TEACHING AND TRAINING

A Handbook for Instructors

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Contents

<i>Preface</i>	vii
<i>Introduction—The Importance of the Instructor's Job</i>	ix
1 The Background to Training and Some Objectives	1
2 The Instructor's Job	11
3 The Instructor and His Teaching	30
4 The Class and its Learning	55
5 Assimilation	68
6 Assessment	82
7 More about the Learning Process	112
8 The Various Methods of Instruction	154
9 The Use of the Film in Technical Training	179
10 Further Training Aids	199
11 Summary of the Main Points Concerning the Instructor's Job	224
<i>Appendix 1—Example of a Multiple-choice Test</i>	235
<i>Appendix 2—Some multiple-choice Questions for Discussion</i>	249
<i>Bibliography</i>	264
<i>Index</i>	271

Preface

Since the appearance of *Techniques of Technical Training* in 1953, and its first revision in 1967 under the title *Teaching and Training*, there has been a phenomenal increase and great activity in technical training at all levels and in all countries. This has shown itself in the rapid growth in the general literature on the subject and in specialist articles, particularly in periodicals devoted to technical education and training. Training is now a matter of vital national importance in all countries, and is properly regarded as a major concern of educationalists, industrialists, and government departments responsible for economic planning and development. Education and training are recognised as prerequisites of manpower development and economic growth and therefore as a national investment for the future.

The author has drawn on his experience in technical education and training in the developing countries of Asia, where the need for trained manpower is acutely felt and where trained instructors with the necessary skills and knowledge of what to teach and how to teach it are often sadly lacking. This situation calls for special efforts to be made in the field of technical education in these countries, where the many innovations in educational technology are being readily accepted and adapted with even greater enthusiasm than in the industrially developed countries. The lives of millions of people depend on rapid economic development and the effective utilisation of the vast human resources of the subsistence economy countries. The developing countries must have more trained teachers and instructors, and in their struggle for economic development they cannot afford to neglect any innovation or opportunity toward the efficient and effective training of manpower.

Owing to the rapid expansion of training programmes all over the world and the demand for more and more trained instructors, there

is still an urgent need for a primer for instructors and others who are caught up, without much warning, in the training revolution. Training is concerned, in all countries, with the development of human resources, which is essential for economic growth and the alleviation of hunger and poverty.

I wish to thank Mr. George Fleming, lecturer at Salisbury College of Technology, for his helpful suggestions concerning this third edition.

H. R. M.

Salisbury, 1977

Introduction – The Importance of the Instructor's Job

This book does not attempt the task of distilling into a small volume the vast amount of work done in educational and instructional technology over the past few years—in the psychology of learning, learning aids, programmed learning, computer-aided instruction, educational cybernetics, curriculum developments, systems approach to training and course design—although passing references are made. It is quite impossible to include in an instructor's handbook a critical account of the many developments in these areas; such developments appear each month or quarter in periodicals devoted to technical education and training, and are dealt with in more advanced textbooks.

It is important, however, that training officers and instructors should know what is happening in training methodology by perusing, for example, the many brief abstracts of current articles and books on training initiated by the Department of Employment, and selecting for study those that are relevant to their particular job. Abstracts are published regularly by such services including the T and D publications issued by the International Labour Office, Geneva, but the instructor who tries to assimilate all the many new concepts in training methods may become quite confused by the jargon used and the serious lack of agreement among some of the experts.

A number of the innovations may seem unrealistic or remote from situations on the shop floor or training bay. Many of the thousands of training abstracts published over the past ten years have been written by psychologists for other psychologists rather than for instructors. To the instructor who makes an honest attempt to understand what it is all about, it may appear that he is being told what he already knows in words he does not understand, or he may feel that the new outlook on training involves so many variables of such

complexity that he will prefer to go his own way. The instructor who tries to profit from all modern ideas and experimental work may become completely mystified or cynical about some of them and may be tempted to neglect well-established fundamental principles.

Nevertheless, instructors should be aware of the scope of present-day research and development in instructional technology, and should, whenever possible, participate in project work concerning training methods and problems relating to their own jobs. Useful experience can thus be gained, particularly through discussions with colleagues and trainees.

Training officers and instructors should keep an open mind for all new ideas and examine them critically; however, unless the results of research can ultimately be translated into simple terms capable of practical application in a real training situation for the benefit of trainees and instructor then time and money is likely to be wasted. Instructional technology must keep in mind its primary objective : to help instructors instruct and trainees to learn.

This book may help inexperienced or untrained instructors to appreciate some of the basic principles of the teaching and training process which still stand, and perhaps prepare them for a fuller participation in what promises to be a sort of educational technology rat race. In this the rats appear to be running in various directions in a three-dimensional black box which enshrines a computerised system of models, with complicated parameters as inputs, and largely incomprehensible jargon as outputs. Practical wisdom is slow to emerge.

The following quotation appears at the beginning of an introduction to an excellent book '*Systems approach to education and training*', by A. S. Romiszowski:

'A system is a little black box
Of which we can't unlock the locks,
But find out what its all about
By what goes in and what comes out.'

Instructors and training officers may be sustained in their efforts to keep in the race by realising that what is commonly known as 'skills analysis' really consists of writing down exactly how a worker thinks, observes and acts in doing a simple skilled operation; the definition of this procedure is given in a glossary of training terms (H.M.S.O.) as :

'Skills analysis. The identification and recording of the psycho-physiological characteristics of skilled performance, and the deter-

mination of the effector, receptor and decision-making functions involved.'

Skills analysis is by no means new; its value and importance was fully recognised more than 200 years ago.

An account of systematic analytical training in A.D. 1760, relating to the Candlemakers art, was published in the journal *Industrial Training International* (June 1969) and the diagrams, pictures and notes correspond closely to most aspects of modern skills analysis. It is further not without significance that two of the most sophisticated pieces of hardware used in the U.S.A. in educational technology, as computerised instructional aids, or teaching machines, are called after Socrates and Plato respectively, who both over 2 300 years ago, used didactic methods involving systematic programmes of questions and answers and the use of logic akin to those required by modern teaching machines, and programmed learning.

It may help further to reassure instructors, who feel overwhelmed by the spate of literature on instructional technology, if they bear in mind the fact that their job is fundamentally a matter of good two-way communication and sound personal relationships.

The rapid technological developments and industrial growth of the past fifty years have created an urgent and almost insatiable need for efficient and rapid training at all levels, and a corresponding demand for efficient training methods. The old, rigid, time-serving apprenticeships of five or more years, in which young people were expected to pick up their skills with negligible systematic instruction, is now unacceptable.

Many of the new developments in training methods are linked with new media such as films, video tape or computers. Some, such as programmed learning and skills analysis, are, as we have seen, old ideas with a new look, and some are more remote from the instructor's experience and are as yet matters of interest for discussion at symposia of psychologists.

A really significant development is the emphasis now being given to the importance of the learner as an individual, and the special emphasis being given to attitude training and the related behavioural changes that training can effect. A further development of the past two decades is that training can be more effective when emphasis is placed on the techniques of learning in a learning situation rather than on the techniques of teaching in a teaching situation.

There will, however, be no danger that the flood of educational technology will erode the importance of the teacher's work. On the contrary, the teacher, in helping trainees to learn, and creating for them at all times a learning situation, will find that he has a more interesting and arduous task than that of just holding forth to his class. The instructor is now faced with many new methods of teaching and aids to learning, and he is made aware that individuals differ; that one man's learning aid is another man's stumbling block (see p. 223).

Yet the instructor's job is doomed to failure unless there is a desire to learn on the part of the trainees. This desire may have to be promoted and sustained by the instructor, and this may prove to be one of his main tasks, particularly where incentives to learn are weak or lacking. This book emphasises the importance of having the right objectives and priorities in all forms of training. A point which emerges again and again from recently published articles on training is that unless training involves the attitudes and characters of the trainees, it is largely a waste of time.

It is the function of basic technical education to give people a sound understanding of the fundamental principles of science, mechanics and mathematics and an ability to discover for themselves principles and techniques that they will have to master in their work; this can be achieved only through the proper guidance of keen and skilled teachers. Young persons so educated and trained will be able, in a short time, to adapt themselves to any technological environment and learn new skills and techniques. Experiments have shown that there is a good correlation between literacy and ability to learn psychomotor skills. The literate person has learnt how to learn and this ability is transferred to other skills; he is familiar with various modes of communication and has acquired his literacy through the use of several cognitive and motor skills, such as reading and writing.

Training officers and instructors will have a wider range of objectives and greater motivation in their work if they are fully aware of the importance of their task and the valuable part they play in shaping the economy of their country, which is entirely dependent on properly trained manpower in all sectors and at all levels.

Liaison and co-operation essential

A simple systems approach to training and economic development

FIGURE I

has been outlined in figure 1 which illustrates manpower production based on co-operation and good communication between education, training (A), industry (B), Government ministries (D), professional institutions and trade unions (C). Manpower when produced by this process is of no use unless effectively used by sound management (E) with development plans (F) to produce overall national economic development (G).

To complete the system there must be feedback from (G) to (A), (B), (C) and (D) so that training at all levels is suited to, and controlled by, the needs, either local or national.

The feedback will help to ensure that education and training programmes prepare people for the rapidly changing job market and give them the necessary skills, knowledge and attitudes to profit from further on-the-job training.

This is particularly important in the developing countries where it has been found that only about 50 per cent of the people with a vocational education actually fill jobs for which they were prepared.

What is so often lacking, particularly in the developing countries, is effective communication and co-operation between the groups (A), (B), (C) and (D) in the diagram. Each one should be in close liaison with the other three.

In Britain the importance of this co-operation was recognised by the 1964 Industrial Training Act the establishment of a Central Training Council and Industrial Training Boards for each of the major industries and more recently by the constitution of a Technical Education Council to co-ordinate and rationalise technician education throughout the country. In the developing countries (A) is often given undue financial support and priority in the mistaken belief that technical education by itself can produce trained manpower, and will automatically increase the industrial development and productivity of a nation—a condition for industrial development is mistaken as a cause of it. Technical education is a *necessary*, but not a *sufficient*, factor in the system. Manpower is produced by co-operation between (A), (B), (C) and (D), but the output must go through the process denoted by (E), (F) and (G). The process represented by E–F (retraining) is becoming increasingly important on account of the rapid changes in industrial technology brought about by computers, calculators, S.I. units, international communications etc.

The aims of training

The object of this book is simply to suggest ways in which instructors, technical teachers, training officers, works supervisors or managers can improve the quality and speed of training, and to emphasise that their task is not merely to instruct but also to help people to acquire skills, attitudes, habits of thought and qualities of character that will enable them to understand their jobs and perform them efficiently and with satisfaction. This will give them an increasing sense of responsibility in their chosen trades or professions and generally fit them for their part in the world of competitive industry.

Training is not an expensive luxury and reward for the more able or hardworking employees, it is, in this technological age, essential for the proper development of industry at all levels, and is an indispensable factor in the economics of industry. It has long ceased to be regarded as a kind of welfare. It also need no longer be a long-term investment, for with efficient and effective training programmes, the dividends can appear in a matter of months. Training is now essentially a responsibility and a function of management.

An instructors job is to help make full and efficient use of the manpower he has to train, as any wastage in human resources is just as uneconomic as a wastage of time or materials. There is today an increasing demand throughout the world for trained men : scientists, technologists, technicians, and craftsmen. The study of education, technical training and manpower is of such importance to a nation's economic development that it must be regarded as a branch of economics.

Industry quite properly estimates the cost of training—but an equally important complementary exercise is estimating the cost of not training, or the cost of inefficient production resulting from haphazard, prolonged and morale-destroying methods of acquiring skills and 'know-how'. This unplanned type of training is known by the common catch phrase 'sitting by Nellie', a term which admirably denotes the casual and unsystematic learning of a skill by a trainee who merely watches and imitates another worker. In all firms where training is carried out, someone senior and qualified should be given specific responsibility for it. If left to anybody, either it becomes nobody's job, or 'Nellie' ends up doing it.

So important has occupational training become, so encouraging has been the change in attitude towards it in recent years, and so effective

the new techniques, that these changes have been heralded as the 'instructional revolution' and its influence is forecast as being comparable in effect on our industrial development, as the Industrial Revolution of 150 years ago.

Those who wish to study the many recent developments in current theories of learning, and in the hardware and software of educational technology, are referred to the select bibliography on p. 264.

Basic training should be broadly based

As developments in science and technology occur they bring to industry new materials, new processes, new principles and new machines; these change the actual jobs that have to be done. In order to meet this very mobile situation, basic training must be broadly based.

In the modern world, the wealth of a country depends on its capacity to produce, and that depends in turn on its possessing a labour force which is highly skilled and very flexible. To raise the level of operator skill and improve flexibility is a pre-requisite of increased production, and for this we need better education and training. Soundly based technical training, in addition to being of immediate importance to local or national industry, can contribute to the raising of living standards in all parts of the world and especially those in the developing countries. It can also increase national wealth more quickly than any other educational expenditure; certainly, in the short-term, more quickly than university education.

There are seven types of training based on the various kinds of trainees, where they are based and whether or not their training is systematic and/or recognised (see figure 2). (3), (5) and (7) are commended; (1) and (4) are generally unsatisfactory.

Wastage through inefficient training

From various recently published reports it is clear that the needs of the large number of part-time students taking advanced courses, and school leavers who are not apprenticed or under any form of systematic training, are being sadly neglected, and a vast reservoir of talent is being wasted. With the rapid technological advances of this century and the need for flexibility, the outmoded time-serving concept of apprenticeship (generally five years irrespective of the nature of the

FIGURE 2

craft skill to be acquired) must eventually be replaced by a more efficient and modern system. The apprenticeship schemes inherited from earlier days were often devoid of regular and systematic training and without any final standardised trade testing. They doubtless served their purpose, supported by the Trade Unions, as a means of controlling the size of the skilled labour force and ensuring security to the craftsmen who had served their time.

A new analytical approach has helped to reduce the drudgery and inefficiency of old 'time-serving' training, although tradition dies hard. As an example, an industrial psychologist investigated the training of weavers, he was told that two years was the minimum and to be highly skilled, five years. Further, he was told that there was not much hope of success for a weaver unless two of his or her grandparents had also been weavers. The difficulties of the craft were alleged to be many thousands, but the total number mentioned was fifty. A 'museum' of these faults was set up and a systematic training plan put into operation. Girls aged 15-16 so trained achieved top quality in four weeks and were only slightly lower than the very experienced weaver who instructed them; they were well up to the required quantity and quality of output by the end of three months.

The training for a skilled craft or job should be planned and imparted after a job analysis has been carried out and it has been made possible to define 1. the nature of the training required; 2. the syllabus to be followed; 3. the academic and practical requirements; 4. the time, space and machines required for the training in order to achieve a satisfactory and generally agreed standard; and 5. the standard to be achieved, and the nature of the tests to be passed for certification of the trainee.

Education and training authorities often seem to pay more attention to the organisational and administrative problems of training and instruction than to methods of instruction, the techniques of training and the establishment of the necessary learning resources. No attempt is made in this book to deal with the organisational and administrative problems of technical education and training, nor to contribute anything new to studies in applied psychology. It is essentially a handbook of general principles on how to teach, for the instructor who wishes to help people to learn, and who wishes to know more about the techniques of training; it does not tell the instructor what to teach, as he is presumed to be up to date and an expert in his particular subject. Many instructors enter the instructing arena fully

confident that they know their subject well and are experts in it, but this confidence can soon be shaken when they have to teach their knowledge and skills to others.

Good teaching or instruction is basically good communication between people, no matter at what level or on what subject. The term 'teacher', 'instructor', and 'training officer' are used here in conjunction with 'class', 'students' and 'trainees', but the essential feature of the relationship in a learning situation is communication, whether this takes place in a works, a college, an office, or on an expedition. Not only is good communication the basis of training, but it is also the essence of good organisation and sound industrial relations. When trouble arises in an organisation or in personal relationships, the cause can often be traced to a lack of communication.

Although the world has undergone many changes, nevertheless, in a letter to the Corinthians St Paul observed : 'Be not deceived : evil communications corrupt good manners,' and so it is today.

Lecturers and new methods

It is well known that an advanced knowledge of a subject in no way ensures the capacity to impart that knowledge. Being taught by a brilliant but boring person has been described as the 'mystification of the ignorant by the indolent'. The most successful teacher is one who is in close touch with the students' own problems and difficulties, and who appreciates that in the early stages of a subject, particularly mathematics, progress by small steps is necessary to achieve understanding, whereas in more advanced stages some of these steps can be 'jumped'.

The word 'obvious' is a favourite with some instructors, but it should be banned or used very sparingly, as what is obvious to the instructor may be far from obvious to the trainee. While it is considered important for school teachers to be trained in the art of teaching, it is still too often assumed that university and technical college lecturers need no training to teach their particular skills. There are not infrequent complaints among students of monotonous delivery, hurried style, no learning aids apart from languid squiggles on a chalkboard, dictated lectures, inaudibility, avoidance of discussion, and most serious of all, the boredom of the lecturer himself. This book is not, however, written with the university or technical college lecturer in mind, but should any read it and be induced to examine

their methods and approach, they may care to experiment with some of the ideas and suggestions put forward and improve on them, or at least study the bibliographical references.

More attention to methods needed

A great many books have been written over the past twenty years on the theory and practice of teaching, and on the organisation and administration of technical education and occupational training in industry, but a disproportionately small number has appeared for the guidance of instructors engaged in technical training, many of whom are brought face to face with a class of trainees without any previous experience in the art of communicating skills and knowledge. Although much of the basic material remains, this edition incorporates some of the more recent new developments in the hardware and software of instructional technology of the past few years.

The guidance given is based on practical experience and is intended as a guide to those general principles of training that can be applied to any course of technical instruction, no matter what the subject may be, or for whom the course is intended. As a reference book, it should be useful during a short training course for instructors or technical teachers. Some sections, for example chapters 6 and 7, are designed more particularly for those who have to supervise training, or for those who wish to become acquainted with some of the experiments in practical psychology as applied to technical training.

The instructional revolution from 1950 onwards has come about because of the ever-increasing demand for more and more technical education and training, partly through research and developments in our understanding of how people learn, which leads to programmed lessons, and partly through audio visual aids to learning, which include the use of modern mass media, such as films and television (see p. 223, 'What is involved in teaching and learning'). These developments have proved to be particularly applicable to the teaching and learning of skills.

This book may serve as a stimulus to the instructor who is on the lookout for ideas and new methods. One of the biggest handicaps to a good training scheme is the 'seasoned' instructor who has been teaching in his own way for years. There is a story of one such teacher who applied for promotion on the grounds of twenty-five years' experience. It was rather harshly pointed out to him that his twenty-

five years was not fully relevant as it consisted of one year's experience repeated for twenty-four years !

The Services, and many progressive firms, with modern emphasis on technical skills of every kind, accord a high priority and importance to training methods and to the training of instructors. Intense short courses in methods of instruction have been amply rewarded, and suitably planned courses for training instructors of various kinds in industry have enhanced their efficiency and the quality of the training. Twenty years ago the instructor was generally someone designated to look after apprentices and this was often a backwater job for those nearing retirement.

In recent years several institutions for the training of technical teachers have been established in different centres, but these can deal with only a fraction of the number who require training and who would greatly profit from a systematic course on the basic techniques of technical training—of which this book provides an outline. One of the specially valuable results of the Industrial Training Act of 1964 has been the encouragement given to the training of instructors and training officers and the consequent recognition of the responsible nature of their work as a vitally important aspect of management.

Under the powerful stimulus of war, when large numbers of trained men were desperately required, it was found that 80 per cent or more of the skilled jobs in industry could be learned fairly satisfactorily in a fortnight by keen men. By the use of practical and intensive methods of instruction, men and women who had never before been inside a factory could satisfactorily carry out skilled operations after a few weeks' training. Normally such achievements were believed to be attainable only after some years of apprenticeship. Intensive methods are not ideal, but the results achieved helped to focus attention on the value of planned systematic training methods.

A book of this sort cannot be expected to turn all bad instructors into good ones, but it is nevertheless essential at the start to refute that mischievous doctrine that a good instructor has some sort of divine gift denied to other men. The 'gift of the gab' does appear to be in-born in many people, but this must not be mistaken for ability to instruct. Instructors are in fact *made* not *born*. There are techniques of instruction, which have to be studied, learnt and practised. The more common errors have to be brought to the notice of all who aspire to proficiency. For example, instructors on the whole tend to talk too much. They frequently indulge in over-long periods of con-

tinuous talking as this practice requires less preparation and teaching skill than planned class activity. It requires less effort and skill on the part of a teacher to foster a teaching situation than a learning situation. The instructor's job ultimately is not simply to transmit information or to demonstrate, but to help his trainees to learn. Principles of class comfort are often lost sight of, and visual aids, including films or video tape recordings (see p. 49), are often used ineffectively because they are used without discrimination or skill. It has been shown by carefully conducted experiments on actual classes under instruction that the speed and success of technical training depend very largely on the methods of instruction. There is a good deal more in a piece of good instruction than meets the eye.

Teaching is in fact hard skilled professional work for which study, training and practice of all the tricks of the trade are necessary for the full efficiency which will give satisfaction and a sense of achievement both to the teacher and the taught. Good instruction makes difficult subjects easy to learn, but bad instruction makes even easy subjects difficult to learn.

Thousands of courses are being organised all over the country in technical institutions, firms, and government departments and specialists are frequently called upon to run or help with such courses at short notice, having had little or no training for the work, and often with little previous experience as instructors.

Although the techniques used in training require a good deal of pedagogical wisdom and experience, the whole subject is really a common-sense application of those principles of good communication and man-management which have proved to be most effective in achieving the specific objectives of training, and particularly the larger objectives of all training, namely to make the man on the course a better and happier man at his job, to improve teamwork, and to increase production.*

* It is interesting to note that the term 'production training' is used instead of 'practical training' in the syllabuses of technical colleges and schools in the U.S.S.R.