

Paper No. 504

Technician education in developing countries

BY

Shafqat Hussain Qureshi

Director, Technical Education, Lahore

TECHNICIAN EDUCATION IN DEVELOPING COUNTRIES

By
Mr. Shafqat Hussain Qureshi*

SYNOPSIS

In an engineering team a technician is a person, who has a middle position in between the Engineer and skilled worker. The Technician should have:-

1. Skill in understanding the industrial processes.
2. Skill in dealing with people.
3. Cost estimating, accounting and budgeting.

Recently Technician Education has expanded considerably in the developing countries of the world but quick expansion has produced some problems and in many countries like Pakistan, remedies have to be found to overcome the shortcomings and deficiencies. These deficiencies are mainly:-

- 1) Shortage of well qualified and adequately trained staff.
- 2) Non availability and lack of use of teaching learning resources.
- 3) Outdated, obsolete, and deficient portions in curricula.
- 4) Defects in system of testing and evaluation of students.
- 5) Rigidity in the functioning of Rechnical education systems.

In this paper, effort has been made to highlight various features of the systems in vogue in some developing countries, necessities of running the systems and suggest some remedies as far as Pakistan is concerned. Detailed plans to implement the suggestions is beyond the scope of this paper as it involves analysis of the administrative and financial structure of the Departments of Technical Education in Pakistan, their functioning and control and other features of the Government machinery.

A summary of recommendations from UNESCO has also been included so as to provide guide lines and point out that efforts can be made to streamline the system in this country by adopting suitable recommendations from international bodies.

INTRODUCTION.

The developing countries of the world have been intensifying their efforts to improve and expand their technician education and training systems to meet the changing needs of technical manpower requirements in the context of their respective national development plans and programmes. The technician education and training systems are at various stages of development in the developing countries due to the traditions of technical education, the economic development plans and available recourse inputs to various sectors of technical education. A study of these systems and exploration of remedies to defects and deficiencies has become important for the future development of the countries seeking proper economic growth.

*Director, Technical Education, Lahore.

TECHNICIAN.

The technician plays a dominant and strategic role in the planning process, in the dissemination, transfer and application of scientific and technical knowledge to production process, in the development of innovations and research, in the practical training of workers in specialized skills and technical know-how.

A very precise definition of technician is difficult. In some countries people undertaking technician job do not have any formal education qualifications. In highly industrialised societies, the technician is closer to the engineer as "engineering aide" and may possess professional qualification similar to formal university degree. These vary from country to country, and occupation to occupation depending upon the stage of economic development and resulting activities to maintain the growth and development of technology.

The Commonwealth Conference on the Education and Training of Technicians (1966) defines: "Throughout the whole range of industry and commerce there is a broad spectrum of occupations lying between the craftsman on the one hand the professional (or technologist) on the other. Within this spectrum there are wide differences both in subject interests and in degree of expertise which must be taken into account when planning educational and training programmes, but the whole band does represent a unique and distinguished group of people who, whatever their specific function, can be broadly classified as technician".

Although technicians are not identified and defined uniformly in all the developing countries, there is a general agreement that technician constitutes middle level manpower occupying positions in industry between engineers and skilled workers. He may hold such positions as supervisor, forman, technical assistant, estimator, technician instructor, senior draftsman etc.

Another approach to identify a technician is through the competencies he is required to possess which may be as under:-

- Skill in understanding craft processes and development of work which includes in selecting, maintaining and operating the equipment, preparing specification, planning and controlling production.
- Skill in analysing and diagnosing problems such as inspecting, fault finding, interpretation of test results.
- Skill in dealing with people (managerial skills) including leadership, human relationship, supervision and control of staff, cost estimating accounting and budgeting and skill in written and oral communication.

In some countries the technician is closer to engineer as "engineering aide" and the skilled worker may be doing merely repetitive operations because of a sharp division of labour. However, in a developing economy the technician may have to exercise supervisory functions and also a good deal of manipulative skill on shop floor. It is the proportion of knowledge and skill in given mix which distinguishes the role of technician in an industrial set up.

To develop the above competencies technician training programmes in some countries, inspite of variance in contents, generally have a uniform pattern. These comprise a 10-12 years of general education

followed by about three years of technician education. In some cases, industrial training or exposure to industrial environment also forms an integral part of the training programme.

Colombo Plan Bureau has recommended a ratio of five Technicians to one Engineer in an Engineering Team but in actual practice it depends on type of work being done or the type of goods manufactured in a factory. To accelerate the pace of development most of the developing countries required a large number of technicians to meet the demand thus created. Technician Education Institutions therefore, proliferated quickly and in countries like India, the number rose to about 450 in three decades.

GENERAL FEATURES OF TECHNICIAN EDUCATION AND TRAINING SYSTEMS.

Surveys of the technician education and training systems in Afghanistan, Bangladesh, Bhutan, Burma, Fiji, Hong Kong, India, Indonesia, Iran, South Korea, Malaysia, Maldives, Nepal, Pakistan, Papua New Guinea, the Philippines, Singapore, Sri Lanka and Thailand were conducted recently.

Both in respect of geographical area and in respect of population these countries contribute the largest part of the developing world.

All these countries have recognised the importance of technical manpower in the context of their national economic development. They have therefore, established their own systems of technical and vocational education and training, which reflect the countries' state of economic development, technology level and other factors.

The systems representing the regional countries have several important features. Some of the features are generally common to all the systems while others are special to individual systems. While it is beyond the scope of this presentation to analyse and discuss all aspects of the systems, including the issues out of them, the following main features are worth noting:-

- i) All the systems are national in the sense that they are planned, organised and administered by governments as an integral part of their national development efforts. They are therefore, public systems financed by Governments and with varying degrees of governmental control and accountability.
- ii) Excepting in Papua, New Guinea and Fiji the systems are wholly institution-based, i.e. the technician courses are in the form of full-time institutional studies. In Papua New Guinea and Fiji, the systems are both industry and institution based, in the form of apprenticeship of on-the-job training complemented by institutional studies on block release or part-time basis.
- iii) The systems may be grouped under two broad categories; First, those which are essentially at the tertiary level after 10, 11 or 12 years of general education and secondary school certificate. At the secondary stage, the schools are either purely "academic" schools or "Technical High Schools" or both. Students entering technician courses are generally of three years in duration. Second, systems which are built upon and in extension of vocational or technical schools following elementary education. These vocational or technical schools which are after 8-9 years of elementary education are distinct and different from high schools (general or technical) and their curricular offerings designed with emphasis on vocational preparation of students as skilled workers or for other gainful occupation. The vocational curricular offerings vary from three to four years. The technician courses built in extension of its vocational school system vary in duration from one to three years.

Shafqat Hussain Qureshi

In some countries (e.g. Indonesia and Thailand) both categories of technician systems exist together, but in separate institutions, and the graduates are distinguished by the labels "Higher Technician or Engineering Technician" and "Industrial Technician or Trade Technician". Implicit in the distinction is that the curricular offerings for the former aim at higher cognitive, technological abilities and for the latter more of operative skills.

In some countries (e.g. Singapore and Malaysia) although the technician education system belongs to the first category, it is subdivided into two subcategories, viz. higher-engineering technician and industrial technician, and carried out through separate institutions. The duration of these courses also differ: three years for the former and two years for the later.

Being essentially institution-based systems (Excepting in Papua New Guinea and Fiji) the technician courses in most countries do not have any in-built practical experience in industry. Only in Malaysia and Sri Lanka do the technician students have to undergo practical experience in industry as a part of the course. The Malaysian system for lower technicians requires six months of industrial experience between the first and second year of the course and the Sri Lanka system prescribes one year apprenticeship at the end of two years of institutional studies.

The technician courses are all terminal i.e. they do not generally lead on to university level degree programmes. But, in Malaysia, the engineering technician courses conducted by the University of Technology are given access to the third year of the five year university degree programme. In Thailand, a two-year B.Tech. degree programme has been introduced under the auspices of the Department of Institutes of Technology and vocational Education for those who complete in industrial technician course and qualify through an admission test. Pakistan is another interesting case whereas an experimental measure in selected technician institutions, technician diploma holders are allowed to qualify for the degree. The diploma holders study for three years in an institution and after one year of practical training may qualify for B.Tech. These represent the current arrangements in practice to extend higher education opportunities to technician graduates, but it is evident that they are extremely limited.

Technician institutions exist under a variety of names: Polytechnics, technical institutes, institutes of technology, higher secondary vocational schools, vocational institutes, junior technical colleges and so on. In some countries, as for instance, Sri Lanka, Malaysia and Nepal. Technician courses are a part of the activities of university faculties of technology.

CURRICULA

The details of courses for the technicians have to be designed to meet the objectives of producing technicians and it was considered appropriate in most of the countries that the courses should cover:-

- 1) Basic science and courses which provide the foundations of scientific facts, principles, methods and attitudes on which the technician's specialized application of that science depends.
- 2) Mathematics courses as required by the technology to enable the student to quantify scientific phenomena and to establish precise definition and interpretation of such phenomena, observations, or applications.
- 3) Technical speciality courses and their auxiliary supporting studies which teach the special skills, knowledge, techniques, applications, procedures materials, processes, apparatus, operations and services that identify the technology and prepare the student for a variety of employment

opportunities in that technical field.

- 4) Communications courses which teach oral, written, and graphic skills, the required reading capability, and the ability to communicate successfully with co-workers and others.
- 5) Social studies courses which provide a technician with an elementary frame of reference in economics, citizenship, and social relationships as an individual, member of a family, employee, and citizen.

Although the practical component should vary with the technology, it was considered most suitable that technician should be trained with 60% to 70% work on the shop floor. To continuously develop curricula in various technologies and for the purpose of evaluation of students, various countries adopted different systems. In Pakistan, India and Bangladesh Boards of Technical Education were created to meet the academic requirements and to conduct examinations. In Pakistan, Boards of Technical Education are required to perform the following functions:-

- i) to hold and conduct examinations pertaining to technical education below degree level.
- ii) to prescribe courses of study for its examinations;
- iii) to lay down conditions for recognition of institution;
- iv) to lay down conditions for admission to its examinations, to determine the eligibility of candidates and to admit them to the examinations;
- v) to grant certificates and diplomas to persons who have passed its examinations and to withdraw such certificates and diplomas;
- vi) to fix, demand and receive such fees as may be prescribed;
- vii) to supervise the residence, health and discipline of students of recognised institutions and classes with a view to promoting their general welfare; and
- viii) to organise and promote external activities in and for recognised institutions.

The Boards in the countries mentioned in this section of the report do not usually perform the duties enumerated above to a satisfactory extent. They lack expertise to modernise curricula and are unable to keep contact with industry within and outside the country to introduce latest innovations and technological advances. In Pakistan revolutionary changes are needed to eliminate defects in our testing/evaluation system of students. Examinations are still being conducted in the same old fashion as was in vogue hundred years back.

TEACHING-LEARNING RESOURCES.

In a wider sense, anything that facilitates learning such as human resources, buildings and equipment, etc., could be defined as a learning resource. But the term as used in this paper refers to teaching-learning resources which are specifically designed to ensure achievement of instructional objectives, taking into account relevant theoretical concepts about learning. These are instructional softwares with which different methods and media are integrated for effective learning. Teaching-learning

Shafqat Hussain Qureshi

resources may at times provide all the instruction by themselves.

The whole range of such resources could be divided into two broad categories:

- i) **Print Resources.**
- ii) **Non-print Resources.**

Some further details of these two categories are provided in what follows:

Print Resources:

Print resources manifest in the form of documents which are normally made available through printing processes. They are further classified as (A) Planning Documents (B) Class Room Documents/Materials.

Planning Documents: These provide teachers with the information and guidance in designing his instructional activities, select the contents, their sequences, depth of treatment, time to be devoted to various topics, assesment and evaluation criteria and methods and above all the learning objectives to be achieved in various domains. These documents include:

- a) Syllabus/Course contents.
- b) List of Topics and Topics Sequence Diagrams.
- c) Table of specifications.
- d) General and Specific Objectives.
- e) Topic Analysis Sheets.
- f) Lesson Plans.
- g) Students Assessment Plans.
- h) Example Test Questions.
- i) Teacher's Guides.

Class Rooms Documents/Materials:

These aim at facilitating the activities both of the teachers as well as the students in the class rooms, laboratories, workshop etc. They intend to translate the teachers plans and other curricular requirements into action within the desirable environment and space.

Some items falling in this category include:

- a) Laboratory sheets.
- b) Job sheets.
- c) Operation sheets.
- d) Information sheets.
- e) Assignment sheets.
- f) Work books.
- g) Text books.

Non-print Resources:

Following is a brief description of such resources:

Non-Print Resources are further classified as Still Media, Projected Media and Electronic Equipment.

1. Still Media

Following are generally included:

- i) Real things: When they are available and are easy to show to the class.
- ii) Models: When real things cannot be shown either due to size, obscurity, non-availability or non-accessibility, good for concepts, three dimensional presentations, see through or cut out sections.
- iii) Pictures: (Photographs, Charts, Diagrams, Charts) Good when language problems may be felt, save time as drawing in situ may be difficult.
- iv) Chalkboards: For impromptu use, interaction.
- v) Whiteboards: Dust free, bright but expensive to use.
- vi) Flip Charts: Useful for interaction/participations, records can be preserved.
- vii) Felt Board: Good for fixing cut-outs/layouts.
- viii) Magnetic Board: Same as above but using magnets; steel objects can be shown easily.

2. Projected Media.

Films, Filmstrips, Slides, Transparencies for Overhead Projector are included in this category. They are expensive to develop but have the powerful advantage of looking into details, magnifying smaller objects, working details as well as animated versions.

3. Electronics Equipment

- i) Television and Video Recorders possess the same advantages as Films but are suited for smaller groups of audiences due to smaller screen. Programmes have to be developed with sophisticated facilities.
- ii) Teaching Machines/Computer Aided Instructions. More suited for self-learning, step-by-step presentation of materials.

CURRENT STATUS OF T.L. RESOURCES IN PAKISTAN.

The current state of affairs in many institutions in Pakistan, and for that matter in the region, as far as the availability and use of various resources are concerned is characterised by the following major

disciplines/ technologies is concerned. A very suitable enlarged programme, rich in contents of technical know-how, and upto date in modern developments is the need of the day as for as this country is concerned

GUIDELINES FROM UNESCO

At the eighteenth session of the General Conference held on 19th November, 1974, UNESCO adopted revised recommendations concerning technical and vocational education, a summary of which is reproduced below:-

A. Policy, Planning and Finance.

Summary of paras 7, 9-13, 18 of the recommendation.

Broad policies directed to the development and expansion of technical and vocational education as an integral part of the lifelong educational process and in accordance with social and economic development requirements, available to all on a basis of equality, should be adopted. To implement these, comprehensive planning should be undertaken at the same time as appropriate administrative, financial and structural measures. Both policy formulation and implementation should be supported by a strong research effort.

B. Standards and Evaluation

Summary of paras. 14-17 of the Recommendation

Standards should be adopted at national level, when appropriate in accordance with international standards, which ensure the quality of technical and vocational education. Evaluation with regard to all aspects of the quality and functioning of technical and vocational education should be undertaken on a continuous basis and provision made for applying corrective measures where necessary.

C. Technical and Vocational aspects of General Education.

Summary of paras. 19-23 of the Recommendation.

All young people should become acquainted with the world of technology and the world of work in addition to acquiring basic practical skills as an integral part of their general education. Therefore, general technical and vocational studies should be a required element in the curriculum of the general education system.

D. Technical and Vocational Education as preparation for an occupation field.

Summary of paras. 24-44 of the Recommendation.

The highest priority should be given to eliminating any disparities which may exist between education on second and third levels and available and projected employment and career opportunities. To this end, technical and vocational education as preparation for an occupational field should be expanded and strengthened and measures should be taken to adopt the structure and content of traditional education, whether general or technical and vocational accordingly.

E. Technical and Vocational education as continuing education.

Summary of paras. 45-53 of the Recommendation.

Continuing education, whether in general or professional fields, allowing full personal and professional potential to be achieved and adaptation to changing occupational and economic patterns should be available to all regardless of the educational qualifications acquired prior to employment, and provision should be made to this effect.

F. Guidance.

Summary of paras, 54-62 of the Recommendation.

Guidance, directed to aiding all to make educational and occupational choices, should be an integral component of the entire educational process and provision should be made to this end.

G. The teaching and learning process: Method and Material .

Summary of paras. 63-71 of the Recommendation.

All aspects of technical and vocational education should be oriented to the needs of the learner and methods materials developed accordingly.

H. Staff.

Summary of paras. 72-92 of the Recommendation.

The recruitment and preparation of well-qualified teachers, guidance counsellors and administrative staff, alongwith favourable conditions of service and opportunities for promotion are essential to the quality of technical and vocational education and all measures necessary to achieve this end should be taken.

I. International Cooperation.

Summary of paras 93-100 of the Recommendation.

Priority should be given to international cooperation in the field of technician and vocational education in order to improve its quality and to develop and expand it where necessary.

CONCLUSIONS/RECOMMENDATIONS FOR PAKISTAN.

1. Shortage of teaching staff should be eliminated without further delay. Special reference may be made to Part H of summary of paras 72-92 of the recommendations of UNESCO adopted at the general conference at its eighteenth session. It is stated in this part that well-qualified teachers guidance councillors and administrators alongwith favourable conditions of service and opportunities for promotion are essential to the quality of Technical and Vocational Education and all measures to achieve this end should be taken.
2. Well qualified teachers in sufficient number can be available if suitable salaries and fringe benefits

are offered to them and opportunities for promotions at reasonable interval exist. At present Technician Teachers of Pakistan are getting much less than their counterparts in industry. Remedial measures are necessary to be taken in this respect.

3. Adequate teaching learning resources should be made available to every institution.
4. Adequate and suitable teacher training programme should be started without delay so that all technician education institution get the desired faculty. Capacity of the proposed National Technical Teacher Training College, Islamabad may be ascertained and additional training arrangements may be made within the provinces.
5. Monitoring of the working of every institution may be done in such a manner that corrective efforts to remove the defects can be made without delay.
6. Boards of Technical Education may be compelled to fulfil all the obligations prescribed in the acts/ordinances.
7. System of testing and evaluation of students should be modernised and steps being taken to revert back to annual system of examinations should be avoided.
8. Technician Education system should not be operated in Isolation but effective liaison with industry and employers must be a continuous feature of the system.
9. Functioning of the Technical Education Departments is too rigid. For example, a principal cannot meet the simple requirement of employing a visiting teacher for English Language because of limitations prescribed in this respect. He can only employ visiting teachers of Technical subjects. Another example is the limited administrative powers that the Director of a Province enjoys. He cannot employ a Lecturer or Instructor on adhoc basis while the institutions suffer from acute shortage of teaching staff. Certain amount of flexibility is necessary for the efficient working of any organisation and provisions must be made accordingly. There is a necessity of immediate revision of administrative and financial powers.
10. Pakistan is not making full use of guidance available from UNESCO or Colombo Plan arrangements. Opportunities in this respect should not be waived.
11. There is no council at the Ministry level to cater to the needs of Technician/Technical education, while India has such an organisation (All India Council for Technical Education) at national level. An appropriate organisation must be created in Pakistan.