about 50 per cent were not satisfied with industrial training. The main reasons for dissatisfaction appeared to be lack of organization, too long spent learning basic skills and not enough to do. The point is made more graphically perhaps by a student quoted in Peers and Madgwick’s (1963) study of two CATs in which they found that the sandwich course was more frequently criticized than praised:

Much of the industrial work is too drawn out and for most of the time one feels the firm ought to keep an intelligent monkey for the job you get. Any aspect of education, practical backing to college theory, etc., is almost non-existent.

As well as its relationship with college studies, ratings of the industrial placement appeared to be affected by a number of factors. One was the type of experience. In Jahoda’s (1963) study project work was the most favoured, and production work at the workman level the least. The most common kind of experience, moving from department to department, came only just above production work. This seemed to be because it involved a good deal of standing around, instead of, in the words of one student, ‘doing something useful’. More science students than engineering students were given projects and this was reflected in their ratings. In Marris’ (1964) interviews too, it was project work that tended to be commented upon most favourably, and it was the science students who were more likely to be given projects.

Jahoda (1963) also showed that the social climate of the firms appeared to have some influence. The proportion of ‘good experiences’ was higher when the students reported having been a member of a hardworking group, or having been in a firm seen to favour new ideas and methods, or where (interestingly enough) discipline was regarded as strict. Students with good experience also seemed to be more self-confident than students with mixed or bad experiences, and to have changed more in the direction of professional certainty, or interest in subject-matter, or both. But, apart from some suggestion of a curvilinear relationship with the number of industrial
supervisors (two to three appeared to be optimal), none of the measures of supervision taken, including the occupational level of the supervisor, or the closeness of supervision, were found to be significantly associated with the students’ ratings.

These early studies hint at some of the problems of industrial training, but it is clear that they were only beginning to touch the surface of the students’ varied and differentiated reactions to their experiences. They rested heavily on some general indication of liking, satisfaction or some other expression of approval. For example, Jahoda’s (1963) students were simply asked how much they had liked industrial training and how much they thought they had learned from it, and those who replied favourably to both questions were classed as having had ‘a good experience’, to one, ‘a mixed experience’, and to neither, ‘a bad experience’. Those researches were also mainly cross-sectional.

The Bradford studies of industrial training, initiated in 1966, were designed to go beyond these early explorations in at least four ways: they would ask the student to assess his experiences not just along one or two dimensions but in terms of a whole range of possible criteria; they would be studies of change so that outcomes could be related to expectations; they would involve students on both thin and thick sandwiches; and they would attempt to relate the student's reactions to various features of the work placement.

Literature searches, pilot interviews with students and discussion with teaching staff and people in industry suggested that it would be reasonable for the students to rate their industrial training in terms of the extent to which they felt it contributed to their understanding of science and technology, knowledge of industrial organizations and the human problems of working in them, social self-confidence, career prospects, sense of purpose and the extent to which they saw it as integrated with university studies. These came to form the basis of a 30-item scale which was used as the main way of recording the students’ reactions to their experiences. But as a check these were on occasions also assessed by a sentence-completion schedule and rating scales.

The work situation was classified in various ways. The students were asked to indicate the type of experience that they had had using Jahoda’s (1963) categories, and to estimate how much time they had spent on ‘skilled work’, ‘unskilled work’, and ‘observation’ and how much contact the work involved with various grades of employee. The bureaucratic features of the work placements were assessed using a scale constructed from the organizational indices of Aiken and Hage (1966), and a measure based on Elliott Jaques’ (1956) notion of time span of discretion was used to gauge the closeness of supervision.

Sandwich courses at Bradford are organized in a number of patterns, but a small group of three engineering schools, Chemical Engineering, Electrical Engineering and Mechanical Engineering can be taken together as operating end-on thin sandwich
courses. Three other schools - Civil Engineering, Applied Biology and Textile Technology - operate thick sandwich courses (there is actually also a fourth, Applicable Mathematics and Statistics, but this offers in addition a three-year full-time course and, among the intake under study, only a small number proceeded to the four-year sandwich course). The various measures were given, as appropriate, to students on entry to the university and before and after periods of industrial training.

In this chapter we look at the results of these longitudinal studies considering first the development of the attitude-to-industrial training scale, then, in turn, the reactions of the thin and thick sandwich students and some of the factors affecting those reactions, and finally, some of the implications of the findings.

Development of the Likert-Type Attitude-to-Industrial Training Scale

The main method of assessing students’ attitudes to industrial training was a Likert-type scale (see Musgrove, 1968a). Statements for the scale were obtained from interviews with 12 students who were undergoing industrial training and with 24 randomly selected students who had recently returned from periods in industry. These students were asked what they had found valuable in their industrial training periods, what they had found of little or no value, what they had liked and what they had disliked. Forty statements were taken from the students’ verbal responses and presented to 93 students who had had experience of industrial training (and would not be involved in the main study) for agreement-disagreement on a five-point scale. After item analysis ten statements which failed to discriminate between high and low scorers were discarded to leave a 30-item scale. Each item was scored from one, ‘strongly agree’, through to five, ‘strongly disagree’, with scores on negatively worded items reversed. The whole scale therefore runs from 30 to 150: the higher the score, the more unfavourable the attitude.

The scale was also re-cast in prospective form to give to students before they had entered industry. For this version the first item on the scale became: ‘I expect industrial experience will give me an excellent opportunity to discover what jobs are going and what I’m most suited for’ and the second: ‘During my industrial experience I shall probably be little more than a “dogsbody” working alongside very experienced and highly qualified people.’

The internal consistency and stability of the retrospective version of the scale were established by split-half and test-re-test procedures respectively. A split-half reliability coefficient of 0.86 was obtained with a stratified random sample of 122 students with experience of industrial training. One class of 33 students took the test twice at an interval of two weeks and the two sets of scores correlated to the extent of 0.87.
As we shall see on pages 34-38, good agreement was found between the results obtained using the attitude-to-industrial training scale and the three other measures of students’ reactions so that it can be claimed to have concurrent validity. Its content reflects the range of hopes for industrial training so that it can also be claimed to have content validity. Derrick (1970) has subjected the attitude-to-industrial training scale to principal components analysis and, although he found some variation with different groups of students, six factors tended to recur including ‘application and extension of knowledge’, ‘self-confidence and motivation’ and ‘social skills’. These are broadly in line with the objectives declared for industrial training and provide more evidence towards the argument for adequate validity.

Thus there are reasons for believing that, within the confines of the Bradford studies, (more work would have to be done to establish its effectiveness before it could be safely used elsewhere) the Likert-type scale is a satisfactory indicator of students’ impressions of industrial training. The overall score can probably be taken as a general expression of feeling, and the individual items also enable us to consider the experience from particular points of view.

Reactions of Students to Thin Sandwich Courses
The first part of this report concerns students of chemical, electrical and mechanical engineering on end-on thin sandwich courses. They completed the prospective form of the attitude-to-industrial training scale on entry in October 1966 and were followed-up after their first period of industrial training, and after the second also.

Altogether 101 students (86.3 per cent) completed the scale at the outset, 84 (71.8 per cent) after the first experience of industrial training, and 51 (43.6 per cent) a year later after the second. Fifteen students (12.3 per cent) from the original group had meanwhile left the university.

The initial attitude scores of the non-respondents tended to be higher (less favourable) than those of the students who completed the questionnaire on all three occasions, although not significantly so. On the first testing the 51 students who were later successfully followed-up obtained a mean scale score of 58.9; the 50 who were not obtained a mean score of 59.7 (t=0.55, P<0.05=2.01). On the second testing, the 51 students obtained a mean score of 70.9 and the 33 students who also completed the questionnaire at that time, but did not do so later obtained a mean score of 72.9 (t=0.68, P<0.05=2.01).

The data of Table 2.1 show that students entering all three schools expected much from industrial training. The mean scale scores of just less than 60 are very close to the positive pole of a scale running from 30 to 150, and correspond to an average ‘agree’ response across all of the 30 items. Perhaps not surprisingly not all of these expectations were borne out in practice and the highly favourable initial attitude to
industrial training declined somewhat with each experience. In all three schools the change between the first and second tests was greater than that between the second and third, but all the differences were significant beyond the 0.1 per cent level.

Table 2.1: Attitude to Industrial Training Scores of Students on Thin Sandwich Courses

<table>
<thead>
<tr>
<th>School</th>
<th>Attitude to Industrial Training Before First Ind Period</th>
<th>Attitude to Industrial Training After First Ind Period</th>
<th>Attitude to Industrial Training After Second Ind Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>26</td>
<td>59.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>27</td>
<td>58.0</td>
<td>9.7</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>31</td>
<td>59.2</td>
<td>10.6</td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>58.9</td>
<td>9.2</td>
</tr>
</tbody>
</table>

1. Industrial abbreviated to ‘Ind’.

However, although the drift towards less favourable ratings occurred uniformly across students, it did not apply equally to all aspects of industrial training. If, as in Table 2.2, we examine the individual items of the scale we find that the major changes occurred in relation to the integration of theory and practice, and scientific and technical learning. On entry, 98 per cent of the students expected that industrial training would provide an opportunity to see how theoretical knowledge works in practice and would make theory more meaningful, but, after two periods of industrial training, only 31.4 per cent and 43.1 per cent respectively agreed with these statements. Similarly, in the light of experience, only a minority of students agreed that industrial training was useful for learning about the latest practical developments and advances, and for adding to scientific knowledge and understanding, and most students thought they had forgotten a good deal of what they had been learning before. Not many students felt they had become more self-confident in tackling scientific problems. Neither did they feel that industrial experience taught them much about what jobs were going and what they were most suited for.

On the other hand, with many of the social and organisational items the initial high ratings were to a large extent maintained and, in a few cases, even improved. After two periods of industrial training most students agreed that they had developed more self-confidence in dealing with people, and that they had learned a lot about the attitudes and practices of management and workmen. Eighty per cent of the students continued to think that the time in industry was especially valuable for learning how a firm works. Initial fears that they might be lonely proved to be unfounded and most students agreed that they made a lot of new friends especially during the first period of industrial training.

Although most of the students did not feel that they were learning very much about future employment prospects, industrial training was thought to give the ‘edge’ on graduates with no industrial experience and enable them to be of more immediate use
to an employer. But belief in the sense of purpose to be derived from industrial training, never very strong, progressively declined over the periods in industry.

Table 2.2: Attitudes to Industrial Training of Thin Sandwich Course Students (N=51)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Per Cent ‘Strongly Agree’ or ‘Agree’&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Change&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before First Ind Period</td>
<td>After First Ind Period</td>
</tr>
<tr>
<td>Theory in practice</td>
<td>98.0</td>
<td>41.2†</td>
</tr>
<tr>
<td>Distraction from studies*</td>
<td>92.2</td>
<td>78.4</td>
</tr>
<tr>
<td>Lot of low-level work*</td>
<td>54.9</td>
<td>47.1</td>
</tr>
<tr>
<td>Theory more meaningful</td>
<td>98.0</td>
<td>52.9†</td>
</tr>
<tr>
<td>Forgot a good deal*</td>
<td>56.9</td>
<td>31.4†</td>
</tr>
<tr>
<td>Technical self-confidence</td>
<td>94.1</td>
<td>74.5†</td>
</tr>
<tr>
<td>Scientific knowledge</td>
<td>83.4</td>
<td>60.8†</td>
</tr>
<tr>
<td>Latest practical developments</td>
<td>62.8</td>
<td>39.2†</td>
</tr>
<tr>
<td>Helpful guidance</td>
<td>92.2</td>
<td>80.4</td>
</tr>
<tr>
<td>Scientific self-confidence</td>
<td>86.3</td>
<td>52.9†</td>
</tr>
<tr>
<td>‘Dogsbody’ to highly qualified*</td>
<td>66.7</td>
<td>90.2±</td>
</tr>
<tr>
<td>Lonely*</td>
<td>66.7</td>
<td>86.3±</td>
</tr>
<tr>
<td>Self confidence in dealing with people</td>
<td>92.2</td>
<td>80.4</td>
</tr>
<tr>
<td>New friends</td>
<td>76.5</td>
<td>92.2</td>
</tr>
<tr>
<td>Treated as individual</td>
<td>70.6</td>
<td>66.7</td>
</tr>
<tr>
<td>How firm works</td>
<td>100.0</td>
<td>83.4</td>
</tr>
<tr>
<td>Worked on own</td>
<td>45.2</td>
<td>70.6±</td>
</tr>
<tr>
<td>Learned about workers</td>
<td>92.2</td>
<td>80.4</td>
</tr>
<tr>
<td>Learned about managers</td>
<td>90.2</td>
<td>64.7†</td>
</tr>
<tr>
<td>Senior staff approachable</td>
<td>66.7</td>
<td>68.6</td>
</tr>
<tr>
<td>What jobs going</td>
<td>92.2</td>
<td>37.3†</td>
</tr>
<tr>
<td>Edge on non-sandwich graduate</td>
<td>86.3</td>
<td>84.3</td>
</tr>
<tr>
<td>Use to future employer</td>
<td>94.1</td>
<td>88.2</td>
</tr>
<tr>
<td>Moping around*</td>
<td>96.1</td>
<td>92.2</td>
</tr>
<tr>
<td>Cheap labour*</td>
<td>90.2</td>
<td>76.5</td>
</tr>
<tr>
<td>Little more than holiday*</td>
<td>96.1</td>
<td>86.3</td>
</tr>
<tr>
<td>Pay resented by workers*</td>
<td>66.7</td>
<td>76.5</td>
</tr>
<tr>
<td>‘Dogsbody’ to not highly qualified*</td>
<td>78.4</td>
<td>84.3</td>
</tr>
<tr>
<td>Sense of purpose: profits</td>
<td>45.2</td>
<td>27.5</td>
</tr>
<tr>
<td>Sense of purpose: useful work</td>
<td>72.6</td>
<td>51.0†</td>
</tr>
</tbody>
</table>

1. Scoring reversed on asterisked statements.
2. Industrial abbreviated to ‘Ind’.
3. Statistically significant changes according to McNemar’s method between before and after first industrial period and after the first and second industrial periods signified by † for significant deterioration and ‡ for significant improvement of second score. Significant changes overall shown in last column.

Thus, although the highly favourable attitudes with which the engineering students looked forward to periods of industrial training declined somewhat during the first experience and still further during the second, it was not an undifferentiated reaction. The re-appraisal took place principally in relation to the integration of theory and practice, and opportunities for scientific and technical learning. As an opportunity for
learning about organizations and people, and preparing to work in industry, it continued to be rated highly after two periods of training. These findings are supported by observations made using three other measures which were given in the battery of questionnaires after the first period in industry.

**Semantic Differential Scale**

Students’ reactions to industrial training were also assessed by asking them to complete a set of eight rating scales covering such things as the usefulness of the experience to the college course, future professional work and understanding the way an organization works (see Figure 2.1). The scales were set out in a format not unlike that of Osgood’s semantic differential. Reactions as assessed by these scales agreed well with the pattern of attitudes emerging on the Likert-type questionnaire. For the 84 engineering students total scores obtained by summing the responses on all eight items correlated to the extent of +0.745 with the overall scores on the Likert-type scale.

The profile of Figure 2.1 shows that the mean rating on all eight scales is in the positive direction, but there were differences according to the aspect of industrial training being considered. As with the Likert-type scale, the most favourable ratings were on those scales concerned with the usefulness of the experience to future professional work, learning about people, understanding the way an organization works and developing social confidence. Again, less favourable ratings were given to the relation with the university work, gaining scientific knowledge and understanding, and developing confidence to tackle scientific and technical problems.

**Simple Rating**

Another measure simply asked students to think generally over their last period in industry and rate it as ‘a good experience’, ‘a mixed experience’ or ‘a bad experience’. Fifty-five of the 84 engineering students on thin sandwich courses reported ‘a good experience’ and they obtained a post-industrial training mean score of 66.2 ±10.9 on the Likert-type scale compared to 79.9 ±12.5 for the other 29. This difference is significant beyond the 0.1 per cent level. For those reporting a good experience, the mean change during the first industrial period on the Likert-type scale was + 8.9 units compared to +18.2 units for those reporting a mixed or bad experience.

**Sentence Completion Schedule**

Students’ reactions to the first training period were also approached in a less constrained way by asking them to complete three sentence stems:

1. ‘During my period of industrial training I always had plenty of chance to…’
2. ‘During my period of industrial training I always felt that…’
3. ‘Above all, my period in industrial training helped me to…’
Responses were first classified as either positive or negative. Table 2.3 shows that stems (1) and (3), which probably predispose an answer, elicited mainly positive statements about industrial training, but on stem (2), which is more neutral in its construction, there was an even division. Table 2.3 also shows that in all cases there was a large mean difference on the Likert-type scale between those making positive and negative statements.

Table 2.3: Sentence Completion Responses of Students on Thin Sandwich Courses

<table>
<thead>
<tr>
<th>Sentence Stem</th>
<th>Positive Statements</th>
<th>Negative Statements</th>
<th>T</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td>N</td>
</tr>
<tr>
<td>During my period of industrial training I always had plenty of chance to...</td>
<td>68</td>
<td>68.6</td>
<td>11.7</td>
<td>9</td>
</tr>
<tr>
<td>During my period of industrial training I always felt that...</td>
<td>38</td>
<td>64.7</td>
<td>9.1</td>
<td>38</td>
</tr>
<tr>
<td>Above all, my period in industrial training helped me to...</td>
<td>65</td>
<td>68.3</td>
<td>12.0</td>
<td>11</td>
</tr>
</tbody>
</table>
Of the 68 positive statements made in completing the first stem about a fifth (13) referred to the chance of asking questions (“ask relevant questions and be sure of a reliable answer”) and a further fifth (13) referred to seeing industry in operation (“see how a factory is run”/“see an industry at work”). Other common categories were: the opportunity of working by oneself and exercising initiative (10 statements e.g. work on my own and try out my own ideas’), gaining experience of machinery statements e.g. ‘operate and learn about a great variety of machines’), learning about people in industry (5 statements e.g. ‘study the people that would one day be workmen in the industry I would be working at’), and practicing basic skills (5 statements e.g. ‘make useful tools’). The other 14 positive statements tended to be non-specific e.g. ‘increase my knowledge’/‘learn’/‘find out reasons for doing the work’/‘help others’. The nine negative statements nearly all referred to boredom in one way or another (e.g. ‘observe other people but no chance to do anything for myself’/‘do nothing’ (twice) /‘have a cup of tea’).

The sentence beginning: ‘During my period of industrial training I always felt that…’ elicited rather more negative than positive statements, many of which referred to help given, or the level of the work, or its relation to university studies.

**Positive**

“Any person who I was with was willing to help in any way, answer any questions, and give me any knowledge he had acquired through experience.”

“The basic groundwork I was doing was most necessary and advantageous.”

“I was being given every opportunity to learn about every part of the plant.”

“I was one of the team.”

“The job I was doing was worthwhile and enjoyable.”

“Nothing was too much bother to help us in gaining experience and knowledge if we showed an interest and industry in the work we were doing.”

**Negative**

“The facilities for undergraduate students were nil, the training was that of bench work with 15 year old craft apprentices.”

“Though craftsmen were willing to help, the higher positioned people would rather hide somewhere out of the way.”

“My instructors were glorified fitters who know a great deal less about technical subjects than I did myself.”
“I was in the way.”
“It was not for me full-time.”
“I wanted to be at college.”
“This was basically a boring and repetitive job.”
“I was not attaining enough experience to help me at college.”

The kinds of ending added to the third sentence stem, which was designed to elicit the most important aspect of the experience as it appeared to the students, are shown in Table 2.4. The emphasis on social and organizational aspects of industry which together comprise about 60 per cent of the total of positive statements is in line with the favourable ratings on the corresponding items of the Likert-type scale.

Table 2.4: Most Important Aspects of Industrial Experience

<table>
<thead>
<tr>
<th>‘Above all, my period in industrial training helped me to…’</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn about people and how to get on with them</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“know how the average workman thinks and acts”</td>
<td>23</td>
<td>35.4</td>
</tr>
<tr>
<td>“understand people’s points of view at all levels”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“meet plenty of people”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learn about industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“learn about the structure and set up of an engineering works”</td>
<td>17</td>
<td>26.2</td>
</tr>
<tr>
<td>“get a better understanding of how industry ticks”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“understand the fundamentals of working in and running a firm”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add to knowledge of engineering, including basic skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“learn about the use of different machines and materials for different purposes”</td>
<td>12</td>
<td>18.5</td>
</tr>
<tr>
<td>“realize the difficulties in constructing a given article to certain specifications although it looks easy on paper”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“obtain the basic skills in mechanical engineering”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learn about self</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“see life through another window”</td>
<td>6</td>
<td>9.2</td>
</tr>
<tr>
<td>“realize how much I don’t know”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“gather experience”</td>
<td>7</td>
<td>10.8</td>
</tr>
<tr>
<td>“pave the way for any problems which may arise in future”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Not all statements drawn out by this stem were positive; 11 indicated that the particular student had not liked what he had seen. These fell into two main groups, one commenting on the nature of the work (e.g. “pity the workmen and to get the hell out of it”/ “know that I would not like to be a fitter”/ “dislike work”), and, the other, on the state of British industry (“understand the attitudes and inefficiencies in industry, especially in an analytical department”/ “understand why there is a basic drain, and why British industry is way behind the rest of the world”/ “realize many uneconomical aspects existing in a nationalized industry, and a great lack of
organization and co-operation between the departments in the industry”). One student said: “above all, my period in industrial training helped me to swear.”

The coherence of the picture emerging from the Osgood-like scales, the simple rating scale and the sentence-completion schedule, and its many similarities with that provided by the Likert-type scale encouraged us to believe that we were getting close to students’ actual impressions of industry. It also increased our confidence in the Likert-type scale and, when later it became apparent that our battery of questionnaires was becoming too extensive, we felt able to rely on this alone as our measure of attitude-to-industrial training.

Reactions of Students on Thick Sandwich Courses

Students on thick sandwich courses, that is, with the industrial training in the third year of a four-year course, were approached on entry to the university and followed up on two occasions: (a) towards the end of their second academic session before they went out on industrial training and (b) when they returned to university after the year’s industrial training. Three Schools operated thick sandwich course: Civil Engineering, Textile Technology and Applied Biology.

On entry 66 civil engineering students (91.7 per cent of the intake), all male, completed our questionnaires, and, in the follow-up studies, 45 (62.5 per cent) and 47 (65.3 per cent) participated before and after industrial training respectively. In the meantime, 15 (20.8 per cent) of the original intake had left the university. The study of textile technologists and the applied biologists was also confined to the male students. For these two schools the corresponding response rates were respectively: on entry 23 (76.7 per cent) and 21 (100 per cent); before industrial training 18 (60 per cent) and 16 (76.2 per cent); and after industrial training again 18 (60 per cent) and 16 (76.2 per cent). The number of students leaving the two schools during the course of study were: textile technology, six (20.0 per cent), and applied biology, six (25.6 per cent). Overall, the initial response rate was about 90.0 per cent, and the falling-off in the follow-up studies was mainly due to students withdrawing from the University (22.0 per cent).

The students’ changing attitudes to industrial training are shown in Table 2.5. On entry, students in all three Schools were very favourably inclined towards the experience although the applied biologists were significantly less so than the civil engineers (t=2.11, P<0.05). During the two years in the university the attitude of all three groups deteriorated. But industrial training, itself, appeared to affect the technologists and the biologists differently. Among the technologists, the somewhat less favourable attitudes developed during the time at university were largely borne out, but, among the biologists, a striking re-assessment appeared to take place. And from being the least favourably disposed at the outset, having experienced industrial training, they became the most enthusiastic.
An examination of the individual items as in Table 2.6 shows that the pattern of changes among the students of civil engineering was very similar to that occurring among the thin-sandwich students. The change to less favourable ratings occurred mainly on those items concerned with the relationship between the two parts of sandwich courses, and learning related to subject. At the outset, the civil engineering students expected to find that industrial training was an opportunity of applying theory to practice, expected to learn about some of the latest practical developments and did not think it would mean that they forgot a good deal of their college work. But they were disappointed. The students were forewarned to some extent by their two years at university, but the changes on the two items most directly concerned with the integration of theory and practice occurred mainly during industrial training itself.

Relatively few items concerned with social and organisational learning were similarly re-appraised. The expectation that industrial training would help develop self-confidence in dealing with all kinds of people was borne out, and the students were generally satisfied with industrial training as a social experience. They continued to rate industrial training highly as a time for learning about firms and for gaining insight into the attitudes of managers and workers (although rather less so in the case of the latter). The students were surprised at the extent to which they were able to work on their own and were surprised to find the ‘bosses’ so friendly and approachable. While at university the students came to doubt that industrial experience would provide them with a good opportunity to see what jobs are going and this was confirmed by actual experience. But the initial strong belief that they would have the edge over graduates of conventional courses continued to be held.

The textile technologists were similar to the civil engineers but, among the applied biologists, the pattern of changes was rather different. From Table 2.7 it can be seen that here there was a general shift towards less favourable ratings during the two years at college which was more than reversed by industrial training itself. Among the biologists the items relating to subject learning appear to fall into two groups. Like the technologists, they came to doubt whether industrial training was an opportunity of applying theory to practice. On the other hand, they appeared to take a different and more favourable view of the experience at the level of developing scientific and technical self-confidence, and adding to scientific knowledge. Industrial training was
not seen to be the distraction from university studies that it was among the technologists. Like the technologists, the biologists appeared to value industrial training as a social experience, but they did not see it so much as a time for learning about the workings of a firm, or for learning about the attitudes of management or workmen.

Table 2.6: Attitudes to Industrial Training of Civil Engineering Students¹ (N=47)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Per Cent ‘Strongly Agree’ or ‘Agree’</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Entry</td>
<td>Before Ind Training</td>
</tr>
<tr>
<td>Theory in practice</td>
<td>93.3</td>
</tr>
<tr>
<td>Distraction from studies*</td>
<td>88.9</td>
</tr>
<tr>
<td>Lot of low-level work*</td>
<td>55.6</td>
</tr>
<tr>
<td>Theory more meaningful</td>
<td>95.6</td>
</tr>
<tr>
<td>Forgot a good deal*</td>
<td>62.2</td>
</tr>
<tr>
<td>Technical self-confidence</td>
<td>91.1</td>
</tr>
<tr>
<td>Scientific knowledge</td>
<td>80.0</td>
</tr>
<tr>
<td>Latest practical developments</td>
<td>62.2</td>
</tr>
<tr>
<td>Helpful guidance</td>
<td>86.7</td>
</tr>
<tr>
<td>Scientific self-confidence</td>
<td>91.1</td>
</tr>
<tr>
<td>Dogsbody to highly qualified*</td>
<td>55.6</td>
</tr>
<tr>
<td>Lonely*</td>
<td>75.6</td>
</tr>
<tr>
<td>Self confidence in dealing with people</td>
<td>95.6</td>
</tr>
<tr>
<td>New friends</td>
<td>73.3</td>
</tr>
<tr>
<td>Treated as individual</td>
<td>75.6</td>
</tr>
<tr>
<td>How firm works</td>
<td>84.4</td>
</tr>
<tr>
<td>Worked on own</td>
<td>24.4+</td>
</tr>
<tr>
<td>Learned about workers</td>
<td>86.7</td>
</tr>
<tr>
<td>Learned about managers</td>
<td>88.9</td>
</tr>
<tr>
<td>Senior staff approachable</td>
<td>53.3</td>
</tr>
<tr>
<td>What jobs going</td>
<td>91.1</td>
</tr>
<tr>
<td>Edge on non-sandwich graduate</td>
<td>88.9</td>
</tr>
<tr>
<td>Use to future employer</td>
<td>100.0</td>
</tr>
<tr>
<td>Moping around*</td>
<td>97.8</td>
</tr>
<tr>
<td>Cheap labour*</td>
<td>88.9</td>
</tr>
<tr>
<td>Little more than holiday*</td>
<td>95.6</td>
</tr>
<tr>
<td>Pay resented by workers*</td>
<td>40.0†</td>
</tr>
<tr>
<td>Dogsbody with not very highly qualified*</td>
<td>77.8</td>
</tr>
<tr>
<td>Sense of purpose: profits</td>
<td>57.8</td>
</tr>
<tr>
<td>Sense of purpose: useful work</td>
<td>82.2</td>
</tr>
</tbody>
</table>

¹. On thick sandwich courses, all male, 45 on entry rising to 47 during course.
². Scoring reversed on asterisked statements.
³. Statistically significant changes, according to McNemar’s (1962) method, between different stages of the courses signified by † for significant deterioration and ⬤ for significant improvement. Significant changes overall shown in last column.

As we shall see, the different reactions of the biologists and the technologists can probably be accounted for in terms of their different kinds of experiences; whereas
the engineers and textile technologists go out into their industries per se, the applied biologists mainly go to research laboratories.

Table 2.7: Attitudes to Industrial Training of Applied Biology Students (N=16)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Per Cent ‘Strongly Agree’ or ‘Agree’ Before Ind Training</th>
<th>Per Cent ‘Strongly Agree’ or ‘Agree’ After Ind Training</th>
<th>Change3</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory in practice</td>
<td>93.8</td>
<td>53.2†</td>
<td>50.0</td>
<td>0.05</td>
</tr>
<tr>
<td>Distraction from studies*</td>
<td>87.5</td>
<td>53.2†</td>
<td>81.3</td>
<td>ns</td>
</tr>
<tr>
<td>Lot of low-level work*</td>
<td>31.3</td>
<td>21.9</td>
<td>56.3+</td>
<td>ns</td>
</tr>
<tr>
<td>Theory more meaningful</td>
<td>81.3</td>
<td>56.3†</td>
<td>56.3</td>
<td>0.05</td>
</tr>
<tr>
<td>Forgot a good deal*</td>
<td>50.0</td>
<td>31.3</td>
<td>43.8</td>
<td>ns</td>
</tr>
<tr>
<td>Technical self-confidence</td>
<td>93.8</td>
<td>84.4</td>
<td>87.5</td>
<td>ns</td>
</tr>
<tr>
<td>Scientific knowledge</td>
<td>75.0</td>
<td>71.9</td>
<td>75.0</td>
<td>ns</td>
</tr>
<tr>
<td>Latest practical developments</td>
<td>75.0</td>
<td>37.5†</td>
<td>68.8</td>
<td>ns</td>
</tr>
<tr>
<td>Helpful guidance</td>
<td>87.5</td>
<td>93.8</td>
<td>75.0</td>
<td>ns</td>
</tr>
<tr>
<td>Scientific self-confidence</td>
<td>93.8</td>
<td>87.6</td>
<td>100.0</td>
<td>ns</td>
</tr>
<tr>
<td>Dogsbody to highly qualified*</td>
<td>37.5</td>
<td>40.7</td>
<td>100.0+</td>
<td>0.05</td>
</tr>
<tr>
<td>Lonely*</td>
<td>62.5</td>
<td>53.1</td>
<td>68.8</td>
<td>ns</td>
</tr>
<tr>
<td>Self confidence in dealing with people</td>
<td>81.3</td>
<td>81.3</td>
<td>93.8</td>
<td>ns</td>
</tr>
<tr>
<td>New friends</td>
<td>81.3</td>
<td>71.9</td>
<td>87.5</td>
<td>ns</td>
</tr>
<tr>
<td>Treated as individual</td>
<td>50.0</td>
<td>65.7</td>
<td>87.5</td>
<td>0.05</td>
</tr>
<tr>
<td>How firm works</td>
<td>75.0</td>
<td>50.0</td>
<td>62.5</td>
<td>ns</td>
</tr>
<tr>
<td>Worked on own</td>
<td>37.5</td>
<td>46.9</td>
<td>93.8+</td>
<td>0.05</td>
</tr>
<tr>
<td>Learned about workers</td>
<td>56.3</td>
<td>56.3</td>
<td>50.0</td>
<td>ns</td>
</tr>
<tr>
<td>Learned about managers</td>
<td>87.5</td>
<td>68.8</td>
<td>62.5</td>
<td>ns</td>
</tr>
<tr>
<td>Senior staff approachable</td>
<td>56.3</td>
<td>65.7</td>
<td>87.5</td>
<td>ns</td>
</tr>
<tr>
<td>What jobs going</td>
<td>100.0</td>
<td>40.7†</td>
<td>56.3</td>
<td>0.05</td>
</tr>
<tr>
<td>Edge on non-sandwich graduate</td>
<td>81.3</td>
<td>62.5</td>
<td>81.3</td>
<td>ns</td>
</tr>
<tr>
<td>Use to future employer</td>
<td>87.5</td>
<td>71.9</td>
<td>75.0</td>
<td>ns</td>
</tr>
<tr>
<td>Moping around*</td>
<td>87.5</td>
<td>62.5</td>
<td>100.0</td>
<td>ns</td>
</tr>
<tr>
<td>Cheap labour*</td>
<td>68.8</td>
<td>31.3†</td>
<td>62.5+</td>
<td>ns</td>
</tr>
<tr>
<td>Little more than holiday*</td>
<td>75.0</td>
<td>68.8</td>
<td>87.5</td>
<td>ns</td>
</tr>
<tr>
<td>Pay resented by workers*</td>
<td>43.8</td>
<td>78.2</td>
<td>75.0</td>
<td>0.05</td>
</tr>
<tr>
<td>Dogsbody with not very highly qualified*</td>
<td>43.8</td>
<td>62.5</td>
<td>93.8+</td>
<td>0.05</td>
</tr>
<tr>
<td>Sense of purpose: profits</td>
<td>37.5</td>
<td>18.8</td>
<td>12.5</td>
<td>ns</td>
</tr>
<tr>
<td>Sense of purpose: useful work</td>
<td>56.3</td>
<td>34.4</td>
<td>75.0+</td>
<td>ns</td>
</tr>
</tbody>
</table>

1. On thick sandwich courses.
2. Scoring reversed on asterisked statements.
3. Statistically significant changes according to McNemar’s method signified by † for significant deterioration and ‡ for significant improvement after first university period, the first period in industry and overall.

Factors Affecting Reactions to Industrial Training

So far we have been considering industrial training as a whole. But, clearly, how a particular student reacts to the experience is going to be some amalgam of the characteristics of the training situation and the student’s personal qualities. The range of possibilities is obviously very large, and this emerges in the higher standard deviations of the post-industrial training attitude scores, but the early work of Jahoda
(1963) and the pilot interviews held at Bradford suggested that there were some common features capable of description. Among those that we chose to study were: the type of experience, the bureaucratic features of the work situation, the students’ ‘time span of discretion’, the level of skill seen to be involved in the work, staff contact, and also the effects of the students’ previous experiences.

**Type of Experience**

Following Jahoda (1963) the students were asked to say whether the last period of industrial training was spent ‘in a training school’, ‘moving from department to department’, ‘on a project’, ‘on production work at the technician level’, or ‘on production work at the workman level’. Table 2.8 shows how the students described their experience in these terms. The most common kind of first experience for the engineers on thin sandwich courses was the apprentice training school, and for the second, moving from department to department. In fact, it was mainly the mechanical and electrical engineers who went into the training schools during the first period of industrial training, and chemical engineers during the second. None of the thick sandwich students was sent to training school; they either spent their time involved in the work itself or moving from department to department. The experience of the applied biologists was different from that of the technologists in that most of them were given a project of some kind.

**Table 2.8: Types of Industrial Experience**

<table>
<thead>
<tr>
<th>Course</th>
<th>% Training school</th>
<th>% Dept. to Dept.</th>
<th>% Project</th>
<th>% Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin Sandwich¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First experience (N=84)</td>
<td>44.0</td>
<td>26.2</td>
<td>10.0</td>
<td>17.9</td>
</tr>
<tr>
<td>Second experience (N=51)</td>
<td>5.9</td>
<td>66.7</td>
<td>15.7</td>
<td>11.8</td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil engineering (N=47)</td>
<td>nil</td>
<td>34.1</td>
<td>17.0</td>
<td>49.0</td>
</tr>
<tr>
<td>Textile technology (N=18)</td>
<td>nil</td>
<td>38.9</td>
<td>33.3</td>
<td>27.8</td>
</tr>
<tr>
<td>Applied biology (N=16)</td>
<td>nil</td>
<td>18.8</td>
<td>81.3</td>
<td>nil</td>
</tr>
</tbody>
</table>

¹. Chemical, Electrical and Mechanical Engineering.

However, the apparent simplicity of Table 2.8 masks a considerable variation in what the students actually did. The thin sandwich students after their first period of industrial training were also asked to give a brief description of what their work involved:

**Chemical Engineering**

“Mainly obtaining practical experience in several production departments of the factory.”

“Chemical analysis of organics by gas chromatography.”

“Mainly routine testing of daily production.”
“Mainly routine work on the physical property changes of paint.”
“Research into building materials, expansion of bricks etc.”

**Electrical Engineering**
“Spent allotted time in the five training camps within the training centre. Familiarization with ABC of running an industry.”
“First 3 months servicing radio receivers, record players etc. Second three months mechanical engineering, some electrical in training centre.”
“Began in test and inspection department. Went to training school for basic workshop training, spent remaining time in development lab.”
“Mainly in a basic training workshop, doing electrical fitting and mechanical work. Also a little drawing.”

**Mechanical Engineering**
“Basic workshop training. Filing piece of metal etc.”
“10 weeks apprentice training school. 2 months in machine shop working on many different machines. 1 week with plumbers. 1 week blacksmiths. 2 weeks sawmill on many different machines.”
“Work of an apprentice fitter.”
“Basic engineering work applied mostly to the motor industry. Operation of many types of common machines, mostly those involved with production. Standards and inspection work.”
“Helping skilled fitters in erecting turbines.”

The civil engineering students usually joined either a contractor where they were mainly engaged in supervising site work (where they often had a considerable measure of responsibility) or a firm of consultants where they were mainly engaged in design. Another common placing was with a local authority, moving from department to department. It was not usual for the civil engineers to be given a project and, where they have claimed to have spent their time on a project, it is more likely to have been a feasibility study than research.

Textiles students usually joined a large textiles firm where they moved from department to department gaining experience in sales, costing, time and motion study, supervising production work and so on. But, for some of the students, work on the production side, including running and servicing the equipment, came to dominate
the experience. Where projects were given they were usually feasibility studies such as the evaluation of new machinery or sorting out some specific operating problem.

The experience of the applied biologists is illustrated in the following chapter. They mainly spent their time in government research laboratories where they joined research groups as research assistants. Quite often the students were given their own problems to work on, and sometimes this led to publication.

Table 2.9: Attitude Change and Type of Experience

<table>
<thead>
<tr>
<th>Course</th>
<th>Change in Attitude (Scale Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Training school</td>
</tr>
<tr>
<td>Thin Sandwich²</td>
<td></td>
</tr>
<tr>
<td>First Experience</td>
<td>-14.2</td>
</tr>
<tr>
<td>Second Experience</td>
<td>-11.3</td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>nil</td>
</tr>
<tr>
<td>Textile Technology</td>
<td>nil</td>
</tr>
<tr>
<td>Applied Biology</td>
<td>nil</td>
</tr>
</tbody>
</table>

1. On the Attitude to Industrial Training scale a rise in scores indicates a deterioration in attitude. In order that the signs should carry their usual meaning in this and subsequent tables this has been reversed so that a minus sign means that attitudes have become less favourable and a plus sign they have become more favourable.

2. Chemical, Electrical and Mechanical Engineering.

In Table 2.9 the students’ changing attitudes to industrial training are shown by type of experience. The thing which stands out is that those on project work, in spite of the different meanings attached to this term, tended to maintain their initial, usually highly favourable, attitudes to industrial training or even improve them. For the students sent to factories, those on thin sandwich courses and the textile technologists, there did not seem to be any marked differences between the other types of experience, but in all cases there was a noticeable deterioration in attitude. The civil engineers out on site work or with local authorities did not change in attitude much, presumably having learned what to expect while at university.

Experience of Bureaucracy

The firms and organizations to which the students go are bureaucracies. They are, as Musgrove (1968a) has commented, ‘in varying degrees, centralized and formalized’. That is, they differ in the degree to which members participate in decision making, and the degree of work standardization. Musgrove took his operational definition of bureaucracy from Aiken and Hage (1966) who found that both alienation from work and alienation from expressive relations tended to occur more in highly centralized and highly formalized organizations.

The organizational indices of Aiken and Hage were used as the basis of a 14-item experience of bureaucracy scale. This has four aspects since both centralization and
formalization can be subdivided, the former, into hierarchy of authority (‘I had to ask my superior before I could do almost anything’) and participation in decision making (‘I had some share in decisions about new practices’), the latter, into job codification (‘Most people made their own rules on the job’) and rule observation (‘Employees were constantly being checked on for infringement of rules’). The students were asked to indicate on a five-point scale the extent of their agreement with each of the items as applied to their work situation. Since there are 14 items in all, the scale runs from 14 to 70, with low scores indicating the greater experience of bureaucracy.

Table 2.10: Experience of Bureaucracy

<table>
<thead>
<tr>
<th>Course</th>
<th>Mean Scores</th>
<th>Level Bureaucracy Experienced</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Thin Sandwich</strong>²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Experience</td>
<td>84</td>
<td>39.9</td>
<td>10.8</td>
</tr>
<tr>
<td>Second Experience</td>
<td>51</td>
<td>37.8</td>
<td>10.8</td>
</tr>
<tr>
<td><strong>Thick Sandwich</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>47</td>
<td>49.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Textile Technology</td>
<td>18</td>
<td>47.2</td>
<td>9.5</td>
</tr>
<tr>
<td>Applied Biology</td>
<td>16</td>
<td>52.3</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Early reports of the relationships between experience of bureaucracy and attitudes to industrial training were given by Musgrove (1968a, 1970), but here the data have been reworked and further analysed. Any differences between the present results and those appearing before can be accounted for by the use of a 32-item attitude-to-industrial training scale and the inversion of the experience of bureaucracy scale in some of the earlier studies. The data of Table 2.10 show that, in terms of mean scores on the above scale, the civil engineers and other students on thick sandwich courses generally had a milder experience of bureaucracy than the engineers on thin sandwich courses for whom the second period did not differ much from the first. If the scores are re-expressed by dividing the range of possible scores into three, it can be seen that fewer of the students going to factories, the thin sandwich engineers and textile technologists, enjoyed a mild experience than the civil engineers out on site work and elsewhere, and the applied biologists in their laboratories. Portraying the scores in this way shows that proportionately more thin-sandwich students had a severe experience of bureaucracy during their second period of industrial training than the first.

Table 2.11 shows scores on the experience-of-bureaucracy scale examined in relation to the post-industrial training attitude scores. In all five groups, the more severe the experience of bureaucracy the greater the tendency for attitude to industrial training to be less favourable (although in the case of the civil engineers the relationship just falls short of statistical significance). It appears then that one group of factors
influencing students’ rating of their industrial training was the characteristics of the bureaucracies in which they found themselves.

Table 2.11: Attitude Change\(^1\) and Experience of Bureaucracy

<table>
<thead>
<tr>
<th>Course</th>
<th>Experience of Bureaucracy</th>
<th>Correlation(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild</td>
<td>Moderate</td>
</tr>
<tr>
<td>Thin Sandwich(^1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Experience (N=84)</td>
<td>-9.3</td>
<td>-11.2</td>
</tr>
<tr>
<td>Second Experience (N=51)</td>
<td>+0.3</td>
<td>-6.0</td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineering (N=47)</td>
<td>+1.1</td>
<td>-1.7</td>
</tr>
<tr>
<td>Textile Technology (N=18)</td>
<td>-1.1</td>
<td>-4.3</td>
</tr>
<tr>
<td>Applied Biology (N=16)</td>
<td>+14.8</td>
<td>+4.2</td>
</tr>
</tbody>
</table>

1. On the Attitude to Industrial Training scale a rise in scores indicates a deterioration in attitude. In order that the signs should carry their usual meaning in this and subsequent tables this has been reversed so that a minus sign means that attitudes have become less favourable and a plus sign they have become more favourable.

2. Correlation between measures of attitude to industrial training and experience of bureaucracy: significant beyond 5 per cent level *: beyond 1 per cent level **

3. Chemical, Electrical and Mechanical Engineering.

4. One case only.

**Time-Span of Discretion**

A related notion is that of time-span of discretion. This was introduced by Elliott Jaques (1956) as a means of assessing the work level of a job. He was able to show that the maximum time-span of discretion a person has is a reasonable indication of his responsibility within a company. He found maximum time-spans ranging from weeks for managers to a few hours for hourly-paid workers.

We adapted this idea for our own purposes. As an indication of the freedom which students enjoyed during their industrial training we asked them to say on a five-point scale ranging from ‘every hour or more’ to ‘less frequently than once a week’ how often their work was checked by the person to whom they were responsible.

Table 2.12: Attitude Change\(^1\) and Frequency with which Worked Checked

<table>
<thead>
<tr>
<th>Course</th>
<th>Hourly %Students</th>
<th>Attitude Change</th>
<th>Every Few Days %Students</th>
<th>Attitude Change</th>
<th>Weekly %Students</th>
<th>Attitude Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin Sandwich(^2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Experience</td>
<td>16.7</td>
<td>-15.9</td>
<td>61.9</td>
<td>-12.1</td>
<td>21.4</td>
<td>-9.7</td>
</tr>
<tr>
<td>Second Experience</td>
<td>15.7</td>
<td>-12.3</td>
<td>51.0</td>
<td>-4.5</td>
<td>33.3</td>
<td>-8.4</td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>nil</td>
<td>nil</td>
<td>29.8</td>
<td>+2.6</td>
<td>70.2</td>
<td>-1.4</td>
</tr>
<tr>
<td>Textile Technology</td>
<td>5.6</td>
<td>-18.0</td>
<td>50.0</td>
<td>+2.3</td>
<td>44.4</td>
<td>-9.0</td>
</tr>
<tr>
<td>Applied Biology</td>
<td>Nil</td>
<td>nil</td>
<td>56.3</td>
<td>+17.0</td>
<td>43.8</td>
<td>+8.9</td>
</tr>
</tbody>
</table>

1. On the Attitude to Industrial Training scale a rise in scores indicates a deterioration in attitude. In order that the signs should carry their usual meaning in this and subsequent tables this has been reversed so that a minus sign means that attitudes have become less favourable and a plus sign they have become more favourable.

2. Chemical, Electrical and Mechanical Engineering.
Table 2.12 shows that the thin sandwich students were usually checked upon every one, two or three days during their first two periods of industrial training, but the thick sandwich students, particularly the civil engineers, tended to have more freedom. About a sixth of the thin sandwich students had their work inspected every hour or more, but only one thick sandwich student, a textile technologist, was similarly supervised. In Table 2.12 changes in attitude to industrial training are examined in relation to time-span of discretion. It shows that those who were checked most frequently tended to develop the least favourable attitudes to industrial training, and there is also some suggestion that very infrequent supervision was more likely to result in unfavourable attitudes than regular supervision every one, two or three days.

**Level of Skill**

In order to assess the level of skill seen to be involved in the work on industrial training students were asked about the amount of time they had spent on ‘skilled work’, ‘semi-skilled work’ and ‘observation’. They were asked to use the five categories: ‘all’, ‘majority’, ‘about half’, ‘minority’, ‘none’. The distribution of work in these terms is shown in Table 2.13.

<table>
<thead>
<tr>
<th>Course</th>
<th>Skilled work</th>
<th>Unskilled work</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Students</td>
<td>Attitude Change</td>
<td>% Students</td>
</tr>
<tr>
<td>Thin Sandwich¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Experience</td>
<td>33.3</td>
<td>-8.5</td>
<td>25.0</td>
</tr>
<tr>
<td>Second Experience</td>
<td>35.3</td>
<td>-1.4</td>
<td>15.7</td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>72.3</td>
<td>-1.1</td>
<td>8.5</td>
</tr>
<tr>
<td>Textile Technology</td>
<td>33.3</td>
<td>+3.8</td>
<td>27.8</td>
</tr>
<tr>
<td>Applied Biology</td>
<td>81.3</td>
<td>+11.4</td>
<td>nil</td>
</tr>
</tbody>
</table>

1. On the Attitude to Industrial Training scale a rise in scores indicates a deterioration in attitude. In order that the signs should carry their usual meaning in this and subsequent tables this has been reversed so that a minus sign means that attitudes have become less favourable and a plus sign they have become more favourable.

2. Percentage of students does not equal 100 because their experience varied.

3. Chemical, Electrical and Mechanical Engineering.

Again there is a clear difference between the thin sandwich course students and textile technologists, on the one hand, and the civil engineers and applied biologists on the other. Those students going to factories were much less likely to class their work as skilled, and to report more time on observation. Among these students, the data of Table 2.13 indicate that those who considered most of their work to be unskilled were more likely to develop unfavourable attitudes to industrial training than those who regarded it as skilled. Among the thin sandwich students, this also happened with those spending most of their time on observation. Nearly all the civil engineering and applied biology students described their work as skilled and this was associated with the maintenance or improvement of attitude ratings.
Occupational Level of Staff

Students were also asked about the length of time they had spent with personnel at different levels. They were asked to indicate on a scale which ran from zero to 100 per cent, the proportion of time they had spent with ‘management’, professional, technical staff’, ‘skilled workers’ and ‘unskilled workers’. The picture that emerged is given in Table 2.14 although, of course, the average scores conceal wide variation in individual experiences. The thin sandwich engineers during their first two industrial training periods spent most of their time with workers, whether skilled or unskilled, and apparently saw very little of the management. The pattern is not very different among the textile technologists although they reported spending rather more time with management. The civil engineering students and applied biologists spent on average over half their time with professional, technical staff.

Table 2.14: Contact with Staff by Occupational Level

<table>
<thead>
<tr>
<th>Course</th>
<th>%Time With</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Management</td>
<td>Professional, Technical</td>
<td>Skilled</td>
<td>Unskilled</td>
<td>Management</td>
<td>Professional, Technical</td>
<td>Skilled</td>
</tr>
<tr>
<td>Thin Sandwich</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Experience</td>
<td>5.4</td>
<td>39.2</td>
<td>40.2</td>
<td>15.1</td>
<td>4.5</td>
<td>41.2</td>
<td>40.4</td>
</tr>
<tr>
<td>Second Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>9.3</td>
<td>54.9</td>
<td>19.8</td>
<td>16.1</td>
<td>15.8</td>
<td>40.1</td>
<td>21.5</td>
</tr>
<tr>
<td>Textile Technology</td>
<td>12.3</td>
<td>60.4</td>
<td>20.8</td>
<td>6.5</td>
<td>12.3</td>
<td>60.4</td>
<td>20.8</td>
</tr>
<tr>
<td>Applied Biology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When, as in Table 2.15, improvement or deterioration in attitude to industrial training is looked at in relation to the proportion of time spent with different levels of employee, it is clear that the greatest drift towards unfavourable ratings occurred among those students who reported spending most of their time with unskilled workers.

Table 2.15: Attitude Change1 and Occupational Level with which Most Time Spent

<table>
<thead>
<tr>
<th>Course</th>
<th>Professional/Technical</th>
<th>Skilled Workers</th>
<th>Unskilled Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Students²</td>
<td>Attitude Change</td>
<td>% Students</td>
</tr>
<tr>
<td>Thin Sandwich</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Experience</td>
<td>39.3</td>
<td>-7.6</td>
<td>41.7</td>
</tr>
<tr>
<td>Second Experience</td>
<td>47.1</td>
<td>-4.0</td>
<td>35.3</td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>51.2</td>
<td>+0.3</td>
<td>38.3</td>
</tr>
<tr>
<td>Textile Technology</td>
<td>50.0</td>
<td>+1.4</td>
<td>11.1</td>
</tr>
<tr>
<td>Applied Biology</td>
<td>62.5</td>
<td>+11.9</td>
<td>18.8</td>
</tr>
</tbody>
</table>

1. On the Attitude to Industrial Training scale a rise in scores indicates a deterioration in attitude. In order that the signs should carry their usual meaning in this and subsequent tables this has been reversed so that a minus sign means that attitudes have become less favourable and a plus sign they have become more favourable.
2. Percentage of students does not equal 100 because some saw their time as divided equally between two levels of experience.
3. Chemical, Electrical and Mechanical Engineering.
Thus, in addition to field of study, it appears that the type of experience, the bureaucratic features of the work situation, how often the students’ work is checked, the level of skill involved and staff contact, all have some bearing on attitudes to industrial training as measured by the Likert-type scale.

**Entry Qualifications**

The effects of the student's personal characteristics will be considered in Chapter 5, but in order to help us understand students’ initial expectations for the experience it is worth considering at this stage the relationship between entry qualifications and attitudes. It will be remembered that most of the engineering students on thin sandwich courses looked forward to industrial training with highly favourable attitudes, the mean score just less than 60 on a scale running from 30 (favourable) to 150 (unfavourable). These entrants were mostly school leavers who presumably formed their ideas of what to expect from what they had been told and what they had read in the college prospectuses.

But a small number of the students entering on ONC qualifications will already have had some experience of industry. Of the sample of 84, there were eight ONC entrants and their initial scores were less favourable and the mean change in attitude during the first experience was only two units on the Likert-type scale compared with 13.5 for those entering straight from school. When the A-level entrants were divided into those with good passes and those with poor passes (UCCA definition) there was no difference. During the second experience the extent of the change among the ONC entrants and the A-level entrants was similar being about five scale units in both cases. This difference between those with and without previous industrial experience suggests that the school-leavers may have entered upon sandwich courses with unrealistic expectations.

**Implications for Industrial Training**

We have seen that students on both thin and thick sandwich courses entered university hoping for a great deal from industrial training, but that in certain, perhaps crucial ways, they were disappointed. While they rated it highly as an opportunity for social learning in the broad sense, and as an opportunity for learning about the problems and modes of operation of industrial organizations, they did not accept that their experience bore much relation to their academic studies. Nor are these views peculiar to Bradford. Jahoda (1963), Marris (1964), Rice (1965), Heward, Mash and Heywood (1968), Burgess and Pratt (1970) and Smith (1971) have all found indications that industrial training tends to become more a parallel education than an integral part of a complete course.

Even the biologists in the present survey who were generally more enthusiastic than the other students about industrial training did not see it as a time for putting theory
into practice. Rather they saw a relationship with university studies at the general level of learning to be a scientist.

There are, then, reasons for doubting whether the first, perhaps the key objective, for industrial training formulated by the National Council for Technological Awards - that it ‘should illustrate the application in practice of the scientific principles which the student has been taught in college’ – is being attained. It is on this objective that the justification for alternating periods of industrial training and college study really rests. The other benefits of industrial experience: seeing modern plants in operation, learning how firms work and about the people in them, developing social maturity, trying out a future career and so on, could all conceivably be got from periods in industry combined in some way with the conventional three-year course. The students perhaps would learn as much from a spell(s) in industry before starting their courses, or afterwards, or during the long vacations. In Heward, Mash and Heywood’s (1968) study more than three-quarters of those who were satisfied with industrial training would have preferred it to have been placed between leaving school and going to university. In Batcock and Musgrove’s (1970) study of industry’s views on sandwich courses, in spite of being specifically asked not to consider ‘sandwich courses’ which include an unbroken period of three years at university, for example, the 1-3-1 arrangement or the 3-2 arrangement, a number of respondents expressed preference for patterns of this kind. For example, the training officer for a large agricultural machinery firm wrote:

The discontinuity of the sandwich course appears to limit the character development of the student. I would prefer to think that they should be abandoned in favour of the full-time or 1-3-1 format.

The research experience which the biology students apparently found so valuable could perhaps have been equally well placed at the end of the course, as it traditionally is in postgraduate study.

The largely favourable reactions of the biologists to industrial training contrast with those of the technologists, and this represents something of a paradox. For sandwich courses were really invented with students of engineering in mind and got carried over to the sciences in the general application of policy. Industrial training does not have the same apparent relevance to the sciences as it does to engineering, and this is reflected in the students’ initial attitudes to the experience. Nevertheless, in the event, it was the scientists who were pleasantly surprised, and the engineers who were disappointed.

This difference has also emerged in other studies. Heward, Mash and Heywood (1968) in a survey among final year students at five colleges found that all the biologists were ‘satisfied’ with industrial training compared to only 21 per cent of the electrical engineers and 31 per cent of the mechanical engineers. Similarly, in
Jahoda’s (1963) study, appreciably more scientists were classed as having had a ‘good experience’ than engineers.

Why there should be this difference is not clear. But the very absence of a related industry may well be an important factor. For biologists, and presumably other scientists, industrial training is in many ways a continuation of their university experience. Working as they often do in research laboratories as members of research groups, they enjoy something comparable to an MSc year interpolated between the second and third years of their undergraduate studies. It is less difficult for them to appreciate an experience of this kind as a continuation of their personal education.

On the other hand, when technologists go out into industry per se they enter organizations whose main business is not training or education. They have to live with industry as it is and adjust to its demands of production and profit. In a sense that is the whole point of them being there. And so while, in fact, they are probably learning a great deal, neither this nor their personal contribution to the firm is readily apparent. This emerges in some of the things the students said about industrial training on the sentence completion schedule.

“Observe other people, but no chance to do anything.”

“I was part of a production line.”

“I was in the way.”

“Work on my own and try out my own ideas.”

“Show initiative in designing various articles.”

“Work on my own, putting my ideas into use.”

The examination of factors affecting reactions to industrial training also appears to support this argument. For example, of the types of experience, project work seemed to be the most highly regarded. This label was applied to a whole range of experiences, but what they seem to have in common is that the student was given some personal responsibility for completing a task of some importance.

The relationships between experience of bureaucracy and time-span of discretion, and attitudes to industrial training can also be interpreted in this way. High scorers on the bureaucracy scale were saying, in effect, that they had little scope for independent action, that the work was closely prescribed, that even small matters had to be referred to someone higher up and they were constantly being checked upon. It is perhaps not surprising that university students should not take kindly to experiences of this kind and express their dissatisfaction through the Likert-type scale. The degree of freedom given to the students was also examined in terms of their time-span of discretion. The findings here confirm those with the experience of bureaucracy scale,
but bring out the further point that to be neglected is almost as bad as being severely constrained.

Jaques (1956) used time-span of discretion as an indication of occupational level and status. If we use it in that way we find that the older and more experienced thick sandwich students, particularly the civil engineers and applied biologists, were generally given more responsibility than the thin sandwich students during their first year’s (two periods) industrial training. This is supported by the students’ reports on the proportion of time spent on skilled work and the relative amounts of time spent with different levels of employee. Both of these features influenced students’ attitudes to industrial training with the more favourable occurring among those called upon to do skilled work in the company of professional technical staff or skilled workers.

Although responses to both the experience of bureaucracy scale and the time-span of discretion instrument are probably comments on the kind of supervision the students received while in industry the quality of industrial supervision was not studied directly. Cohen (1970) has, however, made a study of the relationships between some of the students of the present inquiry and their industrial supervisors. He found that they tended to view each other’s roles rather differently. The students reported that their supervisors were primarily job-oriented and made little effort to integrate the training with their university studies. The tutors in turn tended to regard the students as trainees. Cohen (1970) interpreted these findings as showing that a more determined effort needs to be made to bring the two parts of sandwich courses closer together.

It looks as if the integration of the two parts of sandwich courses as originally envisaged is not being attained. It is something that the colleges have been working for since the inception of sandwich courses, but it appears that they have been defeated by the very nature of industrial experience. It is this immersion in industry as it is that industrialists apparently find so valuable. Very few seem to attach much importance to the relation with university studies (Musgrove, 1972). Should then the acknowledged benefits of industrial training in university courses be set aside and some other arrangement tried, for example, a year intervening between school and university? It might well be so. But against this it could be argued that industrial experience was found useful in learning about industry as a socio-technical system. Also, whatever their views on integration and technical learning, the students’ overall impressions remained predominantly favourable.

We shall take up these points in the final chapter when we attempt an evaluation of sandwich courses. However, there seems little doubt that students do enter upon these courses with unrealistic expectations. What seems to be needed is a clear and honest reappraisal of this type of education, and for its actual possibilities and difficulties to be made widely known.
III. THE EXPERIENCE OF APPLIED BIOLOGISTS

As we have seen in Chapter 1, the introduction of periods of industrial training into degree level courses in the biological sciences was largely fortuitous. With the establishment of the National Council for Technological Awards, in 1955, there were obvious advantages for technical colleges to obtain approval for as many of their courses as possible. Several biology departments with experience of teaching courses for external degrees of the University of London, including Bradford’s switched their main effort to the new Diploma in Technology - a requirement of which was at least one year’s integrated industrial training. When Bradford became a university in 1966 biology continued as applied biology leading to the award of a BTech degree.

Finding suitable industrial placements posed something of a problem since there is little biological industry as such. There are industries, like the canning and brewing industries, which are concerned with the processing of biological materials, but the expertise required here is more that of engineering than biology. A case could have been made for some biological equivalent of chemical engineering. But, applied biology as it emerged (Gillett, 1964; Wyatt, 1969) was essentially the old London external degree syllabus plus some ‘industrial’ training. A lot of effort was expended in the search for suitable ‘industrial’ placements, but almost inevitably given the nature of the courses, the colleges tended to settle mainly for places in commercial and government research laboratories.

The Nature of the Industrial Placements

Some indication of how the Bradford biology students spent their time in ‘industry’ may be obtained from the reports which they were required to submit at the end of their employment periods. These accounts, although they were not used for assessment purposes, not surprisingly tend to be rather formal. But nevertheless they do convey the flavour of the students’ experiences.

A few students were sent to the food industry where they were mainly involved in quality control.

“Times ranging from days to months spent in each factory department. Work included monitoring waste, water metering, testing products for pathogens, work study and weight control. Comment: excellent general background for people going into any field in the food industry.”

“I had control of a dozen subordinates who performed routine quality checking operations at various stages of the processing of canned processed peas, fresh peas and tomato soup. I reported any faults in can quality and deviations from accepted standards for product quality, spoilage and general hygiene to the shift management who took the appropriate action.”
But the majority were placed in the laboratories of commercial organizations or government research institutes where, with varying degrees of responsibility, they worked on a wide range of problems. Occasionally, a student would have the opportunity of spending most of his time on a project largely of his own choosing.

“The whole of my period was spent working on a single project - a study of the spoilage of sterile fish substrates by pure cultures of marine bacteria. This project initially involved inoculating the sterile substrates (filtration-sterilized press juice of muscle and ethylene-oxide-sterilized whole muscle) with cultures from the National Collection of Marine Bacteria. The cultures were incubated at 0°C and assessed organoleptically and chemically for spoilage ability. Isolates were then made from fresh and spoiling fish and an attempt made to assess these for spoilage. Thus the proportion of potential spoilers after different periods of storage was investigated. (Some further growth studies are then described.) The growth studies together with writing a paper on the work and general reading took up the remainder of the period.”

More usually the students entered into the routine work and research work of their laboratories and were assigned one or more short-term projects.

“I was incorporated into the routine work pattern of the laboratory and also assigned several short-term projects. The routine work pattern was organized to allow every member of the laboratory to use all of the techniques employed in the laboratory. After an initial training period, I was therefore responsible for routine examination of food products sold in all the company’s London shops, and of some of the products of its factories. Microbiological examinations of dairy products such as lactic cheese, cream cheese, condensed milk, un-sweetened evaporated milk, creams and rennet were carried out. Canned and frozen foods were examined, as were raw materials which were to be used in manufacturing processes. The laboratory received all of the consumer complaints of a biological nature. I was responsible for the identification of microbial contaminants and of insects received. Problems which arose in processing plants and depots were received by the laboratory, and assigned to individuals as short-term projects under the direction of my supervisor. I received instruction in modern methods of isolation and characterization of pathogenic bacteria, including the serotyping of Salmonella and Streptococcus species.”

“The main stream of the work was orientated around meat quality and the various factors which affect it. These influencing factors, which can be divided into two groups, ante-mortem and post-mortem, have their influence on quality through the phenomena of post-mortem metabolism
and pH fall. During the year, these two basic phenomena were investigated. The work was then altered in emphasis to investigate the several ante- and post-mortem metabolism factors which influence the rate and duration of post-mortem metabolism and therefore the rate and extent of post mortem pH fall. Associated with this work were the problems of defining meat quality and developing objective methods for measuring the parameters which constituted the definition. For instance, some time was spent on the techniques for measuring meat colour, since this was a major parameter in the assessment of meat quality.”

“During the first half of my employment I was a member of the microscopy section of the laboratory and carried out the two projects mentioned above. The separation of light filth, i.e. rodent hairs and excreta, and insect fragments, was by an oil/water separation and involved much tedious work. Also during this period I carried out a short investigation into the origin of a high Clostridium welchii count in one of the company’s products, and was able to conclude that it had arisen during grinding and mixing of the components and therefore recommend hygiene improvements at the manufacturing plant. Some time was also spent in the identification of foreign bodies, etc., returned as consumer complaints.”

“During the year a little time was spent helping in most of the work of the department. However, most of my time was spent on the translocation work and mainly involved a comparison of different techniques of counting, using both end window counters and scintillation counting, preparation of samples for counting and in the actual feeding of labelled $14^\text{CO}_2$ to plant leaves in different concentrations and in evaluation of the results. This I think has provided me with a sound background to isotope work and all the problems involved. I also had to prepare a number of autoradiographs of freeze-dried plants to show the rough distribution of isotope in the plant, this was then followed up by determinations of total activity of various plant fractions, i.e. fed leaf; leaves older than fed leaf; leaves younger; main stem; roots; other tillers etc. Then finally work was started on determination of the activities of the various carbohydrates, etc. in these fractions. This work will still be in progress and full results of my work will probably not be compiled for a few months yet.”

These experiences are clearly different from each other, but what they do have in common is that the students were all working in laboratories, learning - hopefully - how to apply scientific methods to the solution of problems. The term ‘industrial training’ does not seem altogether appropriate to describe experiences of this kind.
The First BTech Students

It seems implicit in the placing of students that an important objective of the supervised periods away from college is to provide research experience. Specifically, discussions with colleagues in the School of Applied Biology at Bradford suggested that they might be expected to provide experience in the ‘design of experiments’, ‘execution of experimental work’, ‘interpretation of results with a supervisor’, ‘independent evaluation of results’, ‘consultation of papers’ and the ‘writing of reports’. In addition, it was thought that the students might be introduced to the ‘use of instruments not available in the university’ and might learn some ‘specialized techniques relevant to the final year’s work’ (cf. Broadbent, 1968).

These eight statements were used to form the basis of a questionnaire which was included in a study among the first groups of students to successfully complete the DipTech course in Applied Biology at the University of Bradford. (Originally diplomates, their qualification was subsequently transmuted to a degree.) At the time of the inquiry, in 1967, there had been a total of 47 diplomates, and, of these 36 returned questionnaires. In addition to rating various aspects of their experiences, respondents were also invited to give their general impressions.

Applied biology courses at the University of Bradford are organized on the thick sandwich principle, with students spending the whole of the third year of the four-year course away from the University. The whole period may be spent working in one section or laboratory, or it may be divided up in some way. It is not uncommon, for example, for students to spend two periods of six months working in different organizations or in different sections of the same organisation. Where this is the case, the two departments may be side-by-side or in different parts of the country. Since even neighbouring departments can differ appreciably, students were asked to complete a questionnaire for each situation in which they had worked. The 36 respondents provided information about 53 placements. Only seven were not laboratory-based and these have been omitted from the analysis below.

The biology students appear to have been predominantly satisfied with their sandwich placements as periods of scientific training. Table 3.1 shows that about four-fifths of the placements were rated as providing ‘good’ or ‘very good’ experience in carrying out experimental work and none were rated as ‘poor’ or ‘very poor’. More than twice as many placements were seen as providing ‘good’ or ‘very good’ experience in the design of experiments, writing of reports, consultation of papers, and independent and assisted interpretation of results, as were thought ‘poor’ or ‘very poor’ in these respects. However, only a minority of the placements were said to provide ‘good’ or ‘very good’ experience in the use of equipment not available in the university, and less than half the placements were seen as providing ‘good’ experience in techniques relevant to the final year’s work.
Table 3.1: Placements as Scientific Training (N=46)

<table>
<thead>
<tr>
<th>Aspect of Training</th>
<th>% Very Good/Good</th>
<th>% Satisfactory</th>
<th>% Very Poor/Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of experiments to final year’s work</td>
<td>56.5</td>
<td>34.8</td>
<td>8.7</td>
</tr>
<tr>
<td>Techniques relevant to final year’s work</td>
<td>41.3</td>
<td>21.7</td>
<td>37.0</td>
</tr>
<tr>
<td>Execution of experimental work</td>
<td>80.4</td>
<td>19.6</td>
<td>nil</td>
</tr>
<tr>
<td>Writing of reports</td>
<td>50.0</td>
<td>26.1</td>
<td>23.9</td>
</tr>
<tr>
<td>Independent evaluation of results</td>
<td>52.2</td>
<td>28.3</td>
<td>19.6</td>
</tr>
<tr>
<td>Use of instruments not available in university</td>
<td>21.7</td>
<td>34.8</td>
<td>43.5</td>
</tr>
<tr>
<td>Consultation of papers</td>
<td>63.0</td>
<td>19.6</td>
<td>17.4</td>
</tr>
<tr>
<td>Interpretation of results with supervisor</td>
<td>67.4</td>
<td>17.4</td>
<td>15.2</td>
</tr>
</tbody>
</table>

These assessments are not independent, but can be linked in one of two ways: (a) some respondents had worked in more than one laboratory during their industrial year and have given their reactions to both and (b) students are placed in more or less the same organizations from year to year so that we can have the reactions of several different people to the same laboratory. Eleven of the respondents had worked in more than one laboratory. Product-moment correlation coefficients computed across the eight items of the questionnaire for these diplomates showed that, in part, the assessment of the experience was a function of who was doing the assessing. The correlation coefficients ranged from -0.93 to +0.91. Five were significant: four positive, and the highly negative one. As a student this respondent had been very dissatisfied with his first placement and had been moved on that account. In filling out the questionnaire he appears, consciously or otherwise, to have contrasted the two situations.

Nine laboratories had been visited by more than one student. Again product-moment correlation coefficients were calculated and a fair measure of agreement between the respondents found, but not in all cases. The coefficients ranged from -0.23 to +0.83. In all, eight of the nine coefficients were positive and four were significant.

Thus although there is some tendency for students to evaluate two different experiences alike and for experiences in the same laboratory to be rated similarly, there is also an important element of interaction. When the data of Table 3.1 were corrected for bias by taking the average of correlated assessments, the distribution already described remained substantially unaltered. The length of time which a student remained in one laboratory ranged from three to 12 months.

In Table 3.2 ratings of experiences in which the whole year was spent in one laboratory are compared with ratings of shorter placements. Bearing in mind the small number of assessments and the related nature of some of the data, too much should not be read into these findings.
Table 3.2: Ratings of Experience by Length of Stay

<table>
<thead>
<tr>
<th>Aspect of Training</th>
<th>% Rated Very Good/Good One Placement (N=21)</th>
<th>% Rated Very Good/Good More (N=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of experiments</td>
<td>71.4</td>
<td>44.0</td>
</tr>
<tr>
<td>Specialized techniques relevant to final year’s work</td>
<td>42.9</td>
<td>40.0</td>
</tr>
<tr>
<td>Execution of experimental work</td>
<td>81.0</td>
<td>80.0</td>
</tr>
<tr>
<td>Writing of reports</td>
<td>57.1</td>
<td>44.0</td>
</tr>
<tr>
<td>Independent evaluation of results</td>
<td>61.9</td>
<td>48.0</td>
</tr>
<tr>
<td>Use of instruments not available in the university</td>
<td>23.8</td>
<td>24.0</td>
</tr>
<tr>
<td>Consultation of papers</td>
<td>81.0</td>
<td>52.0</td>
</tr>
<tr>
<td>Interpretation of results with supervisor</td>
<td>81.0</td>
<td>56.0</td>
</tr>
</tbody>
</table>

There does, however, appear to be some tendency for those who had spent the whole year in one place to report more favourably on the experience than those who had moved around. This could be due to various reasons. The longer period, for example, probably provides more opportunity for a substantial project to be carried through to completion. But also, as we have seen, some students are moved because their first placement is unsatisfactory in some way.

Other Aspects of the Experience

In the second part of the questionnaire, respondents were asked to add as items any aspects which they felt had not been covered in the rating scales. Of the 47 contributed, 43 were rated as good and three as poor features (one was neutral). The three unfavourable comments referred mainly to individual sources of dissatisfaction. For example, one was lack of “opportunity to follow up findings in pure research.”

The 43 favourable comments were typed on cards and independently sorted by six judges, three each from the Schools of Research in Education and Applied Biology. There was good agreement between the judges suggesting that the statements fell fairly naturally into four categories: broadening of scientific experience; extension of practical work; learning about organizations; and general development.

About a quarter of the statements referred to a broadening of scientific experience: “opportunity to attend scientific meetings”, “the opportunity to meet and discuss problems with people of other biological disciplines” and “the chance to visit several biological research stations and exhibitions”. A similar proportion of the statements pointed to the employment experience as an extension of practical work: “the design of apparatus” and “reliability and rapidity of technique”. A few of the statements that have been included in this category refer to the applicability of science: for example, “efficient use of science in industry”.
In addition to being seen as a period of scientific training, the employment experience was commented upon as an opportunity for **learning how to participate effectively in organizations**. Rather more than one-third of the statements were assigned to this category. In particular, references were made to (a) dealing with people, for example, “management of people”, “tact and diplomacy” and “dealing with people, both workers and staff of other firms”; and (b) understanding the organization, for example, “the structure and running of an industrial concern”, “knowledge of scientific civil service” and “understanding of industrial workings and problems”.

A fourth group of statements referred to more general **aspects of personal and intellectual development**, for example, “thinking on one’s feet”, “opportunity for independent thought” and “taking responsibility”. These four categories, the last two particularly, are reminiscent of the Likert-type attitude-to-industrial training scale (which the participants in this inquiry had not seen) and add to our confidence in its content validity.

**Discussion**

The interpolated year seems to have been much appreciated by the first BTech students in Applied Biology at Bradford for its value as a period of scientific training and as a period of learning how to participate effectively in organizations. Most of the students - those sent to laboratories anyway - were involved in actual research as opposed to the simulations of their college exercises. In addition, they reported enjoying a general broadening of experience, of meeting and working alongside professional scientists uninhibited by the staff/student dichotomy as they might be at the University, of attending scientific meetings (sometimes to read papers) and of visiting research stations. These ends are also presumably served by a period of postgraduate research. However, one argument for incorporating experience of this kind into undergraduate courses is that it ensures that it is available to all students and not just a selected few. A former student who is now a college of education lecturer wrote: “Industrial experience is proving of immense value, particularly when it comes to supervising students’ project work.” Experience of employment as an undergraduate also gives students an idea of employment opportunities: “Also, when we returned to college we chatted together and we were able to build up a fair picture of the different aspects of biology open to us when we left University.”

But the merits of this form of education have to be set against important disadvantages. There is, for example, the interruption of academic studies and interference with the student’s university life which the discontinuities in the sandwich system involve. The Bradford Applied Biology course is a thick sandwich which means that there is a gap of some 15 months between the second and third years of the course. The two or three visits by academic staff to the students in their placements form only the slenderest links between what are, in effect, two courses, one of two years and one of one year. The thick sandwich does, however, mean that
the students are part of the normal rhythm of student life while they are at college. The chopping and changing of the thin-sandwich scheme, such as that at Brunel, limits the opportunities of participation in student affairs. Onions (1968), of that University, has written that:

The sandwich course student cannot play for his university or college at cricket, tennis, or take part in other summer sports since he is not present and may be very many miles away...he never has a long summer vacation as an undergraduate. Thus he cannot easily take part in vacation schemes, including travel abroad, which are available to other students.

He might also have added that the thin sandwich course student cannot easily take a full part in Students Union activities.

The argument about interruption of studies might not stand up if the college and employment periods were fully integrated - if there were some direct relation between what the student studies at college and what he is asked to do as work experience. We have already seen in Chapter 2 that there are reasons for doubting whether this kind of integration is achieved. Insofar as it is achieved in sandwich courses in applied biology, it seems to be at the level of learning to think scientifically and learning how to apply scientific methods to the solution of problems. This may not be seen to be relevant to the final degree examinations! One student wrote:

“There does seem to me to be one fundamental flaw in the layout of this questionnaire. The grading one gives a particular ‘experience’ depends on one’s point of view. Either it can be viewed as experience in the scientific maturation of the student concerned, or as experience related to the final examination. In this case I have taken the former view, but if assessed from the latter, my industrial period would have had very little relevance. The main drawback of the sandwich system is in the inequality of relevance to the final examination.”

If the principal objective of ‘industrial’ training in applied biology courses is to provide research experience then they appear to be doing not badly. But is this their prime purpose? An early prospectus for the applied biology course at Bradford described the main purpose of industrial training as ‘to provide a sound knowledge of the materials, processes and machines which it will be ‘his (the applied biologist’s) prime function to develop’. It is true that a few bewildered students do end up watching pea cannning lines. But most of the students go to research laboratories. This is reasonable since a survey by the Institute of Biology (Marsh, 1966) showed that ‘the laboratory-centred studies of biochemistry and microbiology, together with pharmacology, toxicology and immunology, dominate the employment in biological posts in industry’. Failure to recognize that de facto the employment periods of applied biology courses are not ‘industrial’ in the sense that they are in engineering courses has led to a certain amount of confusion among the students.
“From a personal viewpoint the sandwich year proved to be of great value, both practically and theoretically. (The student obtained a very good pass and returned to the laboratory in which he spent his sandwich year to read for a PhD.) However, whether or not the basic ideal of the sandwich design is fulfilled is a moot point. It seems to me that ‘industrial experience’ during the sandwich year is severely limited. The idea of producing graduates who are industrially inclined, via an Applied Biology course, I suspect has not worked as well as had originally been hoped. I would query the premise that an Applied Biology graduate is any more suited to industry than is a straightforward Honours graduate.”

Nevertheless, as we have seen in this and the preceding chapter, in spite of the almost accidental way in which degree-level courses in applied biology came into being, students on these courses at Bradford generally reacted favourably to the interpolated year. This appears to be mainly because it gave them a chance to do some ‘real’ research and learn what it is like to be a scientist. The ‘industrial training’ year in biology courses may be taken as one of the unforeseen and unintended, but beneficial, consequences of the technical colleges’ quest for status.
IV. EFFECTS ON CAREER INTENTIONS AND DECISIONS

One of the reasons sandwich courses are held to be an improvement on traditional courses is that they are thought to help students towards future careers. As we saw in Chapter 1, statements about career orientation figure prominently in the lists of objectives. Most concentrate on intended advantages to students. The Bradford prospectus, *Integrated Sandwich Courses at University*, for example, suggests ‘sandwich courses should clarify and enhance career prospects through showing students a possible range of employment of graduates and introducing them to a range of possible employers’. The American Report on *Co-operative Education* (Tyler and Mills, 1961) claims similarly that such courses give students a chance to try out possible occupations, and help them to appreciate more fully the meaning of work to the individual and society.

Glassborow’s (1973) also identifies as an advantage of sandwich that they ‘allow the student to find where his particular “niche” lies in Engineering’. He also sees them as helping ‘to meet Industry’s manpower needs’ and here says something which is often assumed, but less frequently made explicit: that more graduates from courses of this kind will leave the haven of higher education and take up jobs in industry. This seems to rest, optimistically, on the view that to know industry is to like it or, more pessimistically, in the belief that, in any case, the periods in industry come to represent a personal investment in this kind of work.

In this chapter we return again to the longitudinal study of the 1966 intake to explore, as far as we can, the consequences of industrial training for the career intentions and decisions of engineering students.

**Occupational Choice**

There are many theories of occupational choice (for summaries see Crites, 1969; Hopson and Hayes, 1968; White, 1968) embracing a wide range of factors, but most take as their starting-point that it is a long-term developmental process in which the person gradually comes to terms with his circumstances. Rosenberg (1957) has described it as a process of progressive delimitation of opportunities. He argued that from the moment of conception onwards a number of factors in the individual and society operate to limit the range of possibilities. A person’s sex, social and geographical background, physique, temperament and intellect will all serve to make some occupations more likely than others. This is not to say that these influences cannot be resisted; there are female engineers, middle-class (by origin) labourers and short-sighted cricketers, but not very many.

Theories of occupational choice also tend to have in common the notion that a people change as they come to terms with what is available and what they can do. These internal changes have been variously conceptualized, either broadly as ‘the process of developing and implementing a self-concept’ (Super, 1953), or more particularly
as ‘interests’ (Strong, 1943, 1955; Super, 1957), ‘personality needs’ (Maslow, 1954; Roe, 1956) or ‘values’ (Rosenberg, 1957; Ford and Box, 1967). Ginzberg and his colleagues (1951) in their influential book, Occupational Choice: An Approach to a General Theory, postulated a well-defined age-related sequence of changes culminating in specific, realistic choices. But it seems more reasonable to suppose, with Katz (1963), that preferences become more crystallized as a point of decision approaches.

Rosenberg (1957) adopted values, in the sense of ‘what people want or consider good or desirable’ as his pivotal concept. Using a measuring instrument incorporating ten possible features of the ideal job or career, he was able to show that there was a mutual interaction of occupational values and choices. Not only did different value patterns tend to orient people towards different occupations, but values appeared to be modified in response to external circumstances. Where there was some inconsistency between what people wanted and what was available, values could change to accord with the realities of the situation, seemingly out of a need for psychological consistency. Thus, if for some reason, a person is constrained to do one thing (e.g. teach) when his own preference would be for another (perhaps research), Rosenberg found that, in some cases, values altered so as to become congruent with the ‘forced choices’.

A major factor in occupational choice is education. The amount and type of education a person receives is closely related to the occupation which he enters. One cluster of occupations is commonly associated with leaving school at 15, another 16 or 18, and a quite different group with a university education. Each stage of education limits as well as facilitates. Choice of particular subjects opens some doors, closes others; to stay on at school is not only to create opportunities but also to by-pass them. The prospective engineer who decides to try for university, for example, usually has to forgo forever the opportunity of an apprenticeship, which means that students failing their examinations, or leaving for some other reason, are worse off in this respect than those going straight into industry.

Although it has profound consequences, the decision to go to university seems often to be taken without particular regard for the future. Apart from the general expectation that it will lead to a good job, little thought is often given to future career. In a study among arts students at the University of Aberdeen, for example, Nisbet and Grant (1965) found that, on entry, only about a third knew what jobs they wanted, a further third made up their minds during the courses, but a third did not reach a decision until after graduating. Similarly, at the University of Warwick, it has been shown (Smithers and Melrose, 1973) that less than half of a sample of the whole range of first-year students had a clear idea of what they wanted to do. These studies at particular universities are borne out by Kelsall, Poole and Kuhn’s (1970) follow-up study of a large national sample of those who gained first degrees in 1960. On entering
university ‘half of the women and two-fifths of the men recalled (albeit after six years) having no particular type of occupation in mind’. This tendency also seems to be true even of students on vocationally-oriented courses (Smithers and Carlisle, 1970).

Students taking higher vocational courses have, of course, to some extent made a commitment. Some qualifications, especially the teachers’ certificate, are only of value on entry to the particular profession. This is also true in some measure of vocational degrees. A BTech in Textile Technology, for example, is less valuable as a general currency than say a traditional BA degree. Without perhaps fully realizing it, the students have delimited their opportunities.

Sandwich course students unlike their counterparts on conventional courses are given the opportunity of trying out possible future careers while still studying, and this might be expected to have a number of consequences. If the students have entered the university with only a rather vague and general idea of what they want to do, their first direct experience of industry might be something of a shock. It might make some students clearer about their prospects, but others could well be unsettled by the experience and even turn away from the careers for which they were preparing. Thus it could be anticipated that more students would have specific vocational preferences after industrial training, but associated with this there may be more uncertainty and more worry about career prospects.

It has also been argued (by Gretton, 1970, for example) that universities tend to raise aspirations beyond the level that can be satisfied. Industrial training through direct experience of employment could be expected to keep aspirations in line with opportunities. A particular kind of aspiration that universities are held to elevate is the desire to stay on at university to do research. One of the charges sometimes levelled at the universities (Lambert, 1966; Coleman, 1973) is that they retain too many of their more able students. It is by no means clear whether sandwich courses would counteract this problem, if indeed these days it is a genuine problem. But industrial training could be expected to exert a considerable influence on the students’ job choices, both ideal and probable. From the work of Rosenberg (1957) industrial training could also be expected to affect the students’ occupational values.

All of these possibilities were examined as part of the Bradford longitudinal study. The students were also followed-up in their first employment to discover what job they had actually taken.

**General Design of the Study**

In this chapter we focus again on students who entered the University of Bradford in 1966 to take courses in chemical, electrical and mechanical engineering (thin sandwiches) and civil engineering (thick sandwich). The combined intake of the
Schools of Chemical, Electrical and Mechanical’ Engineering comprised 115 male students (and two girls who have not been included in the study). During the first two years of these courses 15 students withdrew leaving 100 who are the subjects of this inquiry. Of these, 80 completed the battery of questionnaires on the first and on at least one other occasion. Seventy-two students enrolled in the School of Civil Engineering and 57 successfully completed the first two years of the course. Of these, 46 responded to questionnaires on at least two successive surveys during the study.

The students were asked to complete questionnaires on entry, and before and after periods of industrial training. They were also followed-up early in their first employment. The measures used covered vocational preferences, research orientation, levels of aspiration, occupational values, students’ ratings of their experiences at Bradford and their occupational decisions.

**Occupational Preferences**

Students were asked to say whether they had any expectations about the general field in which they would work on leaving university and, if so, to name the field. They were also asked to indicate their degree of satisfaction with their present work expectations by ticking one of five statements ranging from ‘very satisfied: this is the work I really want to do and see myself in’ to ‘very unsatisfied: shall eventually seek a change’. Preferences were also explored by means of another questionnaire. Discussions with members of staff of the undergraduate schools participating in this study led to the compilation of a list of nine of the most probable broad fields of employment for graduates. These included ‘sales’, ‘design’, ‘production’, ‘teaching (school or technical college)’, ‘research’, ‘construction including site work’, ‘university lecturing’, ‘management’, and ‘administrative civil service’. These were listed and respondents were asked: (a) to indicate the type of work which they would ideally like if they were quite free to choose and (b) if, for any reason, they felt they would not get what they ideally wanted, to indicate the field of employment which, in all likelihood, they would enter.

It might have been expected that a first taste of industry would cause some of the students to think again, and Table 4.1 shows that this was apparently the case. Significantly fewer students answered ‘yes’ to the question: ‘Do you have any expectations about the general field in which you will work when you leave university?’ after industrial training than did so before. However, those doing so were more specific about their intentions. Of the 45 engineering students on thin sandwich courses who continued to hold definite expectations, 80 per cent were specific afterwards compared to 46.7 per cent before (McNemar’s method, 1962, CR=3.1, P<0.01). Among the civil engineering student answering ‘yes’ (N=34) the corresponding percentages were, before, 26.5 and, afterwards, 55.9 (CR=2.41, P<0.05). Before industrial experience about half the thin sandwich students named their future field of work as chemical or electrical or mechanical engineering, but
afterwards only a fifth did so. After industrial training future employment locations were referred to in such terms as ‘petrochemicals’, ‘heavy power transmission’ and ‘research on turbine improvements’. And the civil engineering students were similarly more precise.

Table 4.1: Career Intentions of Engineering Students

| Course                | Before and After Industrial Training | % Before | % After | CR | P<  
|-----------------------|--------------------------------------|----------|---------|----|-------
|                       |                                      | Before   | After   |    |       
| Thin Sandwich²       |                                      | 88.0     | 44.0    | 3.0| 0.01  
| College-based³ (N=25)|                                      | 88.9     | 65.2    | 3.7| 0.001 
| Industry-based⁴ (N=47)|                                      | 89.3     | 76.6    | 1.0| ns    
| All (N=72)           |                                      | 88.0     | 64.0    |    |       
| Thick Sandwich⁵      |                                      | 95.6     | 78.2    | 2.0| 0.05  
| College-based (N=45) |                                      | 95.6     | 78.2    |    |       

2. Chemical, Electrical and Mechanical Engineering.
3. Students enrolled directly in the University.
4. Students enrolled through their employers.
5. Civil Engineering.

As Table 4.1 shows, the change from apparent sureness to indecision occurred mainly among college-based students, but there was also a similar trend among the industry-based. Among students with definite career expectations both before and after the first industrial experience there was a significant tendency to be less satisfied with future prospects on the second occasion. Fifty-one per cent of the thin sandwich engineers were ‘very satisfied’ with their career prospects after industrial training compared to 69 per cent before (C.R.=2.1, P<0.05). Among the civil engineers the proportion fell from 73.5 per cent on entry to the university to 26.5 per cent after industrial training (C.R.=3.5, P<0.01).

The lack of firm preferences is also indicated in the extent of change in the students’ ideal and probable occupational choices. During the first industrial period 25 per cent of the students on thin-sandwich courses changed their ideal choices, and the proportion increased to 38.3 per cent in the year spanning the first college and the second industrial period. In the second college period 39.6 per cent of the students changed their ideal choices. There was even more change in probable choices: 44 per cent during the first industrial period; 44.8 per cent during the first college period plus the second industrial period and 36.4 per cent during the second college period.

The indications in the data that college studies tended to promote more change in ideal choices and industrial experience in probable choices are supported by the responses of the civil engineering students: during the first long intramural period 60.4 per cent of these students changed their ideal choices, but only 34.9 per cent their probable choices. As the data of Table 4.2 show, the change in ideal choices of civil engineering students during the college period was mainly away from construction work towards research and management. During industrial training there
was also a move in probable choices away from construction to research/design, but not so far as to match the aspirations of the students.

Table 4.2: Ideal and Probable Occupational Choices1,2

<table>
<thead>
<tr>
<th>Course and Stage</th>
<th>% Design/Research</th>
<th>% Production/Construction</th>
<th>% Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ideal</td>
<td>Probable</td>
<td>Ideal</td>
</tr>
<tr>
<td>Thin Sandwich</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Entry (N=80)</td>
<td>52.5</td>
<td>33.7</td>
<td>20.0</td>
</tr>
<tr>
<td>After 1st Industry Period (N=72)</td>
<td>54.1</td>
<td>26.4</td>
<td>23.6</td>
</tr>
<tr>
<td>After 2nd Industry Period (N=55)</td>
<td>61.9</td>
<td>38.1</td>
<td>12.7</td>
</tr>
<tr>
<td>After 2nd University Period (N=57)</td>
<td>45.7</td>
<td>24.6</td>
<td>24.6</td>
</tr>
<tr>
<td>Thick Sandwich</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Entry (N=45)</td>
<td>20.8</td>
<td>15.9</td>
<td>69.7**</td>
</tr>
<tr>
<td>After 2 Years in University (N=45)</td>
<td>34.9</td>
<td>15.9</td>
<td>32.6</td>
</tr>
<tr>
<td>After 1 Year in Industry (N=46)</td>
<td>45.6</td>
<td>39.2*</td>
<td>26.1</td>
</tr>
</tbody>
</table>

1. Percentages do not reach 100 because not all fields included.
2. Significant difference beyond 5 per cent level signified by *; beyond 1 percent level signified by **.

Changes in the ideal choices of the students on thin sandwich courses are not oriented in any particular direction and there are no significant changes between the four surveys (Table 4.2). The same is true for probable choices although there is some tendency (McNemar’s CR=1.46, P0.05=1.96) for more students to expect to enter management over the period of two years. About half the students ideally wished to enter the fields of research and design, but only about a third expected to be able to do so. About twice as many expected to have to enter production as really wanted to do so.

Research Orientation

Research orientation was examined by asking respondents to indicate on a five-point scale ranging from ‘I have a very strong desire to stay on at a university for a research degree’ to ‘I am quite sure that I should not wish to stay on for a research degree’ the strength of their inclination to continue as a student either at Bradford or elsewhere.

Perhaps engineering students, who tend to be more industrially-oriented than other groups of students (Kelsall, Poole, Kuhn, 1970), were not a very good group among which to study effects on research preferences. There is some slight evidence in Table 4.3 of an increased inclination to do research among the civil engineering students particularly while they were at college. But the proportion, initially low, is still lower than that of the other engineering students at the end of the first long intramural period, although it catches up after industrial training. The desire of the thin sandwich engineering students as a whole to stay on is apparently uninfluenced by either college studies or industrial experience. Industry-based students did not differ from college-based students in the strength of their desire to continue their studies to a postgraduate level.
Table 4.3: Desire to Stay on at University for a Research Degree

<table>
<thead>
<tr>
<th>Course and Stage</th>
<th>Some Desire</th>
<th>No inclination one way or other</th>
<th>No Wish To</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thin Sandwich</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On entry (N=80)</td>
<td>51.2</td>
<td>33.8</td>
<td>15.0</td>
</tr>
<tr>
<td>After 1st industry period (N=72)</td>
<td>55.4</td>
<td>34.9</td>
<td>9.7</td>
</tr>
<tr>
<td>After 2nd industry period (N=52)</td>
<td>55.8</td>
<td>23.1</td>
<td>21.1</td>
</tr>
<tr>
<td>After 2nd university period (N=59)</td>
<td>57.6</td>
<td>25.4</td>
<td>17.0</td>
</tr>
<tr>
<td><strong>Thick Sandwich</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Entry (N=45)</td>
<td>26.5</td>
<td>46.5*</td>
<td>26.5</td>
</tr>
<tr>
<td>After 2 Years In University (N=45)</td>
<td>44.5</td>
<td>22.2</td>
<td>33.3</td>
</tr>
<tr>
<td>After 1 Year In Industry (N=46)</td>
<td>57.5</td>
<td>25.5</td>
<td>17.0</td>
</tr>
</tbody>
</table>

1. Significant difference beyond 5 per cent level signified by *. 

Levels of Aspiration

Levels of aspiration were measured in the manner described by Musgrove (1967). Respondents were given a vertical line marked off into nine equal units and were asked to indicate: (a) the position they hoped to have reached by the age of 35 and (b) the level they hoped to have achieved at the peak of their career. At three points on the scale cues were given as to the level implied. For example, the top of the scale was labelled ‘Managing Director, Director of Education, High Court Judge’, an intermediate level was marked ‘Head of a Research Station, Area Sales Manager, Head of Department (schools)’ and the first level was labelled with jobs which might reasonably be open to a newly qualified young graduate, e.g. Assistant Teacher, Civil Service, Scientific Officer.

Table 4.4: Levels of Aspiration

<table>
<thead>
<tr>
<th>Course and Stage</th>
<th>% High Aspirations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 35 (Levels 5-9)</td>
</tr>
<tr>
<td><strong>Thin sandwich</strong></td>
<td></td>
</tr>
<tr>
<td>On Entry (N=80)</td>
<td>66.1</td>
</tr>
<tr>
<td>After 1st Industrial Period (N=70)</td>
<td>65.8</td>
</tr>
<tr>
<td>After 2nd Industrial Period (N=48)</td>
<td>71.0</td>
</tr>
<tr>
<td>After 2nd University Period (N=56)</td>
<td>61.0</td>
</tr>
<tr>
<td>First Employment (N=55)</td>
<td>94.6*</td>
</tr>
<tr>
<td><strong>Thick sandwich</strong></td>
<td></td>
</tr>
<tr>
<td>On Entry (N=44)</td>
<td>67.5</td>
</tr>
<tr>
<td>After 2 Years In University (N=44)</td>
<td>86.5*</td>
</tr>
<tr>
<td>After 1 Year In Industry (N=46)</td>
<td>89.2</td>
</tr>
<tr>
<td>First Employment (N=37)</td>
<td>88.6</td>
</tr>
</tbody>
</table>

1. Change significant beyond 5 per cent level *.

At the outset, the levels of aspiration of the engineering students on thin sandwich courses and the civil engineers were similar and they rose to similar levels after graduation, but as can be seen in Table 4.4 the patterns of change were rather different. The thin sandwich engineers did not change much during the first two years
of industrial and intramural experience, but the percentage with high aspirations for both age 35 and peak of career increased significantly between then and first employment. As we saw in Chapter 2, the first employment periods of thin sandwich engineering courses are given over mainly to basic skills with most of the time spent on the shop floor, so it is possible that these industrial training experiences were tending to hold down aspirations. Among the civil engineers mean levels of aspiration rose significantly during the first long university period and were then maintained during industrial training and into the first employment.

**Occupational Values**

Students were asked to indicate the extent to which a job or career would have to satisfy each of ten possible requirements (e.g. ‘provide me with a chance to earn good money’) before it could be considered ideal (adapted from Rosenberg, 1957). For ease of presentation the students’ ratings have been converted to rankings as shown in Table 4.5.

**Table 4.5: Occupational Values of Engineering Students on Thin Sandwich Courses**

<table>
<thead>
<tr>
<th>Value</th>
<th>On Entry (N=80)</th>
<th>After 1&lt;sup&gt;st&lt;/sup&gt; IP (N=72)</th>
<th>After 2&lt;sup&gt;nd&lt;/sup&gt; IP (N=55)</th>
<th>After 2&lt;sup&gt;nd&lt;/sup&gt; UP (N=59)</th>
<th>First Employment (N=58)</th>
<th>Actual Job (N=49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good Money</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Use Special Abilities</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Work With People</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Rather Than Things</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Stable, Secure Future</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Social Status and Prestige</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helpful To Others</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Creative And Original</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Relatively Free Of Supervision</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Adventure</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Leadership</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

1. IP stands for Industrial Period and UP for University Period.

On entry, as in Rosenberg’s study, the students - engineering students - attached high importance to the extrinsic rewards of ‘stable, secure future’ and ‘good money’ and the intrinsic rewards of ‘opportunity to use special abilities’ and ‘permit me to be creative and original’, and relatively low importance to working with people and being helpful to them. This pattern remained fairly stable over the four years of the course, but the importance of ‘stable, secure future’ progressively declined from first place on arrival to sixth place after graduation. Increasing importance was attached to the ‘chance to exercise leadership’ and being left ‘relatively free of supervision’.
After graduation those students in employment were asked to rank their actual job in terms of the same ten attributes. The order which emerged (also shown in Table 4.5) was rather different from that of the ideal job. Ironically, in view of the trend noted earlier, the jobs were understood to offer above everything else ‘a stable, secure future’. It also seems that, in spite of all the opportunities for learning social skills and acquiring social self-confidence on industrial training, as brought out in Chapter 2, the students had not completely come to terms with the extent to which they would have to work with people. Other differences were that the actual jobs were ranked lower on ‘opportunity to use special abilities’ and ‘leadership’ than the students would ideally have liked.

The values of the civil engineering students changed similarly, but in ranking their actual jobs they placed ‘chance to exercise leadership’ relatively high, in fifth position, behind ‘money’, ‘supervision’, ‘stable, secure future’ and ‘people/things’. Presumably this reflects the nature of their work where they are frequently in a position of having to supervise construction workers and others. The rest of the order was again very similar to that of the thin sandwich engineers.

Career Decisions

The students were followed up after graduation and, in Table 4.6, the distribution of their first employment in terms of UGC categories is compared with that for other male UK graduates in the same fields in the same year.

Table 4.6: Destinations (UGC categories) of Bradford and Other Graduates

<table>
<thead>
<tr>
<th>Field of Engineering and University</th>
<th>Research/ Further Study</th>
<th>Teacher Training</th>
<th>Public Service</th>
<th>Industry &amp; Commerce</th>
<th>Employment Overseas</th>
<th>Seeking Employment</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Bradford (N=67)</td>
<td>19.4</td>
<td>nil</td>
<td>nil</td>
<td>70.1</td>
<td>6.0</td>
<td>4.5</td>
<td>nil</td>
</tr>
<tr>
<td>Other Universities (N=560)</td>
<td>21.7</td>
<td>2.3</td>
<td>1.6</td>
<td>59.3</td>
<td>6.4</td>
<td>7.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Electrical Bradford (N=46)</td>
<td>8.7</td>
<td>8.7</td>
<td>nil</td>
<td>73.9</td>
<td>nil</td>
<td>6.5</td>
<td>2.2</td>
</tr>
<tr>
<td>Other Universities (N=1538)</td>
<td>15.1</td>
<td>2.0</td>
<td>3.4</td>
<td>67.6</td>
<td>3.3</td>
<td>2.9</td>
<td>5.7</td>
</tr>
<tr>
<td>Mechanical Bradford (N=55)</td>
<td>3.6</td>
<td>nil</td>
<td>nil</td>
<td>90.9</td>
<td>3.6</td>
<td>1.8</td>
<td>nil</td>
</tr>
<tr>
<td>Other Universities (N=1171)</td>
<td>14.3</td>
<td>0.8</td>
<td>3.3</td>
<td>72.2</td>
<td>3.7</td>
<td>3.6</td>
<td>nil</td>
</tr>
<tr>
<td>Civil Bradford (N=54)</td>
<td>3.7</td>
<td>nil</td>
<td>40.7</td>
<td>44.4</td>
<td>7.4</td>
<td>3.7</td>
<td>nil</td>
</tr>
<tr>
<td>Other Universities (N=1411)</td>
<td>12.4</td>
<td>0.6</td>
<td>25.6</td>
<td>52.9</td>
<td>6.3</td>
<td>1.1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

1. Both those beginning in university or industry; for thin sandwich courses at the University of Bradford.

2 I am grateful to Mr. John Geale, Head of the Careers and Appointments Service, University of Bradford, for help with these data.
It can be seen that there was a tendency for more Bradford graduates in all fields to enter employment in industry and commerce (plus public service for the civil engineers) than for UK graduates as a whole. Apart from chemical engineering rather fewer of the Bradford graduates went on to do further research or study, but a high proportion went into research, design, development and commissioning within industry. Thus, of the 132 thin sandwich students taking up appointments in industry, 61.4 per cent were classed as having taken up direct appointments and 38.7 per cent as having gone on to further training, either technical or general. The 81 direct appointments were divided as follows: 54.3 per cent research, design, development and commissioning; 33.3 per cent production, operation, maintenance; and 12.3 per cent technical service (sales etc.). Of the 19 going on to do research or further study all but one remained at Bradford, most taking courses of advanced study as opposed to higher degrees by research. Most were in fields directly related to the subject of the first degree, but four went on to take courses in business studies and two in computer science.

The civil engineering graduates tended to enter mainly ‘public service’ or ‘industry and commerce’. Apart from one graduate employed by the Ministry of Public Building and Works all of the 22 entering ‘public service’ took up appointments with local or river authorities, because, as they said, the training and salary offered were better than elsewhere. Out of the 24 entering industry and commerce, 19 went on to further technical training. One of these was appointed to a design office, 11 to positions on site and seven to combined design/site jobs. All were hoping to get both types of experience to qualify for membership of the professional institution, but a few expected to have to change employers to get the necessary design work.

**Discussion**

On entry most of the students in this study appeared to have some idea of the career they would like to follow and they seemed generally satisfied with their prospects. But during their courses they apparently became less sure and less satisfied, and there are indications in the data that these changes were associated with industrial training.

This pattern contrasts with that described for other universities where students generally seem to become surer of what they wanted to do as they progress through their courses. At the University of Warwick, for example, it has been shown (Smithers and Melrose, 1973) that less than half the students indicated definite occupational intentions in the first year, but most were able to do so in the third year. This difference between the two universities may have something to do with the declared aims of their courses. At the University of Bradford courses are avowedly applied whereas at the University of Warwick, for all the fuss about *Warwick University Ltd.* a few years back (Thompson, 1970), they are less explicitly occupationally-oriented. Even the engineering course - engineering science as it is
called - is so designed as to allow a final decision between say electrical and civil engineering to be deferred.

It might be expected, on the basis of Katz’ (1963) view that preferences become more specific with proximity, that entrants to the University of Bradford would have given more thought to their careers, and this seems to be borne out by the data. However, it could also be argued that being able to name a prospective field of employment need not necessarily mean that these students had carefully chosen courses leading to desired careers. It could be that the expressed preferences were ex post facto rationalizations: that having ended up on an occupationally-oriented course for some reason the student felt obliged to claim a career intention, if only for the sake of psychological consistency.

It seems as if something of this kind may have happened in some cases. Certainly, not only did fewer students indicate definite career preferences after the direct experience of industrial training, but also there was a considerable shift in ideal and probable occupational choices. However, that this is not the whole story is suggested by the fact that the pattern of occupational values was found to be much more sharply defined and differentiated among students on occupationally-related courses than those on other courses (Smithers and Melrose, 1973).

Also, after industrial training those Bradford students who continued to have a career in mind were able to say more precisely what they wanted to do. And it may be that students on sandwich and non-sandwich courses come to think about future careers at different levels of specificity. After three years, the students on full time courses may not have progressed much in their career decisions beyond those of the Bradford students on entry. But, as we shall see later, the sandwich student who turns away from the career for which he is being prepared is in a rather difficult position, whereas the conventional graduate who finds he does not like his first choice of career is at least able to negotiate with the advantage of a degree.

Among the Bradford students there appeared to be considerable fluctuation in both ideal and probable choices. The large amount of change recorded may mean that the measuring instrument used was not very reliable or that many of the students really had no firm intentions. If we take the results at face value, comparison of the industrial and university periods for both the thin and thick sandwich engineering students suggests that the former may promote more change in probable choices, the latter, in ideal choices. The drift in choices appeared to be in the direction of the opportunities available. Thus it could be argued that the periods in industry help to develop a realistic outlook. This is supported, in part, by data from the levels-of-aspiration scale, but there is some suggestion that the first two industrial periods of the thin sandwich courses may have held down aspirations unduly.
During the four years of their courses the students’ conceptions of the ideal job or career, as measured in terms of Rosenberg’s (1957) list of occupational values, remained relatively stable. On entry, the students – engineering students – were extrinsic- and intrinsic-rewards oriented, but not people-oriented. This accords with much previous work on the value orientations of technologists. Roe (1956), for example, attempted to summarize the evidence then available in the following profile:

In this Group (Technology) interest in personal interaction is generally low, perhaps the lowest for all groups (eight in all). There are marked intellectual interests in the upper levels of this Group, but these are distinctly quantitative and spatial rather than verbal. Mechanical aptitudes and interests are of greater significance in this Group than in any of the others. Artistic interests and values are low, and masculinity ratings are high. Persons in this Group seem to have an object-orientation of interests which has characterized them throughout life, and the lack of interest in or necessity for personal interaction is not necessarily defensive (p. 317).

The low people-orientation that the engineering students exhibited on entry tended to persist through their courses into their first employment and it was in relation to ‘working with people rather than things’ that the main discrepancy occurred between students’ conceptions of the ideal job and the requirements of the job they actually obtained. In Chapter 2, in our study of students’ attitudes to industrial training we found that the experience tended to be highly regarded as an opportunity for social learning, of learning about people and how to get on with them. And given the predispositions of students attracted to the study of engineering this would seem to be an extremely important part of their education to take up positions in industry. But, in spite of three or four training periods, it appears that the students had still not fully reconciled themselves to the extent that they would have to work with people by the time they came to take up their first employment.

During their time at university there were shifts in the relative importance which the students attached to a ‘stable, secure future’ which declined, and ‘freedom from supervision’ and ‘leadership’ which increased. Rosenberg and his colleagues (Goldsen, et al, 1960) in their longitudinal study of American students also found that as they ‘went through college the appeal of the security which a job or career might offer became weaker, not stronger, while the appeal of “money” remained constant’. This along with other evidence was interpreted as showing that the students had not given up ‘the dream of rapid advancement and financial success in order to settle for security and stability’. While perhaps Goldsen et al are drawing too much of a contrast between ‘good money’ and ‘security’, the present results could be interpreted as indicating that the students were becoming more positive and confident in their outlook. Alternatively, it might just be that the students were coming to take a ‘stable, secure future’ for granted (perhaps unwisely in view of recent economic trends) and not emphasizing it as an occupational value. This sort of explanation is perhaps
favoured by the finding that the students saw their first jobs as offering above all ‘a stable, secure future’. The actual first jobs also differed from the ideal in not offering the desired opportunities for leadership (except perhaps for the civil engineers). But this is understandable in that only the first rungs of the career ladder had been reached.

The data on first employment show that proportionately more Bradford engineering graduates than engineering graduates from other UK universities tended to go to work in industry and commerce (and for the civil engineers, public service). Cotgrove and Fuller (1972) have made a similar observation. In a study of some 600 chemistry and electrical engineering students on sandwich and traditional courses, in their first and final years, at seven universities and technical colleges offering CNAA degrees, they found that final-year sandwich students were more likely to choose a career in industry. But there were also differences between the intakes which made them reluctant to interpret this as an effect of sandwich course experience itself.

Cotgrove and Fuller (1972), in fact, found rather few influences of sandwich courses on occupational socialization and choice. For example, there was apparently little effect on identification with academic (‘places most value on the pursuit of science/engineering for its own sake and is eager to publish his findings and to establish a reputation’) as opposed organizational values (‘stresses the excitement and rewards of applying science/engineering to practical problems’). Something similar emerges in the present study where there seemed to be little overall change in the desire of students to stay on at university to take a research degree associated with either the industrial or college parts of their courses. Toomey (1970) has examined the research preferences of Bradford students in more detail and found no significant differences in the direction of change associated with sandwich course experience. He did, however, find evidence of cross-currents of change, some students moving one way, others in the opposite direction, and he interpreted this as part of the general promotion of changes in occupational preferences occurring on such courses, rather than a particular effect on research orientation.

For those students whose career expectations are clarified and confirmed by industrial training there should be a smooth transition from study to employment. But for those students whose career expectations are overturned, sandwich courses are potentially very worrying. Musgrove (1969) in his study of the problems of Bradford University students found ‘worry over career prospects’ increased considerably from the first term to the summer term of the second year particularly among students with sandwich course experience. He attributed this to ‘exposure to the realities of the world of employment’.

A student who after direct experience realizes that he no longer wants to become say a chemical engineer is faced with the choice of either continuing with what is now to him an irrelevant course (for perhaps three more years with three more periods in industry) or he has to withdraw. Society can still be very hard on those who leave
university without a degree whatever the reason. The aim of giving students the chance of trying out possible occupations is basically a good one, but its implications do not appear to have been fully thought through. A necessary concomitant of experiences which are likely to change students’ ideas about themselves and what they can do (it might be thought that this is true of the university experience itself) would seem to be freedom to change courses either within or across institutions. Although, at present, there is little provision for this, the Educational Redeployment Service (Malleson, 1972) set up in London on a Leverhulme grant, in 1969, is perhaps a step towards establishing this kind of transfer service.

In this chapter we have seen that changes do take place in students during their four years at university, some of which look as if they might be associated with industrial training. The students appeared to become clearer about their vocational preferences and to develop a realistic notion of what awaits them if they take up jobs in industry. It thus seems that one important objective of industrial training, that ‘sandwich courses should clarify and enhance career prospects’, is being partly met. However, as we have also seen, there are problems with this form of education which perhaps have not been fully reckoned with, particularly regarding the student who changes his mind.
V. INDUSTRIAL TRAINING AND PERSONAL DEVELOPMENT

Another important claim for sandwich courses is that they contribute more to the student’s personal development than do conventional courses. As Bradford’s prospectus, *Integrated Sandwich Courses at University*, puts it: ‘the extramural periods promote the personal development of students (maturity, self-reliance, ability to communicate etc.) through the experience they provide of working with a variety of people in multi-disciplinary teams in a range of locations’. And similar statements have been made elsewhere (Glassborow, 1973; Tyler and Mills, 1961). In this chapter we take up the difficult topic of personal development and attempt to explore both how different people react to industrial training, and the effects of industrial training on personal characteristics.

The evidence that we have about the influence of different educational experiences on personality development is far from conclusive. It has even been argued that there are no major effects at all. Collating the results from a wide range of post-war American studies, Jacob (1957) concluded that there were few significant changes during the college years. ‘No sharp break seems to occur in the continuity of the main patterns of value which the students bring with them to college. Changes are rarely drastic or sudden and they tend to emerge on the periphery of the student’s character, affecting his application of values, rather than the core of values themselves’. Or, to put it another way, Jacob found little to suggest that higher education touched the deep and pervasive elements of the student’s character or being.

Not all commentators have been so negative. Webster, Freedman and Heist (1962), for example, reviewing early American studies found a certain amount of agreement that students appeared to be changed in the direction of ‘a more liberal attitude on social issues and a more tolerant attitude toward persons’. This received some support from the work of Plant (1965) at San Jose State College, and Lehmann *et al.*, (1966) at Michigan State University. Both groups found that students appeared to become more open-minded while at college, but when drop-outs were also considered they too were found to have moved in the same direction, which raises the possibility that the apparent change was not due to college attendance at all. It could have been a maturational effect, for example, or merely a consequence of re-taking the same measure. That there is, in fact, some connection with education is suggested by Trent and Medsker’s (1968) study of non-college groups which found correlations between level of schooling and liberal attitudes. More recently, in a major longitudinal study embracing eight American institutions of higher education, Clark *et al.*, (1972) found that over a period of four years the students appeared to become more liberal, less authoritarian and show greater personal adjustment, but that there was little change in intellectual interests (all as measured by the Omnibus Personality Inventory, 1962). Different institutions appeared to have different effects, the small liberal arts colleges seeming to have the greatest impact. But the changes appeared to be associated more with the social environment than the curriculum itself. This bears out some earlier
work. Lehmann (1963), for example, concluded on the basis of interviews with students at various stages of their courses that ‘informal, non-academic experiences such as friends, persons dated, “bull-sessions”, and so forth have a greater impact upon personality development than do formal, academic experiences’. And relationships with staff may also be important. Johnson (1969) has shown that change in levels of dogmatism among a group of student teachers was a function of the degree of dogmatism of the supervising teachers. Even Jacob (1957) conceded that ‘some teachers do exert a profound influence on some students’.

Although the personal development of students in higher education has been extensively researched in America there have been comparatively few studies in this country. Some inquiries have been carried out in colleges of education which seem to show that the educational opinions of student teachers change in the direction of radicalism, naturalism and tender-mindedness during their courses (Butcher, 1965; McIntyre and Morrison, 1967), the changes apparently being reversed during the first year of teaching (Morrison and McIntyre, 1967). McLeish (1970), in a longitudinal study of over 1,600 college of education students, found a number of changes in the students’ attitudes, all in the direction of the views of their college lecturers. But changes among university students, and changes in relation to particular fields of study, have received relatively little attention. However, one study at the University of Bradford (Smithers, 1970a) has shown that both engineering and social science students tend to become more open-minded while at university, although, as in other researches, students withdrawing from the University during the first year also seemed to change in the same direction.

Contrasting with the fairly optimistic findings reported earlier, American research has also suggested that students may become more psychologically disturbed while at college. Thus Webster et al (1962) found a consistent trend for senior students to score higher than freshmen on scales of the Minnesota Multiphasic Personality Inventory indicating psychological instability. And follow-up studies (e.g. Tate and Musick, 1954; Freedman, 1962) have shown that these difficulties tend to recede once the students have left college. There is also some evidence that students in this country find universities exacting environments. More students than other young people seem to seek psychiatric advice with minor and moderate degrees of disturbance (Payne, 1969; Ryle, 1969) -- although this may simply reflect the superior consultation facilities available. Psychiatric difficulties often appear to be triggered by the demands of academic work and examinations (Spencer, 1958; Still, 1966), but, in line with the claims for the sandwich courses, it has also been suggested that the isolation and artificiality of student life may be a factor (Marris, 1964).

However, although universities may expose psychological weakness, there is no evidence that they actually cause it. Those students seeking psychiatric advice have been found to have higher levels of neuroticism than other students (Kelvin et al,
1965; Ryle and Lunghi, 1968), but they may also have been more neurotic to start with. On arrival at university students tend to be more neurotic and more introvert than the general population (Child, 1969), the extent of the divergence varying with subject and institution: science and engineering students being generally more stable than arts students (Child, 1969). Students entering the colleges of education and technological universities less introvert than those entering the older universities (Cattell and Warburton, 1961; Evans, 1964). Indeed, it has been proposed that deviation from the norm on these characteristics may be taken as an index of the academic standing of an institution (Heist et al, 1961). In one of the very few longitudinal studies to have been conducted, Kelvin et al (1965) found that, apart from a small group of students who failed to graduate, neuroticism actually declined over a period of two years at university.

Sandwich course students are exposed to two environments: university and industry. And it is a widely held view that the periods in industry help the students to become more adult (Tait, 1969; Glassborow, 1973). According to Onions (1968) ‘the first period in a “thin” sandwich scheme turns schoolchildren into men and women’. However, we should not forget that the students are growing older while they are away from university and it is possible that the appearance of greater maturity may have something to do with seeing them again for the first time in six months or a year. People in industry have also suggested that sandwich courses make students more mature (e.g. Williams, 1971), but it is not clear whether this is ascribed to industrial experience, university experience or both. There is some evidence that the university is regarded as a maturing influence. Lambert (1966) found that a number of senior industrialists preferred their bright young men to go up to university, ‘the feeling behind this being that the university course may give confidence and maturity in later years’.

The belief that sandwich courses confer personal benefits beyond those of conventional courses is to some extent shared by the students themselves. Marris (1964), in the comparative study of students at the Northampton College of Advanced Technology and four universities mentioned previously, found that the sandwich course students were more likely to say that their courses ‘had influenced them towards a broader, more tolerant, more rational outlook and they sometimes went out of their way to explain that this was due as much to their industrial experience as the college itself’.

These ideas about the sandwich course are not easy to investigate. The concept of ‘maturity’, at least in the sense it is being employed here, is essentially normative. The person using it must have somewhere in his mind some notion, if only vague and elusive, of the fully developed human being. This will have been built up from all the hints and clues of life’s experiences, and conceptions are likely to vary considerably. It is not therefore the kind of concept which readily yields itself to some simple
measuring scale. In order to make a study of the students’ personal’ development on sandwich courses then, a more circuitous route has been taken.

An important element in the liberal, intellectual image of the mature person is likely to be the capacity for open-minded appraisal of assumptions and values. Indeed, the scales of social maturity which are currently available are essentially concerned with this aspect. Webster et al (1962), for example, in summarizing their scale describe low-scorners as, among other things, ‘authoritarian, compulsive and rigid’ and claim that it provides a measure of authoritarianism that is ‘less ideological than the original F scale’ (cf Adorno et al, 1950). Rokeach’s (1960) dogmatism/open-mindedness scale is similarly intended as a measure of general authoritarianism. As we have seen, there is a certain amount of evidence that higher education does promote open-mindedness, but that this may have more to do with the people encountered than the curriculum itself. The social milieu of industry is likely to be different from that of university. For one thing, Rokeach (1960) has shown that the mean level of dogmatism among British workmen tends to be higher (in fact, not far short of that for American war veterans) than for student groups.

Other, and related elements, in conceptions of maturity are likely to be tact and independence of judgement, and, here again, there are reasons for supposing that the two environments might have different effects. Toomey (1970) has suggested that sandwich course students in their roles as university students ‘are autonomous, self-directing, have few direct daily obligations to a superior authority and are expected by their superiors and by their peers to display independence of judgement using strictly intellectual criteria. In their roles as industrial trainees they have to learn to work as a member of an organization. They will be evaluated on their competence to carry out instructions successfully rather than on their ability to question the value of what they are doing.’ These differences, if indeed they do exist, may cause the students to come to value tact and independence of judgement differently.

The question of the students’ maturity was also attempted using a more phenomenological approach. The students were asked to describe themselves as they actually were and as they would ideally like to be in terms of 25 bipolar descriptive scales both before and after their university or industrial experience. In this way it was hoped to learn something about the qualities they valued, how they saw themselves in terms of those qualities and any changes occurring which might be attributable to their experiences. A wide range of descriptors touching on intellectual and non-intellectual characteristics was provided including some which are probably part of most conceptions of maturity e.g. ‘self-sufficient’, ‘resourceful’, and some which may be more specific to a particular setting e.g. industry: ‘willing to compromise’, ‘efficient’; or university: ‘intelligent’, ‘imaginative’. Since, as has been known for a long time, ‘others’ are extremely important in the picture a person forms
of himself (Cooley, 1902; Mead, 1934), any changes associated with university or industry will also tell us about these experiences as psychological environments.

The idea of psychological environment was also approached more directly by asking the students at the end of their first industry or university period to indicate the ‘sort of person who does best in your field of study in the university/in your line in industry’ on a set of 25 bipolar adjectival scales. Since there is evidence which suggests that universities tend to favour introverted behaviour while the demands of industry appear to be quite different (cf. Chapter 2), particular attention was paid here to the possible introverting/extraverting influences of the two environments. But, again, adjectives were made available which touched on other possible aspects of ‘the mature person’.

The Eysenck Personality Inventory (1964) was included in the study primarily as a simple way of grouping the students to see if different personalities looked forward and reacted to industrial training differently. But, as a check, it was also given after the periods in the university or industry. In theory little modification would be expected. The Inventory is intended to measure neuroticism and extraversion as relatively enduring traits of the individual not liable to change in the short term. High scores on the neuroticism scale are interpreted as indicating that a person’s anxiety is easily aroused, not that he will necessarily be in a state of high anxiety in relation to a particular set of circumstances. These, the dispositional and the situational, are sometimes distinguished as ‘trait’ and ‘state’ conditions respectively (Eysenck, 1972). However, since the scores on the Inventory are obtained by asking the person to recall certain things about himself, for example, ‘are you easily hurt when people find fault with you or your work?’ (from N scale) and ‘do you like doing things in which you have to act quickly?’ (from E scale), the answers are likely to be affected by immediate past experiences. For the students of this study these will bear some relation to their time at university or in industry.

The main thrust of this study of the students’ personal development on sandwich courses then was to assess before and after periods in the university and on industrial training the students’ personality characteristics, their perceptions of themselves, the relative importance which they attached to ‘tact’ and ‘independence of judgement’, and their degree of open-mindedness. As well as studying the students themselves, measures were taken so that any changes could be set within the context of the two environments: university and industry.

**Plan of Inquiry**

As we have already seen, courses at the University of Bradford in chemical, electrical and mechanical engineering are organized on the thin sandwich principle of alternate periods of six months in the university and industry. There are two intakes each year, one in October, the other going straight into industry and entering the university the
following February. At any one time, therefore, there are parallel groups of students in the two environments, and the opportunity exists of making comparisons between them.

Two hundred and seventeen students enrolled for the Schools of Chemical, Mechanical and Electrical Engineering of the University of Bradford in October, 1969. Of these 114 entered the university and 103, industry. Both groups were asked to complete a battery of questionnaires and personality measures before and after the first six-month period of their courses.

Of the autumn intake, 110 remained at the end of six months, and of these 99 (90 per cent) completed both the pre- and post-tests. Of those going into industry, 99 entered the university in February, 1970 and of these 95 (96 per cent) completed questionnaires both before and after industrial experience. Among the autumn entry were five foreign students (not resident in this country for at least three years prior to entering university) and in the spring intake, three. These have been excluded from the analysis leaving an effective university sample of 94 (42 chemical, 28 electrical and 24 mechanical engineers) and an industry sample of 92 (42 chemical, 22 electrical and 28 mechanical engineers). All these students were male.

The two groups did not differ in social or geographical background, or A-level attainment among the GCE entrants. More students with ONC qualifications entered in the autumn (25.6 per cent) than the spring (13.1 per cent, \( \chi^2 = 4.64, \text{df}=1, p<0.05 \)) and rather more of the spring (60.9 per cent) than the autumn intake (48.9 per cent) were sponsored by industry (\( \chi^2 = 2.67, \text{df}=1, P_{05} = 3.84 \)). This reflects the policy of the engineering Schools in trying to bring students from industry into the university for the first part of their courses and sending school leavers into industrial training straightway. Also, since industrial training places are not always easy to arrange, there is a tendency for late applicants, perhaps via the UCCA clearing scheme, to come into the university first. Thus although the two groups are roughly equivalent, as we have shown, they are not exactly similar.

At the outset of this inquiry it was intended to adopt a form of cross-over design in which the students were followed-up after both parts of their sandwich courses. However, surveys of this sort make heavy demands on those taking part, and it did not prove possible to carry the whole design through. We are left, then, with comparisons between those who go to industry and those who enter university for the first period of their courses.

**Attitudes to Industrial Training**

The students’ expectations of, and reactions to, industrial training were assessed using the Likert-type attitude-to-industrial training scale described in Chapter 2 (see pp. 30-31). The prospective form of the scale was given to both the university and the
industry group on entry, and afterwards the prospective form was given again to the university group, and the retrospective form to the industry group. As Table 5.1 shows, the results obtained were an interesting confirmation of those reported in Chapter 2.

<table>
<thead>
<tr>
<th>Table 5.1: Attitudes to Industrial Training</th>
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<tbody>
<tr>
<td>Experience</td>
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<tr>
<td>------------</td>
</tr>
<tr>
<td>University (N=94)</td>
</tr>
<tr>
<td>Industry (N=92)</td>
</tr>
</tbody>
</table>

1. The higher the score the less favourable the attitude.
2. t-test for correlated data.

Again industrial training turned out rather differently from what the students were expecting. To begin with both groups held very high expectations for the experience, although not quite so high as the students of the earlier chapter. But over the six months of the study the students’ attitudes to industrial training became less favourable. This occurred mainly among the students who had been in industry during this time, but there was also some change among those who had remained at university.

Reactions to the different aspects of industrial experience also followed the same lines as before. As a way of focusing on particular features of industrial training, 20 items of the Likert-type scale were used to form four sub-scales.

(1) Technical Learning (e.g. ‘I expect that during my period of industrial practice I shall learn about the latest practical developments and advances in my field.’).

(2) Organizational Learning (e.g. ‘Industrial experience will be valuable in giving me an idea of the attitudes and outlook of management.’).

(3) Social Learning (e.g. ‘During my industrial experience I expect to develop far more self-confidence in dealing with all kinds of people.’).

(d) Integration of Learning in University and Industry (e.g. ‘Industrial experience will give me a good chance to see how my theoretical knowledge can be applied in practice.’).

These comprised the first 20 items of the full scale as listed in Table 2.6 (though this is not the order in which they were presented to students). Each sub-scale was made up of five items and runs from 5 (favourable) to 25 (unfavourable).

Table 5.2 shows that the group in industry initially held significantly lower expectations for social learning than for technical learning (\(t=2.83, P<0.01\)), organizational learning (\(t=1.93, P<0.1\)), or industrial training as integrated education.
(t=2.92, P<0.01). But, looking back over the experience, while reporting favourably on opportunities for social learning, the students expressed some disappointment with the ‘technical learning’ and ‘integrated education’ aspects.

Table 5.2: Particular Aspects of Industrial Training

<table>
<thead>
<tr>
<th>Aspect of Training</th>
<th>Attitudes to Industrial Training¹</th>
<th></th>
<th></th>
<th>t</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>t</td>
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<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University (N=94)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical learning</td>
<td>10.8</td>
<td>2.06</td>
<td>11.8</td>
<td>2.64</td>
<td>3.64</td>
</tr>
<tr>
<td>Organizational learning</td>
<td>11.6</td>
<td>2.12</td>
<td>11.4</td>
<td>1.99</td>
<td>0.88</td>
</tr>
<tr>
<td>Social learning</td>
<td>11.6</td>
<td>2.00</td>
<td>11.6</td>
<td>2.35</td>
<td>0.15</td>
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<tr>
<td>Integrated education</td>
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<td>2.54</td>
<td>12.7</td>
<td>3.03</td>
<td>4.93</td>
</tr>
<tr>
<td>Industry (N=92)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical learning</td>
<td>10.7</td>
<td>2.24</td>
<td>14.2</td>
<td>3.34</td>
<td>9.74</td>
</tr>
<tr>
<td>Organizational learning</td>
<td>11.1</td>
<td>2.01</td>
<td>11.3</td>
<td>2.90</td>
<td>0.66</td>
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<tr>
<td>Social learning</td>
<td>11.7</td>
<td>2.55</td>
<td>10.7</td>
<td>2.69</td>
<td>3.44</td>
</tr>
<tr>
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<td>10.7</td>
<td>2.30</td>
<td>14.6</td>
<td>3.53</td>
<td>9.80</td>
</tr>
</tbody>
</table>

¹ The higher the score the less favourable the attitude.

On entry, expectations were also higher for ‘technical learning’ than ‘social learning’ (t=2.57, P<0.05) or ‘organizational learning’ (t=2.49, P<0.05), but, during the university part of their courses, the students became less confident about this also. Thus, to a large extent, the changes in the university group paralleled those of the students in industry, presumably as a result of some sort of ‘feedback’. But it was only in industry itself that the students seemed to become aware of its usefulness in social learning.

So far we have been treating the students as if they were all alike. In order to see if there were any differences with personality, the Eysenck Personality Inventory (Eysenck and Eysenck, 1964) was included among the pre-tests. Table 5.3 shows the attitudes to industrial training of the students grouped into four personality types by dividing the extra-version and neuroticism dimensions of the EPI at the mean for the general population (from the Manual). The frequencies of students falling into the four groups was rather different for the two intakes ($\chi^2=10.32$, df=3, P<0.05), with more neurotic extraverts in the university sample than to be expected from the work of Furneaux (1962), but he showed that the relatively small proportion of this personality type he found was more a selection effect than a reflection of the numbers coming forward.
Table 5.3: Personality and Attitude to Industrial Training

<table>
<thead>
<tr>
<th>Personality</th>
<th>Before M</th>
<th>SD</th>
<th>After M</th>
<th>SD</th>
<th>t</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurotic introvert (N=16)</td>
<td>70.5</td>
<td>10.0</td>
<td>68.6</td>
<td>11.7</td>
<td>0.85</td>
<td>ns</td>
</tr>
<tr>
<td>Neurotic extravert (N=23)</td>
<td>67.6</td>
<td>8.9</td>
<td>69.6</td>
<td>8.4</td>
<td>1.05</td>
<td>ns</td>
</tr>
<tr>
<td>Stable introvert (N=19)</td>
<td>66.5</td>
<td>5.4</td>
<td>67.0</td>
<td>7.0</td>
<td>0.40</td>
<td>ns</td>
</tr>
<tr>
<td>Stable extravert (N=18)</td>
<td>66.7</td>
<td>10.5</td>
<td>70.5</td>
<td>9.5</td>
<td>1.72</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurotic introvert (N=16)</td>
<td>66.4</td>
<td>7.9</td>
<td>73.6</td>
<td>14.6</td>
<td>2.21</td>
<td>0.05</td>
</tr>
<tr>
<td>Neurotic extravert (N=23)</td>
<td>60.6</td>
<td>10.7</td>
<td>78.0</td>
<td>11.3</td>
<td>7.32</td>
<td>0.001</td>
</tr>
<tr>
<td>Stable introvert (N=19)</td>
<td>66.2</td>
<td>9.3</td>
<td>81.9</td>
<td>9.3</td>
<td>5.28</td>
<td>0.001</td>
</tr>
<tr>
<td>Stable extravert (N=18)</td>
<td>64.6</td>
<td>10.6</td>
<td>73.3</td>
<td>17.2</td>
<td>2.92</td>
<td>0.01</td>
</tr>
</tbody>
</table>

1. The higher the score the less favourable the attitude.
2. t-test for correlated data.

In recent years the competition for university places in engineering has fallen off considerably which means that there is less chance for any selection effects to show. On the other hand, the composition of the industry sample, made up mainly of recent school-leavers, is not very different from that described by Furneaux (1962) with a preponderance of stable extraverts and neurotic introverts. The ‘deviations’ in the university sample are consistent with it containing a larger proportion of ONC entrants and late applicants.

There were few indications that personality as measured by the Eysenck Personality Inventory is related to attitudes to industrial training. There were no significant differences in the initial scores, although the neurotic introverts, the group supposed to be specially suited to university studies, tended to be the least favourably inclined in both cases (for the two samples combined, neurotic introverts v. others, t=1.43, P05=1.96). Whilst on industrial training itself the attitude of all four personality types deteriorated significantly with perhaps rather more movement among the neurotic extraverts and the stable extraverts, but they were the smaller groups. Among the students who were at university during this time, the mean attitude to industrial training of the introverts did not change, but that of the extraverts grew somewhat less favourable (t=2.01, df=40, P05=2.02). Why this should be is not clear, but the experience itself, involving as it does plenty of contact with people, would seem at first sight to be more congenial to extraverts.

**Perceived Demands of the Environments**

Students’ perceptions of the university and industrial environments were obtained using a modification of the semantic differential technique (Osgood et al, 1957). This was originally invented as a test of Osgood’s theory of meaning. But while the theory has receded into the background, the format of the semantic differential has been retained as a convenient way of getting people to describe something in terms of
specified adjectives. The respondent is given a set of bipolar adjectival scales, and asked to rate an object or concept against each in turn. It is hoped that by working quickly across a spread of scales the respondent will be revealing more than by giving his considered views in response to a few directed questions. It is a technique which has been used with some success in estimating the ‘press’ (cf. Murray, 1938) of different environments (e.g. Pervin, 1967; Nelson, 1971), the theory being that the averaged responses of a large sample on, say, the conditions for success in a particular environment, give some indication of the pressures acting upon a person within that environment.

In this case the students were given 25 nine-point bipolar scales on completion of their first university or industry experiences and asked to describe ‘the sort of person who you think does best in your field of study at university’ or ‘the sort of person who you think does best in your line in industry’. The adjectives were chosen with particular reference to the possible extraverting (e.g. ‘sociable-reserved’, ‘active-passive’) and anxiety-arousing (e.g. ‘carefree-concerned’, ‘striving-relaxed’) effects of the two environments, but adjectives were also included to cover a range of other possible influences (e.g. ‘theoretical-practical’, ‘co-operative-competitive’, ‘conventional-unconventional’).

The items which differentiated between the two environments are shown in Figure 5.1. Of the five adjective pairs chosen to examine extraverting effects, four distinguished statistically between the two settings. Industry was seen as favouring more the sociable (t=4.38, P<0.001), warm (t=3.08, P<0.01), active (t=2.42, P<0.05) and less serious (t=2.96, P<0.01). Only ‘impulsive-deliberate’ which is concerned with a rather different aspect of extraversion failed to discriminate. Thus, in spite of the obvious caution with which these results must be treated (we are after all dealing with two different samples in different environments), there does seem to be some indication that industry is an extraverting influence. This is consistent with the finding that people in industry do have higher scores on the Eysenck Personality Inventory than those who opt to go into more academic work (Eysenck, 1970).

Of the five adjective pairs relating to anxiety arousal, only one gave a significant difference. Industry was seen as favouring the restless (t=2.93, P<0.01). In addition, the person who does well in industry was seen as hard (t=2.05, P<0.05), practical (t=3.61, P<0.001), co-operative (t=1.87, P<0.1) and realistic (t=2.73, P<0.01); and also individualistic (t=2.09, P<0.05), specialist (t=2.46, P<0.01) and less orthodox (t=1.98, P<0.05). Some of these fit in with common impressions of the demands of industry, but the last three are somewhat surprising.

**Self-Conceptions**

The semantic differential technique was also used to explore the students’ self-perceptions before and after the university and industry experiences. They were given
two frameworks of 25 nine-point bipolar adjectival scales and on one asked to describe themselves ‘as you actually are’ and on the other ‘you as you would ideally like to be’.

**Figure 5.1: Perceived Demands of University and Industry**

The adjectives were chosen so as to give the students a chance to express a range of intellectual and other personal qualities. Some were drawn from Hudson’s (1968) ‘four selves’ study which embraced a variety of scientific, artistic and manly virtues.
But the main concern here was with the students’ perceptions of their ‘maturity’ which was explored through such pairs as ‘self-sufficient-dependent’, ‘responsible-irresponsible’, ‘willing to compromise-unwilling to compromise’ and idealistic-realistic’, some of which are likely to form part of most conceptions of ‘the mature person’ and others of which are likely to have a more specific connotation. The students found no difficulty at all in separating the notions of ‘actual self’ and ‘ideal self’; out of the 100 possible comparisons (25 adjective pairs x 2 samples x 2 testings) only 14 did not give significant differences, four of these coming from ‘rough-smooth’, and another four from ‘theoretical-practical’.

If we look first at ‘actual selves’ we find (Table 5.4), interestingly enough in view of the differences between the two intakes already noted, that, at the outset, the university group reported themselves less bright, less intelligent and less exciting than the school-leavers who went straight into industry. But, as we can also see, the university and industry environments appeared to affect the students differently. Whereas the university group saw themselves as more bright, intelligent and exciting after six months, the reverse was true of those on industrial training.

Table 5.4: Changing Conceptions of Actual Self

<table>
<thead>
<tr>
<th>Scale</th>
<th>University (N=94)</th>
<th>Industry (N=92)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>dull : bright*</td>
<td>6.47</td>
<td>6.81*</td>
</tr>
<tr>
<td>intelligent : unintelligent*</td>
<td>3.10</td>
<td>2.71*</td>
</tr>
<tr>
<td>worthless : valuable</td>
<td>6.52</td>
<td>6.92*</td>
</tr>
<tr>
<td>sensitive : tough</td>
<td>4.10</td>
<td>4.43*</td>
</tr>
<tr>
<td>dependable : undependable</td>
<td>2.87</td>
<td>2.78</td>
</tr>
<tr>
<td>dull : exciting*</td>
<td>5.80</td>
<td>6.29*</td>
</tr>
<tr>
<td>feminine : manly</td>
<td>7.81</td>
<td>7.63</td>
</tr>
<tr>
<td>yielding : stubborn</td>
<td>5.50</td>
<td>4.62*</td>
</tr>
</tbody>
</table>

1. Mean scale scores.
2. Change significant beyond 5 per cent level (t-test, correlated data) signified by *.
3. Significant difference beyond 5 per cent level in ‘before’ scores of university and industry groups (t-test, independent data) signified by +

Since the initial scores on these scales of those entering the university and those entering industry were different the statistical phenomenon of regression to the mean could have been involved here. But, as the scores actually crossed-over rather than just coming closer together, this does not look to have been the whole story. It is also possible to account for these changes plausibly in other ways. For example, the view a person has of himself will depend in part on comparisons he makes between himself and others. Thus the changes occurring in the university are consistent with it not being so frighteningly intellectual as was at first feared, while those in industry may reflect the realization that there is still a lot to be learned. Another possibility is that the experience in industry causes the students to reassess their values, and that subsequently they do not feel so obliged to claim intellectual qualities for themselves.
Table 5.5 shows that industrial training promoted considerable re-appraisal of ‘ideal selves’. After the experience students appeared to attach less importance to being bright, intelligent, exciting and imaginative than before, which suggests a certain drift away from academic values (although it is also true that increased emphasis was placed on ‘theoretical’). In contrast, there were rather few changes among the university group.

Table 5.5: Changing Conceptions of Ideal Self 1, 2

<table>
<thead>
<tr>
<th>Scale</th>
<th>University (N=94) Before</th>
<th>University (N=94) After</th>
<th>Industry (N=92) Before</th>
<th>Industry (N=92) After</th>
</tr>
</thead>
<tbody>
<tr>
<td>dull : bright*</td>
<td>8.36</td>
<td>8.24</td>
<td>9.42</td>
<td>8.04*</td>
</tr>
<tr>
<td>theoretical : practical</td>
<td>5.98</td>
<td>5.88</td>
<td>6.43</td>
<td>5.78*</td>
</tr>
<tr>
<td>warm : cold</td>
<td>2.60</td>
<td>2.43</td>
<td>2.02</td>
<td>2.48*</td>
</tr>
<tr>
<td>intelligent : unintelligent*</td>
<td>1.51</td>
<td>1.51</td>
<td>1.42</td>
<td>1.64*</td>
</tr>
<tr>
<td>resourceful : helpless</td>
<td>1.67</td>
<td>1.53</td>
<td>1.41</td>
<td>1.57*</td>
</tr>
<tr>
<td>willing : unwilling to compromise</td>
<td>3.48</td>
<td>3.34</td>
<td>3.63</td>
<td>4.03*</td>
</tr>
<tr>
<td>decisive : indecisive</td>
<td>1.52</td>
<td>1.80*</td>
<td>1.64</td>
<td>1.82</td>
</tr>
<tr>
<td>feminine : manly</td>
<td>8.43</td>
<td>8.17*</td>
<td>8.56</td>
<td>8.33*</td>
</tr>
<tr>
<td>confident : unsure</td>
<td>1.40</td>
<td>1.58*</td>
<td>1.53</td>
<td>1.60</td>
</tr>
<tr>
<td>dull : exciting</td>
<td>8.22</td>
<td>8.20</td>
<td>8.36</td>
<td>8.08*</td>
</tr>
<tr>
<td>hard : soft</td>
<td>3.68</td>
<td>3.74</td>
<td>3.43</td>
<td>3.74*</td>
</tr>
<tr>
<td>imaginative : unimaginative</td>
<td>1.73</td>
<td>1.70</td>
<td>1.57</td>
<td>1.85*</td>
</tr>
</tbody>
</table>

1. Mean scale scores.
2. Change significant beyond 5 per cent level (t-test, correlated data) signified by *.
3. No significant differences in ‘Before’ scores.

Apart from the re-orientation in relation to intellectual qualities, there is no clearly discernible pattern. In particular, there seemed to be no consistent movement on those descriptors which it was thought might be associated with maturity. But insofar as there was a shift in emphasis it seemed to be away from the ‘mature’ poles. After having been in industry students conceived of their ‘ideal selves’ as being less resourceful, less willing to compromise, less manly and less hard. The change on ‘feminine-manly’ was accompanied by a similar change in ‘actual selves’ (this occurred among the university group too), which were also reported to be less stubborn and less dependable.

**Tact and Independence of Judgement**

Two particular qualities which it was thought that the university and industry environments might affect differently were ‘tact’ and ‘independence of judgement’. In order to assess their relative importance to the students they were asked to indicate whether they thought it more important for a Bradford graduate to be prepared:

- ‘to politely but firmly to disagree with the views of his superiors on scientific, technical or professional matters, if he thinks they are wrong’;
or ‘to be ‘tactful; able to fit in easily with people at all levels in the organization which employs him’.

These two items were embedded in a matrix of four other possible attributes of the Bradford graduate in order to disguise the purpose of the scale.

Table 5.6 shows that there were few changes associated with either experience. When considered within the framework of these six items there was no evidence that the relative weights given to tact and independence of judgement were modified in the ways which might have been predicted (see p.79). This was confirmed by direct comparison between the two relevant items.

<table>
<thead>
<tr>
<th>Desirable Attributes</th>
<th>University Before</th>
<th>University After</th>
<th>Industry Before</th>
<th>Industry After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquainted with latest developments</td>
<td>3.24</td>
<td>2.98</td>
<td>2.50</td>
<td>2.63</td>
</tr>
<tr>
<td>Independence of judgement</td>
<td>3.00</td>
<td>3.17</td>
<td>3.00</td>
<td>2.83</td>
</tr>
<tr>
<td>Interested in cultural matters</td>
<td>5.68</td>
<td>5.69</td>
<td>5.74</td>
<td>5.65</td>
</tr>
<tr>
<td>Capacity for original ideas</td>
<td>2.22</td>
<td>1.98</td>
<td>1.74</td>
<td>1.90</td>
</tr>
<tr>
<td>Tactful</td>
<td>2.74</td>
<td>2.94</td>
<td>3.00</td>
<td>3.07</td>
</tr>
<tr>
<td>Active interest in community and world problems</td>
<td>4.30</td>
<td>4.78*</td>
<td>4.83</td>
<td>5.02</td>
</tr>
</tbody>
</table>

1. Median ranks.
2. Change significant beyond 5 per cent level signified by *.

In fact, the only significant shift was that the university group came to attach less importance to ‘an active interest in community and world problems’ over the six-month period. However, in line with the findings on self-conceptions, there is some suggestion that ‘original ideas’ and ‘acquainted with the latest developments and advances’ came to be ranked slightly lower in industry and slightly higher in the university. In spite of all the difficulties of interpretation, this is perhaps another hint of the ‘press’ of the two environments.

**Personality Scores**

The Eysenck Personality Inventory (Eysenck and Eysenck, 1964), which has been devised as a measure of the traits of extraversion and neuroticism, was used in the study mainly as a simple way of describing the students before they began their university studies or industrial training. However, out of interest, it was also given among the post-tests. The scores for the two testing sessions correlated quite highly in both groups. For extraversion, the coefficients were: university +0.691, industry +0.624; for neuroticism: university +0.712, industry +0.611 (N=90 in all cases). But, although there was this degree of co-variation, as Table 5.7 shows, there were also indications of systematic shifts in the scores. In the pre-tests neither the university group nor the industry group obtained E or N scores which differed from those of the general population (at least as recorded in the Manual), but afterwards, whereas again
the university group did not differ very much from the norm, the industry group were significantly above it on both scales.

Table 5.7: Levels of Neuroticism and Extraversion

<table>
<thead>
<tr>
<th>Personality Type</th>
<th>University (N=90)</th>
<th>Industry (N=90)</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Neuroticism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (Form A)</td>
<td>9.73</td>
<td>4.95</td>
<td>8.66</td>
</tr>
<tr>
<td>After (Form B)</td>
<td>10.98</td>
<td>4.89</td>
<td>11.63*</td>
</tr>
<tr>
<td>Extraversion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (Form A)</td>
<td>12.30</td>
<td>4.12</td>
<td>12.28</td>
</tr>
<tr>
<td>After (Form B)</td>
<td>14.94</td>
<td>4.14</td>
<td>15.29*</td>
</tr>
<tr>
<td>Lie scores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (Form A)</td>
<td>2.67</td>
<td>1.90</td>
<td>2.68</td>
</tr>
<tr>
<td>After (Form B)</td>
<td>1.20</td>
<td>1.21</td>
<td>1.01</td>
</tr>
</tbody>
</table>

1. Significant differences from general population beyond 5 per cent level signified by *.
2. From Manual of the Eysenck Personality Inventory.

As we shall see later, there are several reasons for being cautious about these apparent changes, but, in view of the perceived demands of the industrial setting noted earlier, it is very interesting that the students should report themselves more extravert after having been in industry for six months. It is also possible to account for the apparent changes in neuroticism scores by reference to certain aspects of the industrial experience.

Table 5.8: Attitude to Industrial Training and Personality Score

<table>
<thead>
<tr>
<th>Personality Dimension</th>
<th>More Favourable (N=24)</th>
<th>Markedly Less Favourable (N=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Neuroticism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>8.50</td>
<td>4.66</td>
</tr>
<tr>
<td>After</td>
<td>9.30</td>
<td>4.21</td>
</tr>
<tr>
<td>Extraversion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>11.58</td>
<td>4.12</td>
</tr>
<tr>
<td>After</td>
<td>13.00</td>
<td>3.76</td>
</tr>
</tbody>
</table>

1. Before and after industrial training.
2. Correlated data.
3. Adjusted.

In both this this chapter and Chapter 2, it emerged that industrial training turned out rather differently from what the students were expecting, and it could be surmised that the discrepancies would be a source of anxiety. In Table 5.8 students whose initial attitudes to industrial training (as measured by the Likert-type scale) were sustained or improved are compared with those who reacted against the experience to the extent of 20 points or more. It can be seen that the development of higher levels of neuroticism occurred mainly in this latter group.
The data of Chapter 4 also suggest that an aspect of industrial training which may be particularly worrying is its relation to future career. For many students the first period in industry is their first direct encounter with what their career choice would be likely to involve. In Table 5.9 students have been divided according to whether or not they saw industrial training as helping them to discover what jobs are going and what they are suited for. The data indicate that those students who did not relate the experience to their future careers developed higher levels of neuroticism.

Table 5.9: Perceived Career Relevance of Industrial Training

<table>
<thead>
<tr>
<th>Personality Dimension</th>
<th>Relevant (N=32)</th>
<th>Not Relevant (N=58)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Neuroticism</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>8.69</td>
<td>4.56</td>
</tr>
<tr>
<td>After ‡</td>
<td>9.36</td>
<td>4.48</td>
</tr>
<tr>
<td><strong>Extraversion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>11.88</td>
<td>4.26</td>
</tr>
<tr>
<td>After ‡</td>
<td>12.39</td>
<td>4.27</td>
</tr>
</tbody>
</table>

1. Personality scores before and after industrial training.
2. Correlated data.
3. Adjusted.

While it is a stretch of the imagination to think that the students’ personalities are being changed, it has to be borne in mind what we are actually measuring is how the students report their personalities, in other words, see themselves. In support of this we found that the 12 students with previous industrial experience who presumably had a better idea of what to expect (their mean change on the attitude-to-industrial training scale was only +4.7 compared to +10.1 for the whole group) did not change significantly on either neuroticism or extraversion.

Open-Mindedness

Open-mindedness was measured by the Rokeach (1960) dogmatism or open/closed-mindedness scale. This consists of 40 items and is intended to measure a complex construct embracing the compartmentalization of beliefs, reliance on authority and time perspective. According to Rokeach, open-mindedness is the capacity to evaluate and respond to the relevant factors in a situation, and not be unduly influenced by the rewards and punishments of external authority or irrelevant internal pressures such as unrelated habits and irrational ego-motives. Essentially, it is conceived of as the cognitive style of authoritarianism free of ideological content. To attempt to measure this is an ambitious undertaking and the dogmatism scale is not without its weaknesses (Vacchiano et al, 1969), but The Open and Closed Mind provides impressive evidence of its content, concurrent, predictive and construct validity. In the British setting too there is evidence that it is related to personality (Smithers, 1970b), political attitudes (Lobley, 1974), attitudes to innovation (Bennet, 1975),
openness to experience abroad in language courses (Willis et al., 1976) and students’ acceptance of the constraints of the syllabus (Josephs and Smithers, 1975) in ways that could be predicted from Rokeach’s conceptualization.

Table 5.10: Dogmatism and the Sandwich Course Experience

<table>
<thead>
<tr>
<th>Experience</th>
<th>Dogmatism Score Before</th>
<th>Dogmatism Score After</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>University (N=94)</td>
<td>155.7</td>
<td>22.2</td>
<td>154.6</td>
</tr>
<tr>
<td>Industry (N=92)</td>
<td>153.7</td>
<td>20.0</td>
<td>157.2</td>
</tr>
</tbody>
</table>

1. For correlated data.

The dogmatism scale was given to the university and industry samples before and after the first six-month periods of their courses. Table 5.10 shows that the two groups were not initially dissimilar, but they appeared to be affected differently by their experiences. In industry there was a statistically significant increase in the mean level of dogmatism, while in the university, if anything, the scores moved slightly the other way. Although the overall change in industry was not large, the significance test indicates that it must have been fairly consistent from student to student.

Discussion

In this chapter we have looked at the way different students view industrial training, and how they seem to be affected by it. The present findings offer strong support to those reported in Chapter 2. The highly favourable attitudes with which industrial training was anticipated appeared to be modified by actual experience. In particular, the students seemed to become uncertain about the integration of the industry and university parts of their courses, and the contribution of industrial training to their technical learning. But they did value it as a social experience and as an opportunity for finding out how organizations function. Interestingly, the changes in relation to integrated education and technical learning were mirrored in some degree among the parallel group of students who had begun their sandwich courses, but had not yet gone out on industrial training.

These doubts raise once again the questions considered at some length in Chapter 2. Are the two parts of sandwich courses mutually enhancing as is sometimes claimed? If so, why is this not clear to students? (It is worth remembering here that these reactions were not just associated with the first period of thin sandwich courses, but occurred more generally.) If not, what is the justification for alternating the periods in industry and university? Also, in view of the students’ reservations about the technical side of their training, is it safe to assume that ‘we can use the industrial experience to give at least as adequate a practical education and the kind of experience as that normally given in university laboratories’ (Edwards, 1970)? To pose these questions is not necessarily to imply the answers to them. One must always be aware
of the limitations in data of the kind presented here. But certainly they reveal features of sandwich courses which ought not to be taken for granted.

Students of different personalities seem to look forward to industrial training with much the same expectations, although perhaps the neurotic introverts, for whom universities may be something of a haven, were slightly less favourably inclined than the rest. The different personality types also seemed to react similarly to industrial training, but the changes taking place among those in the university (i.e. without direct experience) occurred mainly among the extraverts. This was unexpected, but it could possibly be because, as the more sociable, they would have more contact with others and therefore more opportunity of hearing about what industrial training really is like. However, before taking this too far one would like to be sure that this was not just an artefact of the present group of students.

The students appeared to be affected by their experiences in several ways. After industrial training, they reported themselves to be more extravert and more neurotic. But we have to tread warily. These apparent changes could have arisen from a test-re-test effect or from some other difference in the circumstances of testing, for example, the use of parallel forms of the Eysenck Personality Inventory. After all, six months is a very short time in which to detect personality changes. However, as we have already seen, there are reasons for supposing that the Inventory is not solely a measure of ‘trait’ characteristics as is intended, but is almost certainly also subject to the influence of immediate past experiences.

There is, too, a certain consistency and plausibility about the scores. The apparent increase in extraversion coincides with the perceived demands of the industrial environment which, as recorded in this study, was seen more than the university as requiring students to be sociable, active, warm and less serious. This emphasis on sociability in industry emerged too in Musgrove’s (1970) study of the expectations of the two environments as experienced by thick sandwich course students at the University of Bradford. The extraversion scores also recall the favourable reactions of the students to industrial training as a social learning experience.

The apparently higher levels of neuroticism could have been due to the extra stresses of industry. These may have arisen, in part, from the discrepancies between what the students were expecting and what they actually found. The data of the present study show that the higher N levels occurred mainly among those for whom this disparity was most marked. Industrial training, also, seems to bring career problems to the front of the students’ minds (cf Chapter 4), and the higher neuroticism scores were found among those who were not able to relate the experience to their likely futures.

Another reason for having some confidence in these scores is that similar findings have been made by Preece and Flood Page (1974). In a study of the School of Industrial Technology at the University of Bradford, to check the findings reported
in this chapter they administered Cattell’s 16 PF (Cattell et al., 1970) to one intake of students on entry, after the first university period (9 months) and after the first industrial period (also 9 months). After their period in industry the students indicated themselves to be more anxious and somewhat more extravert in terms of Cattell’s second-order factors, and this was a reversal of the trends in the university. However, again, there are reasons for being hesitant, particularly in view of the low numbers involved.

The comparatively small degree of change among the university group in the present study is consistent with findings elsewhere. Kelvin et al. (1965), for example, found few personality changes in their study of students at University College, London. In general, research in this country lends little support to the pessimism of some American research (e.g. Webster et al., 1962) regarding the mental health of students, although Musgrove (1968, 1969) has shown that Bradford students (the 1966 intake) do experience a variety of academic and other problems. Students in industry appeared to experience fewer problems than those in the university, which does not tie in completely with the evidence presented here, but Musgrove’s problem checklist was a measure of range rather than intensity, and also there were actually fewer items on the industry list (18 as against 22 on the university list). A major problem in industry appeared to be worry over career prospects.

On the matter of the students’ maturity, it is difficult to say anything definite and clear-cut. But, insofar as open-mindedness is an aspect, the indications are that the period in industry is associated with a small, but statistically significant, decrease. This may be associated with higher levels of neuroticism since there is evidence which suggests that closed-mindedness may arise as a defence against anxiety (Rokeach, 1960; Smithers, 1970). But more likely any change reflects the social influence of industry. There is evidence that closed-mindedness is amenable to social influence (Lehmann, 1963; Johnson, 1969), and Rokeach, himself, found high levels of closed-mindedness in a sample of British workmen. British studies of prospective teachers (e.g. Morrison and McIntyre, 1967) also suggest that moving from an educational environment to a working environment may be associated with the development of less open attitudes. Other research among engineering students suggests that any increase in closed-mindedness in industry can be reversed in the university (Smithers, 1970a).

Industrial experience seemed to be associated with reassessment of ‘ideal selves’, with items relating to various intellectual characteristics coming to be rated less strongly. Depending on one’s point of view this could be interpreted as militating against some of the qualities which a university is seeking to cultivate or, alternatively, it could be taken as evidence of the development of a more realistic and less extreme view of life, with less tendency to see the person in purely intellectual terms. In describing their ‘actual selves’ students apparently saw themselves as more
bright and intelligent after six months in the university and less so after six months in industry: This was not expected, but it could possibly be due to a certain relief among the university group that they were not out of their depth and an appreciation among the industry group that there was "a lot to be learned. The earlier, more modest, impression that the university group had of themselves would be consistent with this view. A further factor for the industry group might be their changing view of ‘ideal self’.

After industrial training students seemed to attach less importance to resourcefulness and willingness to compromise, and saw themselves as less dependable and tough. Again there is a certain similarity here with the results of Preece and Flood Page (1974) who found that after a period in industry students reported themselves less mature and less self-sufficient in terms of Cattell’s Personality Inventory (Factors C and Q2) However, we are dealing here with perceptions rather than actual changes so these shifts could reflect some adjustment to the different standards of industry.

Thus the claims for sandwich courses in relation to the personal development of students are hard to assess. Taking the evidence of this study at face value it would seem that while in industry the students become somewhat more extravert, anxious and closed-minded. They also apparently come to attach less importance to academic virtues and to rate themselves as less intelligent. If they were becoming more mature they did not seem to be aware of it; the drift, if anything, being the other way. However, this might reflect a changing and developing view of the world. A parallel group of students in the university did not appear to change very much over the same period of six months, but they did come to see themselves as more bright, intelligent and exciting. Bearing in mind the difficulties of trying to capture elusive and complex human qualities and experiences as scores on psychological scales and the particular limitations of the present inquiry, these apparent effects should be treated cautiously. The impressions of those like Onions (1968), Tait (1969) and others who see industry as helping students to become more adult may well be getting closer to the truth than the scores reported here. But we should not forget that while in industry the students were getting older.
VI. A MAJOR INNOVATION?

Belief in the sandwich system is still strong. Indeed with such zeal has its claims been pressed that it is necessary to guard against being prejudiced into the opposite point of view. Religious metaphor - ‘act of faith’, ‘hot gospellers’, ‘fundamentalism’, ‘Holy Writ’ (Corbett, 1970; Cotgrove, 1973; *Times Higher Education Supplement Leader*, 1972; Topping, 1970; Bourne, 1970) - has been freely used to convey the strength of feeling. But the precise benefits to students and society are by no means clear. As Wainwright’s (1972) comprehensive bibliography shows, there have been relatively few systematic studies of sandwich courses. In their underrated book on the colleges of advanced technology, Burgess and Pratt (1970) claim ‘the sandwich course marks the CATs’ triumph’ and ‘the “sandwich” principle is perhaps the only major academic innovation in higher education this century’. It was certainly a major innovation in the sense of representing a big change in curriculum organization, but whether it can be regarded as a triumph in an educational sense is not so obvious.

In attempting to evaluate sandwich courses perhaps the basic question to be asked is: how well do they serve the purposes they were intended to serve? And before we can attempt this we have to ask: what purposes? As we saw in Chapter 1, the early development of sandwich courses was slow and haphazard, and they only became a major feature of the higher education scene with their adoption by the National Council for Technological Awards. Formal objectives for such courses were not set down until after they had become established, so, to some extent these have been *post hoc* attempts to make explicit what had been taken for granted all along: that students could not fail to benefit in some way from what Sir Peter Venables (1959, 1967) has called ‘walking the wards of industry’!

The lists of objectives that are now available (NCTA, 1964; Glassborow, 1973; *Integrated Sandwich Courses at University*, 1974) claim essentially that sandwich courses, through the integration of theory and practice, contribute to effective learning of various kinds: learning about the sorts of problem that occur in industry and how scientific and technical knowledge and principles can be applied to meet them; learning about the social, economic and administrative factors which influence the working of an industrial organization; learning about firms generally and the people in them. Other objectives include increasing student motivation, clarifying and enhancing career prospects and promoting the personal development of students. In addition, the sandwich form of education is sometimes claimed to bring other benefits. It has been variously suggested that it is more acceptable to students from working class homes who might otherwise not consider going on to higher education (Sandford *et al.*, 1965), that it meets ‘the need of all students, irrespective of their subject, to overcome their isolation from society at large’ (Marris, 1964) and that it helps to ensure that higher education is responsive to social and industrial needs (Burgess and Pratt, 1970).
In assessing sandwich courses in terms of these objectives and assumed advantages, it seems fair to look first of all at the views of those most closely involved - the students, people in industry, and academic staff. We can also consider what the effects on students appear to be. Thirdly, we can examine the extent to which these courses have been taken up freely outside the aegis of the NCTA and CNAA. Finally, it also seems pertinent to ask what the costs might be.

**Students’ Reactions**

In the systematic studies reported in Chapters 2 and 5, we saw that students entered sandwich courses with highly favourable attitudes to industrial training, but as their courses progressed they became somewhat less enthusiastic. The changes were mainly associated with the periods of industrial training themselves and they occurred among students on both thin and thick sandwiches and in various fields of study. It was not, however, an undifferentiated reaction. Attitudes tended to decline most when the students were given low-level work, or they found themselves mainly with unskilled workers, or when they had little scope for independent action. Of the types of industrial experience, project work seemed the most favoured, probably because here the students were given some personal responsibility for seeing a task through. Science students tended to be given projects more frequently than technology students and this may account, in part, for the somewhat surprising finding, in view of the history and intentions of these courses (but supported by Jahoda, 1963; Heward *et al*, 1968 among others), that it was the science students who ‘reacted more favourably.

The students also reacted differently to the different aspects of industrial training. They seemed to agree that industrial training was a good opportunity for learning about organizations and people, and they thought that when it came to getting a job they would have the ‘edge’ over graduates of non-sandwich courses. But they did not feel that they had learned much which was directly related to their academic studies, they did not seem aware of any special sense of purpose to be derived from the experience, and they found it hard to accept sandwich courses as integrated courses. Hanson (1971), a professor of chemical engineering at the University of Bradford, has suggested that this was because the studies covered only the early parts of the courses: ‘There are instances in which the experience gained during these early industrial periods may not have appeared to integrate fully with the immediately adjacent academic work. The later periods are the ones where the closest tie is possible between academic and industrial work.’ This is a fair point but it would not apply to the thick sandwich course students whose reactions were similar, or to some of the other inquiries discussed in Chapter 2 - Marris’ (1964), for example. The students’ doubts over the extent of the relationship between the two types of experience are, as we shall see later, shared by people in industry and college staff.
**Industry’s Views**

It is generally assumed that industrialists are largely in favour of sandwich courses, and it is true that this seems to be the tenor of their public statements. Bury (1973), Director of Education, Training and Technology for the Confederation of British Industry, has put on record the attitude of the CBI (which is probably the nearest one can get to a collective voice for industry): ‘With very rare exceptions, CBI and its membership are solidly behind the continuation of these courses in terms both of their inherent value and of the more direct link with employment which they often provide.’ Several prominent individuals have also expressed their support (e.g. Morris, 1971; Stokes, 1974). But, in spite of these positive sentiments and the generous provision of sandwich placements - not far short of 30,000 for degree-level courses in 1971 (see p. 12) - it may be that industry is still puzzled by the system and is not altogether sure that it provides the sorts of recruit required.

Certainly, industry was at times a reluctant partner when the sandwich system was given its major push forward by the NCTA. Rudge (1957), principal of a technical college, wrote of his difficulties in trying to set up a sandwich course in chemical engineering. He sent letters to over 100 firms but only about half were answered. Many of the replies that were received offered criticisms of the sandwich scheme, the main being: loyalty - the fear that after a long and expensive training, the student would leave for a better paid job, ‘does not fit into our apprentice schemes of training’, and the cost. These and other fears -- for example - the siphoning-off of traditional recruits and effects on production, have also been expressed elsewhere (e.g. Newton, 1959; Liddiard, 1961; Wooding, 1961). It may be that Bradford’s (1957) view that: ‘There is no doubt that sandwich courses do cause a certain amount of inconvenience but, if in the long run they are going to produce the men we need we must put up with it’ voiced what a number of people in industry were privately thinking at that time.

Whether, in fact, degree-level sandwich courses do produce the men industry needs is debated still. There may not be such a clear preference for sandwich graduates over ONC or HND holders or the graduates of conventional courses as is sometimes assumed. A speaker at the Brunel Conference on Sandwich Education (1970) put industry's position thus:

> The second problem (the first was: Is it a worthwhile investment?) that industry has is in deciding the difference between a sandwich course student and one who has grown up with the company on the basis of day release and has got a qualification of degree standard as is possible in many subjects. Sandwich courses have not been running long enough for us to come down firmly in favour of one or the other (p. 37).
And L.H. Williams (1971), formerly a deputy chairman of ICI, summarized what he took to be industry’s views in the recent Cantor Lectures of the Royal Society of Arts:

The large majority of senior industrialists consider that sandwich courses produce a more practical and mature outlook…but they do not regard sandwich graduates as more useful than non-sandwich ones. In any event, comparison of the products of the two systems should be made with regard for the additional year in the sandwich course, and a better comparison would be that of the sandwich graduate and the non-sandwich graduate after a year in industry. Any initial differences will diminish with time, and the ultimate test is the ability of the individual and how he has developed after five years in industry.

These impressions are supported by the only major systematic study to have been made of industry’s reactions to sandwich courses (Batcock and Musgrove, 1970; Musgrove, 1972). A sample of 400 science-based and engineering-based firms taken from the CRAC Yearbook and theCornmarket Directory of Opportunities for Graduates was approached, and the senior personnel officer and one other senior member of the firm were asked to complete questionnaires comparing sandwich and conventional courses, and their graduates. Many of the respondents did not find the distinction between courses and graduates an easy one to make. There was a feeling that sandwich courses attracted somewhat weaker students, and any comparison ought to take this into account. However, it was considered that the sandwich graduate was likely to enjoy a short-term advantage in that he would probably have ‘a more realistic attitude’, a better grasp of technical problems, be more able to get on with fellow workers, and be more interested in the practical application of knowledge, but these differences were thought to be soon outweighed by the individual characteristics of the recruits.

Orthodox graduates from the outset were thought to have the greater ‘management potential’, to be more likely to have a thorough grasp of their degree subjects, and a greater ability to get their ideas across - reflecting the view that these were initially the more able. Sandwich courses were thought to have the disadvantage of disrupting the student’s studies and his university life in general. Musgrove (1972) examined the possibility that these reactions may have been prejudiced by the respondents’ own educational experiences but found no evidence of this. Thus, although there are reasons for believing that industry supports the sandwich system, there also seem to be doubts and uncertainties. Industry’s views on the crucial question of integration will be taken up in detail later.

**Views of College Staff**

The views of college staff do not appear to have been systematically studied - apart from Heywood’s (1967) investigation mentioned earlier which showed that students
and staff tended to hold different views on the aims of industrial training - but it is possible to form their published statements into at least three groups: first, there is what might be called the official point of view; secondly, there are the opinions of the teaching staff themselves; and, thirdly, there are the comments of those who have carried out research on sandwich courses.

The official view, as might be expected, is mainly one of warm support. Sir James Tait (1969), first Vice-Chancellor of the City University, is reported as saying at one of the University’s Open Days:

The sandwich course student matures very much more quickly than his counterpart who spends all his undergraduate years within a university. The sandwich method is “absolutely first class”. It introduced the student to industry when he was still young - and not resented by the shop steward - and gave him a chance to learn about mechanical processes and the possible limitations of machines early on in his career. Firms are in favour of sandwich students, and said they could often finish an industrial project before the traditional graduate had thought out how to begin.

There are similarly enthusiastic statements by others in universities including Topping (1962), first Vice-Chancellor of Brunel University, and Venables (1959), first Vice-Chancellor of Aston University. Similarly in the polytechnic sector there was strong support from leaders such as Adamson (1971), Director of the Polytechnic of Central London, and Tolley (quoted in Grinyer, 1972), Principal of Sheffield Polytechnic.

But among the teaching staff themselves there appears to be a sharp division of opinion. In relation to the benefits or otherwise of mixing the two kinds of experience, Hanson (1967) has suggested that it is an ‘excellent answer to the problem of striking a balance between fundamental principles and industrial practice’, whereas Bailey and Leedham (1965), two electrical engineers also at the University of Bradford, argue that ‘from a teaching point of view the attempt at integration has had quite explicit consequences. It soon became clear that the experience of the students on engineering matters was so diverse that it could not be utilized in the teaching. There is therefore always a considerable student body that are completely unacquainted with a subject and equally a considerable number that are quite confident that they know about it’. Marshall (1967), another Bradford engineer and an otherwise fervent supporter of the sandwich system, has admitted that the two parts of sandwich courses are often merely juxtaposed rather than integrated, and in this he suggested that we lag behind American co-operative education.

Those who have researched into sandwich courses are perhaps the most pessimistic of all. Cotgrove (1973), who was given an SSRC grant to study the effects of this type of education on students’ attitudes and careers wrote recently:
Perhaps the courses deserve to die? What small amount of research has been done does not support many of the articles of faith on which they were built. They don’t affect career choice - much. They do attract students who by and large have made up their minds about their future jobs. But far from protecting students from the seductions of academic life, and giving them a taste of the challenges and excitement of industry, a sizeable proportion after their brief encounter with the realities of the shop floor desire to get as far away from it as possible. True, they fit into industry more easily after graduation, but industry does not compare them favourably with full-time students for higher management potential.

Musgrove (1971), who initiated the Bradford longitudinal studies, commented in Patterns of Power and Authority in English Education that the sandwich course ‘generally fails to achieve the integration of academic study and industrial practice that its champions claim for it; but it represents nonetheless a serious threat to the integrity and autonomy of colleges’.

These views, which are available because they have found their way into print, may not reflect the opinions of college staff in general, but like the systematic studies of the reactions of students and industrial staff, some at least do reveal certain misgivings. The principal difficulty on which most seem agreed is the relationship between the two parts of sandwich courses.

**Effects on Students**

If we now turn to the effects on students, we find that two important claims for sandwich courses are that they make it easier for the student to decide upon a career and that they contribute to his development as a mature person. Empirical studies of these claims have been reported and discussed in Chapter 4 (occupational choice) and in Chapter 5 (personal development). But it is worth drawing attention here to the main points again and considering their implications.

**Career Intentions and Decisions**

In the study of the students’ career intentions and decisions perhaps the main points to emerge were: (a) that although some students appeared to become clearer about what they wanted to do, others became less sure and less satisfied and (b) that more of the sandwich graduates took up jobs in industry than did their counterparts on conventional courses.

The finding that some students appeared to become less sure about their vocational preferences during industrial training focuses attention on the problems of experimenting with possible future careers within a relatively inflexible curriculum structure. When a student takes an occupationally-oriented course straight from school, he is to some extent taking a leap in the dark. It is almost inevitable in these
circumstances that, with the benefit of the experience available through industrial training, some will realize that they have made a mistake. There ought to be some provision for these students. It is fair for the American Study of Co-operative Education (Tyler and Mills, 1960) to claim that: ‘With this realistic try-out, a student may discover that he wants a different career than the one he thought he wanted on entering college; he can then change academic plans to prepare for this more informed vocational choice’, since the American higher educational system is a relatively open one with ease of transfer between majors and institutions.

But it is less humane to take the view that: ‘The industrial year does deter some students from industry, possibly for life. I think we should accept this, we should recognize it and it is probably a good thing that it happens then rather than later’ (Moore, 1970). Britain’s higher educational opportunities are still largely ‘one-shot’ (Malleson, 1972). Having committed himself to a particular subject at a particular university the student in this country finds it relatively difficult to move sideways. If we are going to have raw school-leavers trying out possible future careers while still at university then this would seem to imply some general transfer service for those in whom the experience prompts a change of mind. This is only one aspect of ‘wastage through mistaken choices’ (Smithers, 1973b; Cope and Hannah, 1975) and illustrates the need for some kind of national Educational Redeployment Service taking its lead from the one that has been piloted in London (Malleson, 1972).

It is also an argument for encouraging students to delay their entry into higher education. This is recognized by some of the firms who sponsor students for sandwich courses. Morris (1971), of the Personnel Development Services of H.L. Heinz, puts the Company’s policy thus:

We consider it important for an 18- or 19-year-old school leaver to have a year or so in a practical work situation before commencing full-time studies for his degree. We find that a break from academic work at this point enables a young man to take a broader view of life; and he can of course satisfy himself as to the suitability of the career pattern he has chosen before committing himself to the four-year degree syllabus.

Orr’s (1974) recent study of a large sample of ‘late entrants’ found that ‘students’ views on having a break between school and higher education were overwhelmingly favourable. They commonly held that an intermediate year had had (or would have had) “maturing”, “broadening” and “refreshing” effects, in enabling them to see the relevance of their intended course of study, to re-consider their career choice and to adapt far better to university life’. Which, even if it is only part-way true - and it does receive support from elsewhere (Schools Council, 1971; Fogelman, 1972; Watts, 1973) - suggests that this might be at the very least a useful supplement to degree-level sandwich courses, and it might be an alternative, perhaps better, way of doing things than including periods of employment in courses in higher education.
On the other side it can be said that proportionately more Bradford engineering graduates - sandwich graduates – than engineering graduates from other universities entered industry. Similar sandwich/non-sandwich differences have been reported elsewhere. Cotgrove and Fuller (1972), in a comparison involving some 600 chemistry and electrical engineering students at seven institutions, found that final year sandwich students were more likely to be aiming at a career in industry. More recently, Daniel and Pugh (1975) have shown that about 50 per cent of the graduates of CNAA business studies courses (mainly sandwich) went into industry, compared to only about a quarter of the graduates of university business courses (mainly full-time). Thus from this point of view sandwich courses appear to be succeeding. But it is not clear whether this is mainly due to differential recruitment (which is the explanation favoured by Cotgrove and Fuller, 1972), advantages associated with the practical experience of industrial training (favoured by Daniel and Pugh, 1975), or some other reason, for example, the students’ occupational opportunities becoming progressively and rather narrowly delimited by their courses.

For those students whose initial career ideas are supported and sharpened by their experiences sandwich courses will smooth the transition from formal education to work. They will be clear about what they are going to, and they are often able to fit in more easily than graduates of conventional courses. But, as we have seen, initial ideas are not always confirmed.

**Personal Development**

In Chapter 5 we saw that industrial training appeared to affect the students’ personality characteristics as measured by a self-report inventory, the students’ perception of themselves and their degree of open-mindedness. On the Eysenck Personality Inventory they indicated themselves to be more extravert and more anxious after industrial training and this seemed consistent with the demands and stresses of industry. The higher levels of neuroticism developed mainly among those who reacted most strongly against the experience and, interestingly, in view of what has been said about effects on career intentions, those who could not relate it to future careers. Industrial experience seemed to promote re-appraisal of ‘ideal selves’ with less emphasis being placed on intellectual qualities, and the students also came to see their ‘actual selves’ somewhat differently. The increased closed-mindedness of the students was in the direction of that of British workers. But it was found hard to assess the claim that sandwich courses are a maturing influence. In view of the widely held impression that this is the case, it may be true, but it could also simply be that the students had become six months or a year older since they were last seen.
Growth of Sandwich Courses

The present availability of sandwich courses is mainly the result of factors extrinsic to their education merit. They burst into prominence during the 1950s as the technical colleges competed for status via the DipTech and the NCTA, and their current difficulties can be traced to the squeeze on industrial placements associated with the economic recession.

In just the same way as extrinsic factors seem to have governed the growth of sandwich courses in the colleges of advanced technology and the polytechnics, weight of tradition may have prevented their spread elsewhere. But the fact is that the impact of the sandwich system on the older established and, even the newer, universities has been almost negligible. In 1969/70 there were only 142 sandwich course students at universities other than the ex-CATs and, of these, 109 were at the National College of Food Technology which, in 1966, became part of the Faculty of Agriculture of the University of Reading. Thirteen more were at the University of Southampton where a 16-month MSc course is shared with local industry (Sims and Bloodworth, 1969), and the others were scattered and included some postgraduate education students, as at Nottingham University.

Some universities, like Warwick, arrange formal training periods to coincide with university vacations, but only at Lancaster has provision for sandwich courses at the undergraduate level been established de novo. The engineering course there occupies three academic years, but the students may opt to spend a year training in industry between the second and final years. The prospectus, Engineering at Lancaster, is, however, suitably cautious; after mentioning some possible advantages it goes on to say: ‘on the other hand, there are often good reasons for a student preferring a three-year course, including the simple desire to complete his academic education as early as possible and start real work’.

The American equivalent, co-operative education, seems to have fared rather better. It has been adopted widely in the United States and it has spread to both Canada and South America (see p. 16). Its popularity was one of the reasons for the sandwich system being taken up in this country. The basis of this difference between the two schemes is not clear, but it may have something to do with the fact that in North America and elsewhere most students have to work to pay their way through college, and co-operative education is one way, and probably a good one, of financing studies.

Ironically, rather than sandwich courses spreading to older-established universities, the trend has been - again for not wholly educational reasons - for the technological universities to offer three-year full-time courses run concurrently with sandwich courses. These are available now at the technological universities of Aston and Loughborough, the City University, and even, on an experimental basis in some subjects, the University of Bradford. This move has been prompted partly by the
pressure on industrial placements. Boume (1971) was able to bring together comments from a number of technological universities illustrating the difficulties of placing students and indicating that entry to some courses might have to be restricted. The problem, it seems, is not only one of industrial recession, difficult though it may be to justify the continued employment of students to those declared redundant or unable to find work themselves. Apparently, with the ready supply of graduates (cf Greenaway and Williams, 1973) some of the interest has gone out of sandwich courses for firms who saw them primarily as a means of tempting graduates into industry (Grinyer, 1972). The CBI (1972) issued a statement which circumspectly set out industry’s position: ‘the provision of the necessary training places in those sectors of industry that have been involved in the system so far is approaching saturation point, rendering prospects of further major expansion unlikely unless additional sources of training can be found.’ The Engineering Industry Training Board is concerned too, and has been trying to encourage smaller companies to pool their resources to provide training places for sandwich courses run by local polytechnics or technological universities (Sumner, 1972).

From the technological universities’ point of view the problem of placements has been exacerbated by competition from the rapid growth of sandwich courses in the polytechnics, where, under the tutelage of the CNAA, in the period 1964/5 - 1972/3, the number of courses increased from 60 to 217 and the number of students from 2,940 to 18,849 (CNAA, 1973). Fears over the supply of places led the CNAA, in 1972, to carry out a survey of all the sandwich courses that it validated at that time (CNAA, 1973). It was re-assured to some extent, but found that placements in some subjects, for example electrical engineering, mechanical engineering and business studies, appeared to be approaching a ceiling. Also, industry sponsorship had not kept pace with the expansion, so that, whereas the number of sponsored students had increased from 687 in 1964/65 to 1,106 in 1972/73, as a proportion of all sandwich students, the fall was dramatic - from 57.5 per cent to 15.6 per cent. During this period there was also a high turnover in places with 818 lost and 1,397 new ones found. About two-thirds of the colleges reported that more time was having to be spent on finding and maintaining places, the extent of the increase from 1971/72 to 1972/73 ranging from 33 per cent to 300 per cent. The impression that comes across strongly is of the polytechnics struggling hard to satisfy the CNAA’s requirements on sandwich courses.

Costs
Although the studies reported in earlier chapters do not have much to say about the costs of sandwich courses, it seems worth opening up the topic here if only to draw attention to how little seems to be known. There appears to be a view, even among those who feel that the system is worth encouraging, that these courses ‘are extremely expensive of time and money both by the educational institution and the employer, and need to be heavily subsidized’ (Snow, 1973). This, on the face of it, would seem
to have some substance. The courses in most cases last a year longer than full time
courses, and for the educational institution there are the costs of finding places and
attempting to maintain contact with students in industry, whilst for industry there are
the costs of providing the training. Where this counts towards membership of a
professional institution, as with the engineers, or where the student eventually takes
up a job which he adjusts to more readily as a result of his sandwich experience, then
there is something to be set against this extra outlay. But in the case of students for
whom the training has no such relevance presumably the sandwich system is a more
expensive form of education. It is something which needs to be explored.

A major study of the costs of different departments in one university was undertaken
at the University of Bradford by Bottomley et al (1972). The economic cost per
student was calculated taking into account such things as capital and maintenance
costs of buildings and teaching equipment, teaching costs, administrative
expenditures, library expenditures and student facility, general educational and other
expenditures. Schools operating sandwich courses came out as more expensive than
the others, but this was mainly because they were laboratory-based as opposed to
classroom-based (capital costs - taking into account amortization - were found to be
a high proportion of the total costs). Since this was a study within one university there
is no clear indication of how the costs of a sandwich course and its full-time
equivalent would compare, but the figures do show that the industrial year of thick
sandwich courses cost the university from £128 to £161 per student at 1969/70 prices
depending on subject (in each case about 5 per cent of the total). Thin sandwich
courses taking two entries per year (end-on) had an average cost per student of about
85 per cent of those taking only one entry per year, but different fields of study were
involved and their costs may have been intrinsically different.

Edwards, drawing in part on these data, suggested to the Brunel Conference on
Sandwich Education, July 1970, that of the various types of course ‘the most
economical pattern would appear to be the end-on thin sandwich system in which
capital facilities are used for something like 11 months in the year. The second most
economical would be either the full-time course or the thick sandwich course, which
would normally have equivalent capital utilization, and the least economical would
be the thin sandwich course operating on a non-end-on system’. In comparing
sandwich and non-sandwich courses, however, this would seem to ignore the costs of
the extra year and liaison with industry. The comparison between end-on and single
entry thin sandwiches was challenged by another participant, Johnston, who referred
to a study by Chisholm which apparently showed that two intakes per year
represented a saving of only 2.5 per cent.

Whatever the truth may be here, universities operating single entry thin sandwiches
seem rather defensive on this point. Corbett (1970) in an article on Brunel University
found academics there anxious to assure her that thin sandwich students have more
teaching in two terms (24 weeks) than do Cambridge students in three (22 weeks). And similar claims have been made elsewhere (e.g. Bodsworth, 1970). To deflect Corbett’s comment about sandwich courses creating empty campuses one of those she interviewed reminded her of the lavatory fallacy: 'you don’t have to be in it the whole time to prove your need for it’!

In view of the high capital costs of laboratory studies, Edwards (1970) has suggested that some of the practical work normally undertaken in the university could be transferred to the industrial placement. And this also appears in the University of Bradford’s list of objectives for these courses: ‘the extramural periods can provide a supplement or even a substitute for university laboratory work’. However, although this seems plausible, the variability of the student placements and the relative lack of control which the university has over them, make it unlikely that this could be generally implemented. Also, as we saw in Chapters 2 and 5, ‘technical learning’ was one of the aspects of industrial training about which the students were more doubtful.

These comments are just by way of illustrating some of the things which would need to be taken into account in assessing the costs of sandwich courses. There are also the costs to industry. There is clearly a case for a major economic study in this area.

Other Claims

Again, although the empirical studies of this report have little direct bearing on some of the other claims for sandwich courses, it seems worth touching on them here. Among other things it has been suggested that they make higher education more accessible to working class students, that they help the student to overcome his isolation from society at large and that they make higher education more responsive to industry.

Sandford et al (1965), on the basis of a study which showed that there were more students from working class homes on diploma in technology courses at the Bristol College of Science and Technology in 1963 than at various provincial universities, suggested that the sandwich form of education might be more acceptable to such students than traditional university courses. They argued that the work association of sandwich courses and the expectation that the academic course content would be more practical combined to make them seem more useful and less forbidding. However, this claim seems to have been made more from a desire to say something nice about sandwich courses than any close analysis of the situation.

Couper and Harris (1970) themselves showed that by 1966, when the sandwich system remained intact but there had been a number of changes including the impending elevation to university status, the difference from other provincial universities had largely disappeared. The other ex-CATs varied in their working class entry. Thus it is unlikely that the sandwich form per se is a major determining
influence. This view is supported by Hatch and Reich’s (1970) study of eight institutions spread across the whole range of higher education. They found no consistent differences in the social background of the students on sandwich courses and non-sandwich courses and concluded ‘once again general institution factors are shown to be more important than the type of course in determining the student body’.

Marris (1964) suggested that sandwich courses meet ‘the need of all students, irrespective of their subject, to overcome their isolation from society at large, and test the validity of their education in its ultimate setting’. There is certainly some feeling that students, particularly those at the new ‘greenfields’ universities might be dangerously insulated from society at large. This has probably been best expressed by Cottrell (1973) writing on the role of the new universities:

The new universities…have been located in places where few students can live at home and so the majority live in their own student communities, either in university residences on the campus or in lodgings or flats nearby. This means that at a time when we have already a divisiveness of outlook among the young we are taking a very powerful step to encourage this by setting up institutions where the students are unlikely to be able to live at home, and must therefore be separated from the culture represented by their parents and the society in which they grew up. I think it is possible that the role of the new universities in practice, if not in intention, may have been to play a significant part in what history might regard either as the disruption, or the rejuvenation, of our Western European culture (p. 54).

This may be a good, if rather pragmatic, argument for sandwich courses. Certainly the student unrest of recent years has hardly seemed to touch the technological universities and polytechnics, saving of course the Polytechnic of North London (Jacka et al., 1975). Not all students, however, are isolated on ‘green fields’ campuses and even those that are may, as we have seen in another connection, spend no more than half the year there. Marris, himself, showed that a high proportion of students on full-time courses take paid employment and ‘use their long vacations in much the same way (as he suggests sandwich students use industrial training) to re-establish contact with the real world’. Thus, although sandwich courses may differ from other courses in the extent to which they deliberately involve students in society, Marris’ suggestion remains no more than an interesting possibility.

It has also been argued that the introduction of regular periods of industrial training into university courses brings about a new relationship between higher education and society. For those for whom university studies have been remote and privileged, the need to enlist the constant and continuing co-operation of commerce and industry and the outside world in general is seen as a desirable way of keeping universities socially and industrially responsive (Burgess and Pratt, 1970). But it is also possible to see
the interlocking of education and industry as double-edged, threatening the autonomy of educational institutions (Musgrove, 1971). This could happen in a number of ways including ‘the promotion of industrial values within the university context’ and ‘through industry’s supplying “sponsored” sandwich course students’. Commenting on the evolution of higher education in this country, Trow (1969) in America has sought to alert us to the dangers of involving industry in education:

Industry tends to train for its immediate needs and to counterbalance this higher technological institutions ought not to be training for industry, but in a sense, against it. They should not aim to make the integration of their graduates into industry easy, but difficult; the relation between young engineers and industrial management ought not to be smooth, but abrasive. For ‘current practice’ is almost always and everywhere obsolescent and conservative.

Trow concludes that ‘colleges must train for the future, both of their students and of the economy. The relations between industry and the colleges should ensure that the latter are not subordinated to the former’.

Ultimately, one’s views on the general idea of the sandwich principle may reflect one’s implicit assumptions about the nature of education. If the educational curriculum is seen as something ‘designed to accelerate change, promote change which would not have occurred and control the direction of change . . . the contrived activity and experience - organized, focused, systematic - that life, unaided would not provide’ (Musgrove, 1968b) then periods spent on industrial training will probably be seen as an unnecessary interruption of studies. They may be seen as actually inhibiting progress because ‘industry works by rule of thumb’ (Bailey and Leedham, 1965) and because industry will train for its immediate purposes (Trow, 1969).

However, there is an alternative tradition extending at least from Locke’s, *Thoughts Concerning Education*, to Illich’s *Deschooling Society*, which sees Life, itself, as the true educator. From this point of view, industrial training can be seen as an antidote to the artificial world of education made especially necessary by the gradual expansion of the period of formal education to occupy much of the first third of the human life cycle. The idea that there should be opportunities for organized learning throughout the life span, sometimes called recurrent education or *l’éducation permante*, has been receiving increasing attention in recent years (cf Houghton and Richardson, 1974). It may be that we will soon arrive at the situation where arguments about four-year degree-level integrated courses will have been overtaken by arguments about life itself as a kind of sandwich course.

**Integration**

The main justification for sandwich courses is that they are integrated courses: that two complementary experiences are provided, each of which would be the poorer
without the other. This is the *raison d’etre* for alternating periods of work and study or placing the equivalent of a year’s industrial experience somewhere in a four-year degree course. The claim that the courses are integrated was made by the NCTA in its evidence to the Robbins Committee and it is yearly repeated in the prospectuses of the technological universities and polytechnics.

However, the idea of integration in this context is not an easy one. At one level, it implies that the work and study experiences should be administratively brought together into a composite course. Moore and Urry (1971), for example, in arguing that during the 1950s ‘a new concept of integrated sandwich courses took root’ say ‘these new courses differed from earlier ones in that the academic and industrial contributions were planned as a whole and greater emphasis was placed on the tutor system as a means of relating the two parts for the student’. And elsewhere Urry (1970b) has outlined various other devices for bringing the two parts together - notably the formal assessment of the student’s work in industry.

But exactly what is meant by integration in an educational sense is not so clear. Preece and Flood Page (1974) have explored some of its possible facets - direct application of theoretical concepts, illumination and consolidation of academic ideas, alertness to important but non-obvious aspects of the industrial environment - and they suggest ‘that all this and much more is brought together under the umbrella word “integration”’. It is not therefore a precise notion and it may well mean different things to different people, but, at the very least, it carries the implication that the two parts are in some sense interrelated.

The evidence of the empirical studies reported in Chapter 2 and Chapter 5 is that the students did not apparently see much connection between their academic and industrial experiences. This was true of students in various fields of study and of students on both thin and thick sandwiches. It is something which has also emerged in numerous other studies (e.g. Jahoda, 1963; Marris, 1964; Rice, 1965; Heward *et al.*, 1968; Smith, 1971; Preece and Flood Page, 1974). This is not to say that the students were not accumulating what Leuba (1964) has called ‘a wealth of associations necessary for effective learning’, particularly in relation to the social and organizational aspects of industry, only that they did not seem to be aware of the kind of direct relationship that they had been led to expect.

People in industry and college staff also seem to have wondered about the integration of sandwich courses. In an early article, Finnigan (1961), an industrial training officer, reviewed the various provisions and concluded ‘it is clear that college and industrial periods are difficult to integrate under present arrangements. In many cases they are not integrated at all’. Ten years later, Martin (1971), who was for six years a training officer with Associated Electrical Industries and is now a university industrial education officer, wrote after seeing some of the Bradford findings:
On the question of integration of academic work and practical training I think that there is one very important factor which has not been brought out. I agree that the amount of integration which in general exists is nothing like as great as everybody piously hoped when sandwich courses were first popularised. But there are one or two very important exceptions to this and these depend on the geographical proximity of large firms to colleges with sandwich course traditions. In this sort of situation real efforts can be made to do the job properly but I would admit that it is ridiculous to talk about true integration when a sandwich situation exists between, for example, a company in Glasgow and a University in London.

A wide range of college staff have also expressed doubts - from Topping, first Vice-Chancellor of Brunel University - ‘integrating the two halves of the students experience is the most difficult feature of the system’ (reported in Mackay, 1968) - through the actual teaching staff (e.g. Bailey and Leedham, 1965; Marshall, 1967) to the educational researchers (e.g. Burgess and Pratt, 1970; Musgrove, 1971; Cotgrove, 1973). One reason why industrial training may be difficult to integrate into sandwich courses is the large number of constraints within which the educational institution has to operate. Osborne-Moss (1969) has listed some of them: winning the co-operation of a sufficient number of firms and agreeing with them (a) the type of training to be given (b) tutorial arrangements (c) assessment procedures which in the case of the polytechnics and other colleges have to meet the requirements of the CNAA; the policies of the appropriate Industrial Training Board; and the requirements of the Professional Institutions. Although these difficulties have been recognized and admitted they do not seem to have been satisfactorily resolved. Those who believe that things can be made better tend to place their hopes on improving the tutorial system and formal assessment of the industrial periods.

The student while in industry usually has both an industrial supervisor and an academic tutor and they are jointly responsible for his progress. The academic tutor occupies a very important place in the sandwich system. He is the main link between the two types of experience, and whether or not the student continues to feel part of the university or college while away may well depend on him. The expectation is that the academic tutor will visit the student two or three times during the six-month period (although, of course, he could be contacted at any time should the need arise). But it is not always possible. The academic tutor has to fit in his industrial visits among all the other duties which attach themselves to a university or college lecturer, the students could be a long way away and perhaps widely scattered, and the convenience of the host firm has to be met. Not all members of staff like tutoring and some find it a considerable chore. What the tutorial system is sometimes reduced to has been described by a training officer talking about the single visit near the end of the period of industrial experience: ‘The tutor arrives at about 11 am, spends a chatty hour with the training officer followed by lunch. The students are made available at
about 2 pm, and the tutor chats with them or tours the works for about two hours. This is the basis of integration. Is it of any value?’ (Finnigan, 1961). Now, it is not always like that and obviously the academic tutor can do his job well or badly, but the practical difficulties should not be underestimated.

In these circumstances much will depend on the quality of the industrial supervision. This does not appear to have been much studied or commented upon, but Cohen (1970) suggested that again there may be difficulties. He found in an inquiry among civil engineering students and their industry-based supervisors that they seemed to be expecting different things:

These findings suggest that the industry-based supervisors did not see it as their specific responsibility either to plan or to oversee the synthesis between the students’ academic studies at university and their practical applications in industrial settings. By contrast, the majority of students did assign to the industry-based supervisor the responsibility for finding them work which made use of their university studies. A considerable part of the reported student anxiety moreover, seemed to arise from an absence of adequate supervision of this particular aspect of their work.

It may be then that the supervisory arrangements are not altogether successful in bringing the two parts together.

Another way of integrating sandwich courses that has sometimes been advocated is assessment of the industrial periods as part of degree examinations. Different institutions appear to vary considerably in their practices. Urry, 1970a, in a survey of 73 courses covering 10,000 students in the academic year 1968/69, found that most gave some recognition to industrial performance but in only 17 cases did the final degree examinations incorporate industrial assessment marks. At the Brunei Conference on Sandwich Education a discussion group of nine members from seven of the technological universities considered a whole range of assessment methods including tutor reports, student reports, five-point scales and vivas. On balance, they came down against formal assessment on the grounds that the widely differing industrial environments made comparability impossible, that some otherwise useful firms refuse to take part in assessment procedures and that no clear general objectives (taken to be a sine qua non of assessment) seemed to exist for industrial training. They supported the view that the purpose of industrial training is the broadening of experience rather than the assessment of the individual (Blitz, 1970). On the other hand, while recognizing the difficulties, Urry (1970b), among others, favours assessment as a way of signalling the completeness of the whole sandwich course.

Many of those who accept that sandwich courses are not fully integrated at the present time feel that the situation can be ameliorated by improved administrative arrangements. But the problem may be more fundamental than that. Educational
institutions and industry are different types of organization holding different values and pursuing different goals. They may be so different as to make it almost impossible to embrace them within one controlling system. Jahoda (1963) has applied socio-technical system analysis to the sandwich course:

Educational systems, in order to function with optimal efficiency, require an internal organization and order to establish priorities relevant to their central task. Now the central task of industry is obviously not the same as that of a college; if industry were regarded as within the educational system it would bring to it its own task which would make chaos out of the situation; to establish priorities among the very different major concerns of each partner could be achieved only by sacrificing some aspects of one of the central tasks (p. 202).

Jahoda’s solution was to regard the sandwich course as an educational system with its boundaries as open as possible to industry in terms of consultation, research on industrial problems, industrial advisory panels, exchanging staff and so on. But ‘under such conditions of close co-operation all arrangements would ultimately be subject to final decision within the education system only’. However, this is to look at it from the education side of the fence. How it might look from the other side is perhaps suggested by a speaker from industry at the Brunel Conference who, having argued that industry’s reaction to sandwich course graduates will govern the development of this type of education, said bluntly ‘I believe, with all due respect, that industry is the buyer’!

Differences in industrial and educational goals and values may make it impossible in any fundamental way to achieve integration in sandwich courses. Ultimately when threatened the two types of organization will tend to put their own interests first. We are perhaps seeing something of this as the industrial recession and the difficulties of student recruitment are putting the sandwich system under attack from both sides.

Many sandwich courses, at the present time, seem to comprise a degree-level education juxtaposed with periods of work experience. The latter may provide opportunities to learn about industry as a complex and continually evolving interplay of human relationships, organizational structures and technical problems and practices. The student’s understanding of the world may be broadened and deepened by these experiences and he may acquire a wealth of associations on which to base his future learning. But, if education and industry do not together comprise the educational unit, and if the connection between the two types of experience is not as close as is sometimes maintained, does there have to be alternation of experiences? (In any case a full year in industry inserted into a degree course can hardly, except in a strict literal sense, be described as alternation of experiences). Could not many of the benefits of industrial training in sandwich courses be obtained from work experience before going on to higher education? This would perhaps have advantages
for career choice and seems to be favoured by students (Heward et al., 1968; Orr, 1974).

The technological universities seem to have tacitly conceded the case that the interaction between university studies and industrial training is less than might have been hoped. Increasingly, they are tending to run full-time and sandwich courses concurrently with the students attending the same classes. If the academic parts of sandwich courses depended upon, or were even appreciably influenced by, experiences in industry, this would not seem to be possible. As Burgess and Pratt (1970) perceptively remarked in their book on the colleges of advanced technology: ‘integration of the industrial sandwich periods is the Achilles’ heel of the sandwich principle’.

**Conclusion**

If we now return to the criteria for evaluating sandwich courses - the reactions of those most closely involved, the apparent effects on students and the extent to which they have been freely taken up elsewhere - then a tentative conclusion must be that they have been something of a disappointment. Cotgrove (1973), as we have seen from his opinion piece ‘Do sandwich courses deserve to die?’ would probably agree with this. But neither of us would, I think, want to go as far as Ezard (1970), who was led by the first national student conference on sandwich courses to compare this type of education to the Frankenstein monster which was created with high hopes, but, because it was not loved and nurtured, turned and destroyed its maker!

The chief reason for disappointment is the generally acknowledged failure to bring the academic and industry parts into a satisfactory relationship. There are also reasons, as we have seen, for doubting whether some of the educational arguments for sandwich courses carry much force. This is perhaps not surprising when we remember that extrinsic factors have been so important in their growth.

However, while it seems likely that the claims for sandwich courses have been overstated, they are not without advantages. They bring diversity to higher education. They have been found valuable in promoting learning about industry as a socio-organizational system, in preparing some students for future careers and in providing a broader framework within which students can learn about themselves. They may form an important part of courses in which the student is learning a ‘practical organization of knowledge’ (cf. Hirst, 1966) as opposed to an academic discipline. But the elevation of the sandwich pattern to an educational principle applicable to all subjects is probably going too far. We also have to ask to what extent could the benefits of these courses be obtained more economically and conveniently in other ways, in pre-, post-graduate or vacation industrial experience for example?
It would be wrong to attach too much importance to one group of empirical studies which are, after all, somewhat dated now. But the thoughts and speculations prompted by them do seem to make a case for a re-appraisal of the sandwich system. Now that it can be considered more dispassionately than in the days when it was supported with an almost religious fervour perhaps the various bodies and institutions with an interest in this type of education should look at it again.
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