3

The Selection and Assessment of Technicians

In selecting students for technician courses, the main aims are to guide each individual into the type of job in which his abilities, aptitudes and interests, academic performance, intellectual and practical strengths, personal qualities and potential are most suited, and to place him in the course in which he is most likely to succeed.

For several reasons it is not possible to obtain clear information on how technicians are recruited for industry. One is that many employers do not identify a technician category in their manpower classification. Another is that job classification in industry is fast becoming obsolete. And a third is that there is considerable mobility of people into, through, and out of the technician category. The mobile groups include large numbers of technicians who are promoted from craftsmen, and who usually had no formal qualifications on leaving school. They also include significant numbers of relatively highly qualified graduate engineers who are passing through the technician category to higher-status employment and are not getting recognized technician-type training to fit them for technician jobs.

However, the number of technicians who have not received formal training is declining, and older people who have qualified by experience are giving way to younger people with formal technical qualifications. Better educational opportunities have made it possible for more young people to obtain formal school leaving qualifications. Today technician apprentices or trainees are mainly recruited from people who have had sufficient secondary schooling to have acquired G.C.E. or equivalent-level qualifications. The technician category has grown partly in response to a demand arising from technological change and industrial innovation, and partly because the development of secondary and technical education systems has produced a greater supply of people with the necessary general education and technical knowledge.

In most countries and industries a technician employment pattern is becom-

ing apparent with its own level of general education, technical education, and vocational training. There is understanding and acceptance of academic study as a complement to practical training, and of post-secondary education qualifications as being reliable criteria on which to assess the level of an individual worker within the overall technician category.

Secondary schools in many countries offer pre-vocational foundation programmes containing practical and theory elements of lower technician courses. The educational aim is to encourage intellectual versatility and the rational understanding of vocationally relevant technological principles rather than to provide industrial training in precise skills and techniques. The programmes are planned to avoid wastage of human ability by allowing reasonable time for students to discover which technician course suits them best, or alternatively to switch to a craft or skilled worker course. Special arrangements are made for students to transfer to higher technician courses of three to four years' duration if they obtain good passes in mathematics, an appropriate science subject, and a subject requiring facility in the use of spoken and written language.

Technician and similar vocational course entrance requirements are having an effect on secondary school curricula. In a four-year secondary course the normal pattern is becoming two years of studies which all students take, followed by a further two years planned to allow for vocational interests to become the focus of teaching and learning. There is an increasing emphasis on science, mathematics, drawing, and practical and vocational subjects.

Pre-technician courses specifically designed for those who are potentially capable of satisfactorily completing a technician course but who lack the necessary entry qualifications, are another developing feature of secondary education. One of the purposes is to provide educational guidance by studying students over a fairly long period. The courses concentrate on mathematics and science because there is evidence that success in these subjects is likely to lead to success on a higher or middle-level technician course. Those students who successfully complete a pre-technician course frequently do better on technician courses than those who enter directly from school by virtue of examination success. A pre-technician course within the system of technical education could therefore be an appropriate channel to technician training. However, entrants would need to be carefully screened: attempts to use the course itself as an instrument of selection by admitting every applicant would lead only to a very low pass rate in the examination at the end of the course or to a lowering of standards.

Problems of selection for technician training arise for several reasons:

1. A shortage of suitable candidates with basic qualifications in mathematics, science and language subjects due to a national lack of adequate secondary education opportunities and resources.
2. An excess of applicants possessing minimum admission qualifications to technician training.

3. The transfer of craftsmen lacking secondary education to the technician grade.

One reason for the existence of the second of these problems is that the academic standards of recruitment for some blue-collar technician and skilled worker jobs are set far above the required ability levels. The technician training programme, particularly at the middle and lower levels, does not require the academically well-qualified student from the top third of his class. A job-motivated person of average ability and the capacity to stick to a task until it is completed is likely to have the profile required for an effective technician. The selection and recruitment requirements must be directly related to the content and objectives of the technician training course – not so low that wastage is high, or so high that good candidates are excluded. The technician teacher has to ensure that the student of average ability and persistence is encouraged to learn and succeed.

The selection process is concerned with the initial qualifications required before an individual can be trained to do a particular kind of technician job. Although it is not possible to produce a detailed analysis of the type and range of work from which to structure a valid and reliable selection process for technicians, it is possible to identify two kinds of technician: those in whose work practical knowledge and ability is foremost and for which the training should have a substantial craft emphasis, and those in whose work there is greater emphasis on theoretical knowledge and for which the training should approximate to professional standards. Both are concerned with implementation rather than innovation, and both have little involvement in management, planning, evaluation or control. But the higher technician requires a more extensive knowledge and discretionary ability which he can apply over a much broader area of activities than the other technician whose job tends to be much more routine and narrowly defined. This is reflected in the higher technician's vocational education requirements to do the job and in the higher general educational requirements to be selected for higher technician training. In its publication *The Training of Technician Engineers,* the Engineering Industry Training Board (London) lists six main abilities which appear to be demonstrated to a greater or lesser degree by all technician engineers in whatever branch of the engineering industry they may be working. These are:

(a) The ability to use and communicate information.

(b) The ability to measure or make use of measurements which involve a variety of tools and/or instruments.

(c) The ability to choose materials and components and understand the processing of materials.

(d) The ability to understand manufacturing activities and the general commercial organization and practice of their companies.

(e) Diagnostic ability.

(f) The ability to organize (but not necessarily supervise) and give direction to the work of others.

In considering these, it should be noted that there is very little difference in the types of communication carried out by technicians at different levels. Except for draughtsmen, written and verbal communication with customers, suppliers and colleagues is the most time-consuming activity. Draughtsmen, however, spend more than half their working time on the preparation of drawings and sketches. This form of occupation also accounts for between a third and a quarter of the time of those technician engineers who are employed on design. Technician participation in design is limited. Among non-draughtsmen technicians, drawing alone accounts for little more than five per cent of time worked. Draughtsmen working in production appear to have the narrowest range of duties.

The entrance requirements to technician training and the selection mechanisms must be related to the appropriate kind and level of technician training and employment. The mechanisms must measure applicants against the tasks they will have to perform and not against the criteria of the education system that produces them. The kind and range of selection mechanisms must be realistic in terms of the particular country's stage of industrialization, applicable to existing conditions in industry, and directly relevant to technician jobs which are already available or will be available in four or five years' time. The characteristics of both the job and the individual to fill it are interdependent and have to be examined together. Co-operation in selection between industry, school and technical college produces the best results. Vocational guidance counsellors and employment selection staffs are presented with a dilemma if industrial organizations do not specify their educational and other requirements at technician level. Those responsible for selection and guidance need to have from industry a job description and a specification of the make-up of the kind of individual required. They need to know the level of authority of the job in the particular industrial organization, the functions of the job within the firm, the kind of work carried out, and the qualifications required to carry it out. Technician job profiles are standard under a number of headings, such as job title; age; school leaving qualifications; training (apprenticeship); type of work; range of activities; and breadth of knowledge. The profile is based on analysed real-life industrial situations and experiences and is likely to be the most objective and valid evidence available on which to structure such selection devices as tests of general and special abilities, personality inventories, attitude and interest schedules, rating scales, sociograms, and interviewing techniques.

Tests

Tests have been devised to assess an individual's general and special abilities, educational achievement, interests, temperament, and potential. They are used for educational and vocational guidance and selection, and for assessing achievement and progress in scholastic and employment situations. The aim of all

tests is to contribute to a pool of objective information about individuals. In course programme subjects, tests – including scientifically constructed questionnaires, inventories, and schedules – are used to supplement, confirm or adjust teachers' assessments of students' achievements. In vocational selection they are used to eliminate as far as possible candidates unlikely to succeed on the job after training.

The usual reason given for having a testing programme at the stage of initial selection for training is that it facilitates the sorting out and job allocation processes, and reduces the possibility of expensive mistakes. It is based on the theory that there is a framework or profile of abilities and traits relevant to particular occupations and jobs. However, test designers have not constructed valid tests of the basic knowledge, skills, experience and personal make-up necessary for success in particular occupations, and care should be taken not to rely on them too heavily.

The information from tests can be built into the student's record. From the record a profile of abilities can be constructed. This profile is a diagrammatic way of charting and communicating information about an individual. It gives standardized information about his general intelligence, special aptitudes and capacities, and his performance in academic subjects and practical skills. It provides a basis on which a youth's abilities, interests, and personality can be matched with the requirements of a vocational training programme or with a job specification; it offers clues about personality, social maturity and adjustment; and it enables individuals to be compared with one another. But no matter how many tests are used and how well the information is interpreted, the profile can never be complete. All it can do is help us to avoid some of the erratic judgements and decisions which can result from selection based on one test or on a collection of tests which themselves may not be reliable. It cannot by itself be a framework for valid prediction about occupational selection or job placement.

General Intelligence Tests

General intelligence tests are the most widely used instruments in selection techniques. General intelligence is an essential characteristic for students who are tackling the theory associated with vocational training, and who must therefore understand the application of scientific principles to the tools, machines, equipment, materials, processes and techniques of manufacture, construction, and production. A good level of intelligence is an essential characteristic for higher-grade technicians.

However, the value of measuring general intelligence depends on having data from industry about the minimum and maximum intelligence required for success in a particular kind of employment. Such information is very difficult to obtain. As a general rule, tables have been compiled by research workers equating broad intelligence bands with broad occupational bands. In one of them the 100-115 intelligence band (average and somewhat above average) is

equated with skilled work which in modern terms probably includes most technicians. The 115-130 band (superior to very superior) is equated with technologists. Other tables differ considerably from this, and selection and placement staff should exercise caution before using what might appear to be authoritative information.

The intelligence demands of many jobs are overrated by employers. Special abilities or aptitudes are as important as general intelligence when selecting technicians, or any other category of worker. It would be a tremendous move forward if principals of technical colleges were able to provide objective information about the intelligence ranges, special abilities, interests, attitudes, personality traits, social factors, and emotional and motivational make-up likely to contribute to success in technician courses.

Aptitude Tests

Aptitudes for specific activities are difficult to identify and assess. Less is known about them than about general intelligence. They begin to be revealed at the age of thirteen or fourteen and, together with vocational interests, to become stabilized at about fifteen. This, therefore, is the age range when the school curriculum should have a broad vocational bias to give students opportunities to explore their occupational aptitudes and interests.

In some countries the last year of secondary education is used as an occupational diagnostic year by their teachers who build up records of their students' abilities, interests, and achievements. In some cases students are allocated to a particular school offering special pre-vocational courses (e.g. in agriculture, commercial and business subjects, engineering, construction, or applied science). The allocation is based on parents' wishes and pupils' interests, and on headmasters' reports which normally include evidence from standardized tests of general intelligence, aptitudes, subject achievements, personality traits and character qualities. An alternative is to allow students in their last year at secondary school to attend a technical college. There are several reasons for this. For one thing, teachers in technical colleges are accustomed to working with students in their middle teens taking vocational courses and with adults from different levels of many occupations. They can therefore help adolescents to make reasonable choices about the kinds of work and further education from which they are likely to get and to give satisfaction. For another, the technical colleges with their laboratories, workshops, and specialist staff can provide a wider spectrum of vocationally-based studies than all but the largest and most modern secondary schools.

Psychologists do not agree about the nature, measurement and grouping of aptitudes, but they do agree that an individual's pattern of abilities has significance in vocational guidance and selection for training and employment. A rating of general intelligence is probably the most significant component in the aptitude profile of an individual's abilities, but it is not infallible and it does not supply all the information required for vocational guidance or job selection.

As a result, other tests have been devised which seek to distinguish and evaluate an individual's special abilities or aptitudes. The Minnesota Occupational Scale covers 400 occupations in terms of six abilities: academic, artistic, clerical, mechanical, musical, and social. The U.S. Employment Service General Aptitude Test Battery comprises 22 occupational ability patterns for over 500 jobs, and tests general intelligence, verbal ability, numerical ability, spatial ability, form perception, clerical perception, motor co-ordination, finger dexterity and manual dexterity. It takes some two and a half hours to administer. Test batteries usually include individual tests for general intelligence (G), verbal ability (V), and motor ability (K). They are supplemented as necessary for form perception (P), manual dexterity (M), and spatial ability (S). Depending on the purposes for which the scores are to be used, they can be supplemented by evidence from standardized tests of language, science, mathematics, mechanical drawing and other subjects considered to have predictive value in a particular situation as well as by data from tests of personality traits and character qualities.

There are paper and pencil tests and manipulatory tests constructed to measure many capabilities. These include aptitude for mechanical comprehension, mechanical reasoning, the abstract reasoning required to isolate underlying principles in a complicated situation, mechanical judgement, mechanical assembly, manual dexterity, precision of movement, finger dexterity, motor co-ordination, methodical ability, attention to detail, clerical ability, dealing with spatial relationships in two or three dimensions, and speed of co-ordinating reactions. There are also tests for particular occupations, such as specialist engineering or construction craftsmen. Whilst it may be true that low scores in a particular section of an aptitude test do not necessarily mean unsuitability for an occupation, it is seldom wise to ignore them when selecting a student for vocational training. Thus, to take an example, there are many highly intelligent, professionally well qualified and capable people who are unsuited to administrative, management, supervisory, personnel, or teaching jobs because they lack the personal qualities required for effective human relations. They may be able to enunciate the principles of good administration and management, to give lectures on group and inter-personal relationships, to write authoritatively and informatively about management skills, attitudes and techniques, but they lack the aptitude to apply the theories in real situations. As in most walks of life it is easier to 'tell people what to do and to talk about how to do it than to show them how to do it, or in fact to do it.'

Selectors have to decide what are the best tests to use to find out what they need to know about each candidate. Some aptitude tests have such a large intellectual content that people of high general intelligence can score well on them without having much ability in the special test area. This applies, for example, to some tests in mechanical reasoning which are supposed to predict ability to analyse technical data. On the other hand, even with training some people of high intelligence are incapable of using the simplest tools for oper-

ations requiring the most elementary skills. To some extent, also, past experience can influence an aptitude test score. Thus a person's score on a manual dexterity test or on an assembly test such as fitting together the parts of an electric bell, a clothes peg, or an electric switch, may reflect the extent of his experience in using simple tools. In many countries and in many social groups there are still few children who are accustomed to using tools or playing with construction kits or who go to a school that has a well developed technical subjects department staffed by capable teachers of practical craft subjects. For these reasons it is unwise to draw hasty conclusions or make final judgements about an individual as the result of a 'once for all' aptitude testing programme. In any case, no selection testing programme in education or industry should be allowed to be mounted without a clear, convincing statement of its purposes, objectives, techniques and intended consequences. It should have precisely defined limits of content and time requirement. It should not be perpetuated unless there is valid evidence that it correlates with success on the training course and on the job.

Achievement Tests

Educational achievement tests are an important feature of the selection process for technician training. They are often the basis for allocating new students to particular kinds of course in technical colleges and for assigning trainees to courses in works training schools. Some national examination programmes provide the required achievement information. For example, passes in mathematics and science at the ordinary level of the General Certificate of Education after four years' secondary schooling in Britain is a nationally-recognized measure of scholastic achievement. It is also an indication of probable success in most technician courses. Four passes – mathematics, science, English and one other subject (or the equivalent) – are required for admission to courses for the Ordinary National Certificate, a middle-level technician qualification which in turn admits to courses for the Higher National Certificate, a higher technician qualification.

Achievement tests are also used to assess the proficiency of individuals before being granted the status, employment conditions, and pay of a technician. These tests are often under the control of a joint panel of the relevant trade union and employers' association which is responsible for admission qualifications, for the training curriculum, and for ensuring the standards of the vocational education associated with the training.

Though achievement tests are a reasonable measure of *past* performance in other educational or occupational spheres, the evidence regarding their *predictive* value is scanty and not convincing. Success in an occupation cannot be predicted with assurance from achievement tests at the selection stage. One reason for this is that although there appears to be a framework of abilities and traits relevant to a particular occupational group, circumstances can change the nature of the work and the levels of responsibility in the years after initial selection.

Thus some graduates and higher technicians who are reasonably successful for the first few years when they are learning the job and working under direct supervision may later become a liability when transferred to work requiring foresight and creative imagination in perceiving a problem and mounting a sensible plan to solve it. Other aspects of personality, and other factors – such as the nature and quality of teaching, supervision and guidance – influence the way in which a person faces challenges, uses initiative, and learns from mistakes.

Assessing Personality

The techniques available for assessing personality are based on the assumption that each individual has his own pattern of characteristics which can be assessed as separate traits. These traits are the qualities that give a person individuality: for example, creativity, responsibility, integrity, honesty, leadership, co-operativeness, initiative, and drive. Although it is possible to produce standardized tests for some traits such as general intelligence, it is harder to measure those just mentioned or others, such as determination, vitality, independence, consistency, and sensitivity. As a result, personality tests are not highly reliable, and their value in predicting success or failure in any kind of training or employment is limited. However, they can contribute to the production of a personality profile provided their results are combined with the information obtained from other tests, questionnaires, inventories and interviews, and the teachers' records of the student's behaviour in group activities, role-playing situations, discussions, etc. The social aspects of personality are probably the most important in making selections for technician training. Good general intelligence and vocational aptitude can be nullified by inability to adjust to other people, to training, or to the work situation.

It is an individual's attitudes that give meaning and motive to his life and indicate how he will react to an occupation and to the problems that arise in it. They play a large part in determining whether or not a youth completes a full secondary course, goes on to university, or seeks a technician occupation. Professional-class parents understand this and deliberately set out to influence their children's attitudes in favour of university education and white-collar professional jobs which have high social status. Such attitudes may permeate society as a whole, and adolescents beginning work in industry may feel themselves disadvantaged. Attitudes, however, are not permanently fixed. They can change considerably after a youth has begun a technician job which can provide him with status, security, pay and prospects of promotion. Once he perceives a target as being worth-while he will usually modify his attitudes to achieve it.

An individual's occupational interests are of importance in selection and guidance, and opportunities to help him to discover and develop them should be provided in school. Teachers should have as complete a record as possible of their students' interests. However they may need facilities to broaden their own practical and technical interests and widen their own educational horizons if they are to be able to offer the specialist help that students need. Another

requirement, which applies in all countries, is to develop operational research programmes to discover which factors, in school and at home, are concerned in arousing, developing, and sustaining vocational interest among adolescents. However, it should be remembered that success is less dependent on interest than on the possession of the right profile of abilities and temperament. To have great interest in a job is not the same as having adequate ability to do it.

Various techniques can be used to obtain a profile of an individual's pattern of interests. The student can be invited to talk about his interests, and estimates can be made of the extent of them, ranging from total rejection at one extreme to complete involvement at the other. Interests can be listed, classified and appraised by trained observation of the things a student chooses and does, the way in which he works, the time he devotes to different kinds of activity, the way he uses his spare time, the optional curriculum subjects he chooses, and the persistence he displays in different subjects and activities. A person's hobbies are a poor predictor. Though they may indicate a leaning towards some careers, they are not good indicators of the success he is likely to achieve in them.

Interviews

An interview provides an opportunity to explore the nature, content and quality of a candidate's previous education and training, his level of personal development, his maturity and adjustment, and the degree to which he possesses the special qualities he needs to undertake a particular kind of training or enter a particular occupation. It can also be used to elicit information not provided on application forms, and to inform candidates about working conditions, education and training programmes, wages and payment systems, career prospects and other matters. The people on the interviewing panel should be skilled interviewers with up-to-date and reliable knowledge of the present and future employment market, and with clear ideas about what needs to be learned from and communicated to each candidate. They should study copies of relevant documents – such as application forms, confidential references, specimens of work, and observations by teachers and instructors – in advance of the interview, and be given precise instructions, a schedule of questions, and the rating scales and check lists to be used in making their assessment. Each interviewer must conduct his part of the interview according to his brief.

Interviewers for technician training courses should have reliable knowledge of the existing technician job situation and the technician employment changes likely to take place over the next five to ten years. They must have access to detailed job descriptions and to specifications of the kinds of person most likely to match various occupations. They should have first-hand experience of the occupations and industries for which they are selecting technicians for training.

Many selection interviews are conducted within the framework of *The Seven Point Plan* designed by Professor Alec Rodger of Birkbeck College and the National Institute of Industrial Psychology, London. The seven points are structured to explore and report on a person's physical characteristics, attainments,

general intelligence, special aptitudes, interests, temperament, and personal circumstances. The plan allows for flexibility, development and interpretation according to the skill and experience of the interviewers and the precise purpose of the interview. It also ensures that no aspect of the individual is neglected and prevents irrelevancies from being introduced.

The Seven Point Plan

1. PHYSICAL MAKE-UP
Has he any defects of health or physique that may be of occupational importance? How agreeable are his appearance, his bearing and his speech?

2. ATTAINMENTS
What type of education has he had? How well has he done educationally? What occupational training and experience has he had already? How well has he done occupationally?

3. GENERAL INTELLIGENCE
How much general intelligence can he display? How much general intelligence does he ordinarily display?

4. SPECIAL APTITUDES
Has he any marked mechanical aptitude? Manual dexterity? Facility in the use of words? Or figures? Talent for drawing? Or music?

5. INTERESTS
To what extent are his interests intellectual? Practical-constructional? Physically-active? Social? Artistic?

6. DISPOSITION
How acceptable does he make himself to other people? Does he influence others? Is he steady and dependable? Is he self-reliant?

7. CIRCUMSTANCES
What are his domestic circumstances? What do the other members of the family do for a living? Are there any special openings available for him?*

Professor Rodger required that the matters covered by his *Seven Point Plan* should conform to four criteria:

'They should be relevant, in that they should pin-point influences that are commonly and demonstrably connected with occupational success and failure.

'They should be independent in that they should be sufficiently separable from one another to enable us to avoid overlapping assessments that would be wasteful.

'They should be assessable in the circumstances in which the assessments have usually to be made.

'They should be few enough to keep the risk of hasty, superficial judgement to a minimum, but numerous enough to cover the ground adequately. There can be no objection to the addition of items to the standard list where this seems desirable for a special purpose. . . What should be avoided is the changing or omission of existing items, and provided this need is observed others can be put

*Alec Rodger, *The Seven Point Plan,* NIIP Paper No 2, National Institute of Industrial Psychology. 1952. (Third edition 1970.).

in. Even if the new ones make an attempt to break an existing item into component parts, they can reasonably be added, provided that the parent item remains'.

The Plan includes three cautions. The first is that '. . . the order in which the headings appear is not meant to carry any implications whatever about the order of their importance. The weight to be attached to a particular heading. . . will depend. . . on the nature of the employment or training for which an applicant is being considered'. The second is that '. . . it is not intended that any attempt should be made to deal with the seven sections of the plan in the order in which they appear on the paper'. And the third is that '. . . the questions under the seven headings are not meant to be put directly to the applicant by his assessor. They are questions for the assessor to ask himself about the applicant'.

Student Records and Reports

If properly maintained an individual's cumulative school record is of much more value in selection and guidance than the subjective judgements, general impressions and guesses of individual teachers. Teachers should therefore work together as a team to provide a useful, scientifically structured, and well-organized record through which each student can have access to further education and train for a career offering worth-while life opportunities.

The framework of an institution's cumulative record system should be based on a clear statement of the aims of the institution. The plan should require the minimum of paper-work by teachers commensurate with building up an adequate annual profile of the characteristics and achievement of each individual student. Agreed decisions about what has to be written in the record by each teacher should result in a streamlined, uniform, simple method of recording which can easily be kept up to date. Wherever possible, record forms should be tabulated so that they can be completed by clerks.

School or college report material should not include subjective information likely to reflect adversely on the student making a new start in technician education and training. The need is for objective information which will help to guide and advance the student in his technician studies, in his vocation and as a person. The report should evaluate academic achievements, and give assistance with regard to the kind of training course for which the student is best suited.

The cumulative record is the basis of the report prepared by the head of a student's secondary school for use by a selection board, a technical college, a training institution or a potential employer. Woolly thinking about educational measurement and the content of the cumulative record can produce a half-baked report that can be a handicap rather than a help to the student seeking selection for admission to a technical course.

To be effective the record should be started as early as possible in school and be continued through technical college and technician training. The information it provides should be presented in a form in which it can readily be interpreted by other educational institutions and industrial organizations and used as a basis for producing reports, leaving certificates, references, and testimonials for

employers. It should be based on tests and inventories, check lists, sociograms, case studies, vocational interest blanks, and interviews, and enable the individual's personal needs, abilities, behavioural patterns, traits, character qualities, occupational interests and ambitions to be assessed.

It should contain:

1. An account of the individual's progress through school, technical college, and vocational training.
2. A case history of his personality development including information about social factors which could influence his educational and vocational choice, opportunity, and progress.
3. Relevant, usable, meaningful information whether it is complimentary or uncomplimentary to the individual, his teachers, or his school.
4. Relevant documentary evidence to support the validity of judgements.
5. Information on a five-point scale. (See pages 93–94.)

The circumstances in which ratings are made must be stated. A student record containing only a statement of terminal and sessional examination marks is practically useless as a selection tool. The problem is to decide what to include without making the individual's folder unwieldy and without rejecting anything which could be useful. In addition to educational information, the list can include such items as the capacity to make effective use of assigned and unassigned study time; orderliness in work habits; conforming to task plans and directions; neatness, speed, and accuracy of performance; attitudes to the care of buildings, tools, material, equipment, library books, etc; self-reliance and initiative; keeness and interest to learn; willingness to accept advice; industriousness and dependability; energy and persistence in completing a task; attitudes to work regulations and authority; ability to get on with others; readiness to assume responsibility; adaptability; self control; tolerance; flexibility; companionability; general interests and leisure activities; interest in other peoples and community activities; likes and dislikes.

Information about health is necessary to inform selection and guidance staff about the existence, nature, and extent of any known disabilities that are likely to limit an individual's educational progress, personal development, vocational choice, and career opportunities. Standardized check lists are available for recording this information. It is important to know if a candidate for employment suffers from health problems such as headache, allergies, a vision or hearing deficiency, or inability to stand for long periods or to work for long periods in particular conditions.

There is much published information available on the many ways of arranging the items in a record folder, and various views about the design of printed record cards and the main categories of information required to produce an individual student's longitudinal record. General information is best contained in a specially-designed record cover with a contents index refering to specific numbered items arranged in sequence in catalogued sections.

There should be no possibility of matters of personal privacy being at risk. Confidential records, if and where they exist, should be kept under lock and key. Only records which are not confidential should be readily available to teachers. A student should have access through a member of the teaching staff to his own record but not to anyone else's record.

All senior members of staff who are concerned with the progressive guidance, work efficiency, selection and career development of other persons need training in the fundamental principles and practices of using record building and assessment devices.

Examinations and Technician Course Evaluation

External examinations serve a number of purposes in technician education. They test the quality, standard and level of work in the technical college or training institution. They provide an independent check on the validity of teachers' assessments and an objective measure of a person's educational attainment or his proficiency in a job before being granted the qualification, status, employment conditions and pay of a technician. They act as a convenient, accepted, and relatively economical way of testing knowledge and skills and, thereby, of grading and classifying people completing a technician course. They allow technical colleges to compare their results on technician courses with those of other colleges. They can be a selector or predictor of suitability to proceed to further courses. They provide a goal for the student and thereby an important motive for learning. They provide the student with a measure of his performance. They help to ensure that the technician diploma has a wider recognition and status outside the college.

Control of the vocational curriculum by technical colleges may be traditional and appropriate but this does not mean that technical teachers should claim to know everything about the vocational needs of the technician on the job or to have exclusive control of the national examinations taken by technical students. Employers have a direct concern with the content of the technician syllabus, with planning the technician teaching curriculum, with technical examinations, with the evaluation of technician courses, and with the maintenance of technician standards of training, qualifications and performance. Without the involvement of employers, standards can become academic, occupationally remote, and even irrelevant as far as the needs of industry are concerned.

For this reason the final qualifying examination in some countries is under the control of a joint panel of trade union and employers' organizations. The same panel is responsible for the content of the training curriculum and for ensuring the standard of the vocational education course associated with the practical training. It is an arrangement which promotes a close collaboration between employers and technical colleges. It creates opportunities for appraising the knowledge, skills and personal qualities relevant to technician task performance in on-the-job situations. It motivates technical teachers to be less academic in their teaching and attitudes, to be more conscious of production and pro-

ductivity in industry, more technician job-oriented, and more aware of the technician's role. It encourages teachers to develop a closer collaboration with industry to ensure that their technician students are acquiring the appropriate knowledge of subjects relevant to their future job needs, and are gaining sufficient knowledge of processes in workshops and laboratories to operate, supervise and control the situations prevailing in industry.

External examinations may have bad as well as good effects on the work of a college. They tend to confine teaching to the strict content of the syllabus. They may enable questions of a particular type to be spotted so that standard, essay-type answers can be prepared in advance, with the result that the student's intelligence is not given full play. They may lend support to teaching methods in which students regurgitate dictated notes. They may go on too long: in some cases examinations of one sort or another consume more than a third of each term! They may test a poor sample of the total course content. These drawbacks can be reduced if examinations are regarded as the servant rather than the master of the curriculum. To accomplish this it is essential to establish at the outset the critical objectives of each significant item of the training course, to determine the depth to which it is to be taught, and only then to decide how the achievement of the relevant objectives should be measured. This means there must be close and continuous collaboration between those building the technician curriculum, those who test the results and those who employ the graduates – that is between the educationists, the examining bodies and the employers. At the end of his course a technician should be able to tackle any reasonable job put in front of him. The examination should therefore seek to test that ability, and not reflect some abstract concept of the occupational needs of a technician or notion of all-round excellence.

The task of examining in the technician field grows increasingly difficult for many reasons. These include the breaking down of traditional subject boundaries, the need for frequent revision of syllabuses, the widening range of subject matter in specialist areas, improved educational measurement techniques, rising numbers of entries, the greater involvement of teachers in the assessment and examination process, and a growing tendency to replace the completely external examination by college-based examinations or by combinations of both. Among the alternatives are: a written paper externally set and marked; a written paper internally set and marked; a written paper internally set and marked with external assessment; an objective test externally set and marked; a practical or oral internal or external examination or combination of both; course work assessment by the student's teacher; and project work, internally or externally assessed.

Continuous Assessment

The purpose of continuous assessment of the performance of technician students is to encourage them to work steadily and continuously throughout the course. Personal responsibility and enthusiasm for learning are fostered when students are informed of their progress. Students want to know if they are doing better or

worse than last week – if they are achieving appropriate targets, if they are likely to obtain a good pass in the end of course examination, and if they need to take action to prevent a possible failure.

Continuous assessment allows the teachers to have feed-back on individual student performance so that remedial training can have maximum effect. With an end-of-course test there is no such opportunity. Nor can instruction be tailored to cater for individual student differences as they become apparent during the course. Continuous assessment is also more reliable and more valid than a once-for-all end of course examination.

One useful form of assessment is to set students a continuous series of laboratory exercises or a project involving exercises from the design to the production stage. Another is a series of short tests set at appropriate stages to appraise the student's understanding of the principles, processes, systems and techniques covered up to that point. Cumulative records based on progressive tests and giving a systematic assessment of performance must be kept to ensure that adequate control of assessments and standards is maintained. Students need to maintain logbooks, work diaries and notebooks that can give an external assessor a reasonable account of the level and standard of the activities completed during the course. The external assessor or moderator must have access to all the information in the students' folios and record files.

The scope and maintenance of national standards become more important to students and employers as more people seek vocational qualifications. Although the techniques for the validation of standards is a retrospective process, it is important that standards match the immediate needs of industry. The needs should be checked as frequently as possible. The data and information made available by the employer to the institution regarding the performance and changing duties of technicians is important. Equally important is the employers' methods of evaluating the technician for the purposes of job evaluation, promotion and additional responsibilities.

Technician Qualifications

Full technician certification and status should imply satisfactory performance in a technical college technician training course and in approved (on- or off-the-job) industrial conditions. A full technician qualification involves a number of stages. An intermediate examination may assess scientific and technical knowledge, a final examination can give a technical qualification of some merit, and a further examination can add a specialist qualification in a subject as applied to particular industries or processes. The currency of the qualifications must be readily understood by employers and students. The usual practice in industrialized countries is for the college to assess the academic parts of the course, for industry to test ability to apply knowledge and skills effectively on the job, and for a national body to manage final examinations and award certificates and diplomas. It implies close collaboration between government, industry, education, and examining and awarding bodies.

Historically, technician qualifications have not been regarded as important in their own right, but as evidence of failure to proceed to professional engineer or technologist status. This is an ill-considered attitude. The work of the technician is of national economic and industrial importance and his qualification should reflect his worth and his claims to employment and status.

Technician Education Council (TEC)

The Technician Education Council for England, Wales and Northern Ireland, established as an independent organization in 1973, provides one kind of national model for technician education. The Council has published a Preliminary Statement (October 1973), a Consultative Document (November 1973), and a Policy Statement (June 1974). These are obtainable from the Chief Officer, TEC, 76 Portland Place, London W1N 4AA; and the following information is derived from them.

The Council's terms of reference are summarized as follows:

> The Council will be concerned in the development of policies for schemes of technical education for persons at all levels of technician occupations in industry and elsewhere. To this end it will, as proposed in the Haslegrave Report*, plan, administer and keep under review the development of a unified national system of courses for such people and will devise or approve suitable courses, establish and assess standards of performance, and award certificates and diplomas as appropriate.

In addition to rationalizing the existing provision, thereby saving valuable resources, the Council will keep the system it introduces under review. It will innovate, and it will also make use of the innovations it hopes will come from colleges and other establishments. Its aim is to provide a system of technician education responsive both to industrial requirements and to students' needs, while remaining economical and efficient in operation.

The Council will be concerned with promoting advances in technician education, thus enhancing the status of technicians. It intends that the qualifications it awards should be well understood and recognized by professional bodies and the community at large and gain a truly national and international currency. Schemes of study will be built on units, defined as 'self contained and significant components of a programme which may be separately assessed and, if successfully completed, count for a credit towards a student's award'.

The Council's committee structure enables it to perform the functions of validating schemes, designing programmes and acting as an examining body. There are three sector committees, A, B and C, associated with Engineering, Construction, and Science-based subjects respectively. Numerous programme committees function within each sector.

The Council will award Certificates, Higher Certificates, Diplomas, and Higher Diplomas. This range of awards will recognize different levels of performance and different experiences but will not be associated with particular modes of attendance, which may include full-time, sandwich, block release, day release

**Technician Courses and Examinations*, HMSO, 1964.

and evening study or combinations of these. Students who cannot study regularly in a college will also have opportunities to obtain awards.

The Certificate will be the Council's basic award. It will be broadly comparable with the Ordinary National Certificate and approximately half way between Parts I and II of the City and Guilds of London Institute Technicians Certificate (T3). The standard of the TEC Higher Certificate will be broadly comparable with that of the Higher National Certificate and of the CGLI Technicians Certificate Parts II and III combined. Diploma programmes will often have no less depth of technical content but will be broader than those leading to Certificates.

In seeking to establish acceptable standards the Council will take many factors into account, including the following:

(a) The objectives of TEC programmes, which include transmitting a body of knowledge and a command of certain skills and techniques, and increasing the student's capacity to learn, to adapt, to communicate, and to take responsibility.

(b) Acceptability to the student in terms of his personal and vocational needs; to employers of technicians; to professional and other qualifying bodies and industrial training boards; to validating bodies for purposes of admission to courses of higher education; and to authorities within the EEC for purposes of mutual recognition.

(c) Value for purposes of establishing technician education in its own right and improving the status of technicians.

(d) Comparability with existing technician awards in the U.K. and with technician awards overseas.

The Council attaches importance to the achievement of high and generally acceptable standards, and includes among the factors related to this the teaching and supporting staff available and the teaching and learning situation. It does not wish the requirements for obtaining an award to be unnecessarily demanding, believing that a student who meets admission requirements and studies conscientiously should be entitled to a reasonable expectation of success. The Council will be concerned if this does not happen in practice.

The Council expects colleges to be flexible about admitting students to TEC programmes at different ages and different levels of attainment, and to give appropriate credit for previous relevant study.

The Council has also, in its publications, set out guide-lines showing, for each kind of award, the minimum number of units the programme should comprise, approximately how many hours' study in college this involves for the average student, and how many years it will take for students having the minimum entry qualifications.

Programme	*Units*	*Hours*	*Years*
Certificate	12	900	3 (day release)
Higher Certificate	8	600	2 (day release)
Diploma	25	1800–2200	2 (full-time)
Higher Diploma	16	1200–1500	2 (full-time)

Students following sandwich programmes may also be able to gain Diplomas in two years and Higher Diplomas in two years provided they obtain adequate experience in industry. A Certificate holder may qualify for a Diploma by completing the required additional units. Conversely, a Diploma student who fails to qualify for his Diploma may be awarded a Certificate if he has successfully completed the units required for it.

The Council has approved principles for assessment. The main principles are that assessment should be related both to the aims of the programme as a whole and to the learning objectives of the individual unit; that the students' work during the programme should be adequately recognized and there should be no undue emphasis on formal examinations; and that units in the early stages of a programme should normally be internally assessed, with external moderators being concerned with the assessment only of those units that contribute significantly to the award.