

TTTIs : A FUTURE VISION

* PROF. D. P. AGRAWAL

** PROF. K. B. RAINA

1. TECHNICAL EDUCATION IN INDIA :

Technical Education in India has a history of over 150 years. The development of technician education before independence was slow and unplanned and was fashioned on the western models. During the post independence period, India witnessed considerable changes in the objectives and pattern of technical education and realization that technical education is an essential prerequisite for economic development of the country and for improving the quality of life of its people. The Scientific Policy Resolution, 1953 laid down that "The wealth and prosperity of a nation depends on the effective utilisation of its human and industrial resources through industrialization. The use of human material for industrialization demands its education in science and training in technical skill".

Technical Education in India is offered through a 4 tier technical education system, viz,

- Industrial and vocational training for training of skilled workers and craftsmen imparted at the Industrial Training Institute (ITIs) and Higher Secondary Schools.
- Technician training to produce technician engineers through polytechnics.
- First degree courses in engineering and technology; provided at Engineering college / institute.
- Postgraduate courses and Research Programmes; offered at selected engineering colleges and universities.

The technician engineering tier of technical education is aimed at producing technician engineers for the management of activities in the field and on the shop floor in respect of construction and manufacturing, installation and commissioning of equipment, testing repair and maintenance, sales and after sales services etc. The courses for this stream are offered in the polytechnics for students after 10 years of schooling. There are

* Joint Educational Advisor (T) MHRD and National Project Director

more than 1250 polytechnic in India offering 3 years training programmes in conventional discipline such as Civil, Electrical, Mechanical and Electronics Engineering, Pharmacy and modern areas like Computer Engineering, Computer Application, Maintenance Engineering, Medical Electronics, Instrumentation and Control, Plastic Technology etc. About 50% of these polytechnics are run through private initiative. More than 1,60,000 students are admitted to these programmes annually. Some institution also conduct advanced technician engineering programme in selected areas.

In post independent India, the technical manpower in the industry and the corresponding training programmes were generally patterned on the pre-independence mode. The managerial and higher executive positions were held by the degree holders; the so called middle level supervisory positions were held by diploma holders from the polytechnics, and the skilled workers were generally the ITI passouts.

Polytechnic education, being a state subject, received rather limited central intervention. This intervention was in the form of Direct Central Assistance (DCA) in different areas depending upon need of institutions and the limited central funds available. Though DCA was useful to a certain extent, yet it was an ad-hoc response to some urgent needs and was therefore not holistic in response to the totality of polytechnic needs.

In the mid 1960's, it was recognized that polytechnics were playing vital role in the training very important band of

the technical manpower spectrum. While the manpower produced by the polytechnics was then readily absorbed in the various manufacturing and service sector industries, it was increasingly felt that the rapid expansion of industry and the even more rapid changes in technology would call for strengthening the teaching - learning methodologies, continuous updating of curricula, closer links between institutes and the industry and periodic updating of teachers. Towards this end the establishment of Technical Training Teachers' Institutes (TTTIs) in the 1960s was major central intervention of a long term nature. TTTIs became important agents of change for the polytechnic system.

2. ESTABLISHMENT OF TTTIs :

Technical Teachers Training Institutes (TTTIs) at Bhopal, Calcutta, Chandigarh and Chennai were established during 1966-67 by Government of India, as nodal institutes, to improve the quality of polytechnic education with a main thrust to prepare polytechnic teachers for teaching technician students.

To begin with the objectives of TTTIs were :

- to train teachers of diploma institutions through long, modular and short courses;
- to foster and promote research
 - in improving classroom and laboratories technics,
 - in developing understanding for teaching,
 - in all aspects of curriculum development and testing;

- to prepare and supply, wherever necessary, teaching aids, instructional materials including film strips, technical films and other aids to polytechnics;
- to associate the institute with State Councils and other academic bodies on technical education in the region regarding curriculum development, admission procedures and examination reforms;
- to collaborate with institutes and organizations in India and abroad that have similar objectives and function;
- to take initiative in improving polytechnic education;
- to act as centres for disseminating information to all agencies interested in technical education;
- to collaborate with industries in the region in formulating training programmes of mutual interest.

Over the years TTTIs have been training teachers of polytechnics through long and short term courses in the subject matter, particularly in new and emerging areas of technology, in the methodology of teaching, in the use of modern communication media for effective teaching - learning, and updating teachers with the changes that keep taking place in the processes and practices in the field and in the industry.

TTTIs have trained polytechnic teachers of all states in the curriculum development process. As a result, most states have created their own curriculum development centres and are in a position to develop in co-ordination with the industry, curricula in new and emerging

areas as well as to periodically update existing curricula. In fact periodic revision of curricula has now become a norm.

Realizing the important of introducing the use of conventional and modern communication media for enhancing the efficiency and quality of education at the polytechnics, media centre facilities were established at the TTTIs. This included setting up video production and computer facilities. The expertise thus developed has been transferred to the polytechnics resulting in the establishment of Learning Resource Development Centres (LRDCs) in most states and Learning Resource Utilizations Centres in a large number of polytechnics. Print and non-print instructional material particularly in emerging areas, are regularly produced by TTTIs and by LRDCs in the states.

In order to facilitate involvement of polytechnics in promoting activities concerned with the rural development and to encourage self employment among polytechnic pass-outs, departments of entrepreneurship and of rural development were established. Entrepreneurship development programmes to develop entrepreneurial traits and skill development programmes for rural youth and transfer of technologies to rural communities and training polytechnic teachers in these areas are regular feature of TTTIs.

For the Direct Central Assistant Scheme introduced by the Government of India in the 1970s for improving facilities at the polytechnics, TTTIs acted as facilitators for effective use of central grants to polytechnics. The experience

thus gained laid to identification of a number of polytechnics throughout the country as Quality Improvement Centres (QICs). With the help of TTIs, these QICs prepared integrated development plans. This enabled central assistance to be optimally used. More : this exercise and the experience gained therefrom led to the realization that in order to improve the quality and efficiency of the polytechnics, there was need to go in for integrated development of the system which called for massive funding. This led to formulation of a proposal to seek funding through IDA credit for strengthening polytechnic education which led to the World Bank Assisted 7 year project for strengthening technician education in 19 states in India starting from 1990-91.

3. PARADIGM SHIFT IN CONCEPT OF TECHNICIAN :

The changed economic and industrial scenario in national and global environment, coupled with social aspirations, calls for technical manpower in the field and on the shop floor to have virtues of independent thinking, a keen sense of observation, ability to improvise and to innovate, ability to adapt current technology and at later stages in individuals' career progression to select technology and design new processes.

The existing approach to technical manpower assumes three distinct bands viz craftsman / skilled worker, technician and engineer. Whatever significance the distinctiveness of the three bands might have had in the past is only of historical importance. As of today there are only 2 band, each band operat-

ing at number of levels of responsibility. This will become even more true as automation and information technology take over completely. In one band there are skilled workers, whose skills are increasingly calling for a higher order of mental ability in addition to high level physical skills, and who, at the master craftsman level would in the near future, be rubbing shoulders with design and development of new products and processes and for achieving ever improving quality. Depending upon the interest and ability of an individual skilled worker it should be possible for him / her to undergo credit-based courses to join the ranks of design and development engineers if he/she so wishes.

In another band, we have engineers doing a variety of functions. Functions like quality management in the field and on the shop floor, testing, routine design to adapt existing designs to consumer demands, meeting production schedules, observing existing processes and practices and suggesting alternatives, effectively communicating with his/her team of workers and with the consumers and providing feedback to the management are required to be performed by the diploma engineer.

The engineering graduate is required to perform the functions of design and development of, and research in products, processes and services in the various engineering and allied organizations. He/she also engages in planning and scheduling of work, future planning, technology forecasting, market surveys etc.

From this, it follows that the functions of the diploma engineer and of the

graduate engineer are complimentary. The general impression that they bear an inferior-superior relationship is outdated. This impression has led to making the polytechnic courses and curricula scaled down versions of the degree engineering courses which, in turn, has reduced the saleability value of the polytechnic graduate. The 3 band concept has thus continued the myth that the role of the diploma engineer is that of a person between the craftsman and the engineer rather than defining his / her role in terms of functions. This lack of role clarity has made the diploma holders' very need in the system to come under question. The diploma holder is just about tolerated in the minds of many people. Yet, however, in the field and in the industry, he / she has important functions to perform.

Once the functions of the polytechnic graduate are understood in perspective, in the actual context of the world of work, be it manufacturing industry, the small scale and entrepreneurial sector or the service sector, it is clear that certain restructuring of the programmes and policies will be required to draw the best among the student population to the polytechnics and to train them for a progressive career.

4. FUTURE PERSPECTIVE FOR POLYTECHNIC EDUCATION :

To train the diploma engineers so as to make them competent to effectively play the functions as mentioned above, the curriculum and curricular experiences should include the following :

- Subject matter content including state-of-the-art technology with emphasis on practical aspects like

measurements, quality and quality management, science of improvement, economics of motion, design for the consumer and other topics current in the area of study.

- Practical work in the laboratories and in the workshops, and in-plant training in the workplace, so designed as to develop the trait of inquiry and the competence to analyse the data and phenomena observed, not only in the narrow area of the task immediately in hand but also in every important observation he /she comes across in life.
- Project work and case studies which inculcate a spirit of commitment to the work undertaken and develop a sense of pride in whatever the student undertakes, besides reinforcing the competencies and skills in the given area of technology.
- Lectures by visiting specialists and by successful entrepreneurs which impart a sense of importance and respectability about the profession for which the student is preparing.
- Curriculum experiences which inculcate a sense of acute concern for quality, excellence, and perfection among students, and promotes amongst them a sense of anxiety and being tickled as soon as they become even slightly aware of some wrong having occurred or a minor fault having developed in any operation undertaken by them.
- Built-in expectations in the curriculum and the corresponding curricu-

lar experiences, which provoke the student to do things beyond the minimum requirement with eagerness and excitement, and which **help the students to contribute to the improvement / development of a product or a process or an idea** and thus become innovative and creative.

- Inculcate among students the habit of recording professional experiences. This often leads to better diagnosis of faults and fault correction and could lead to development and innovation.
- The significance of planning targets and processes and of the economic reasons for reducing time required to reach targets and therefore to continuously work towards improving the economics of motion to meet targets.
- Inculcate in the students the ability to communicate in order to put across his / her point, the contribution his work has made and the quality of the product he or his company is marketing. He / she must learn to record feed back received by him / her as well as his / her own professional experiences. At the same time, the student should be trained to be a keen and patient listener and to be able to draw out the most significant points from what he / she hears.
- The training programme should sensitize the student to assess his / her own competence through various types of feed-back and use this to improve his / her performance.
- With the knowledge doubling time coming down rapidly and technology changes occurring very fast, the polytechnic curriculum must be so programmed as to encourage independent study and to train the student to access knowledge, information and data in his / her professional life from various sources.
- In order to encourage independent study and to make available information beyond the capacity of an ordinary library in textual and non-textual forms, polytechnics should have librarians qualified in state-of-the art information services and technology and should have computer and internet facilities.

The above mentioned initiatives in curriculum implementation will call for the polytechnics to offer flexible, credit based programmes corresponding to the needs of the aspiring students and to the requirements of manpower in the various employment sectors. These institutions will need to enter into partnership with the industry, not essentially to seek financial assistance but, mainly, in designing curriculum, evaluating student performance, providing visiting experts from the industry, organizing industrial visits and inplant training for students, involving faculty in problem solving of the industry and offering consultancy for research and development. The polytechnics in the future should be institutions for further education upto a degree in engineering (and later on even for a post graduate degree) with emphasis on the type of curricular activities mentioned above. Thus, the students entering a polytechnic would not necessarily

be the rejects of the engineering colleges but those who, for some reasons, would like to start working after a shorter course, but with a clear hope that should they do well they can ultimately also get a degree in engineering for vertical mobility in the profession.

5. ENHANCING STATUS OF DIPLOMA HOLDER :

The term technician assigned to the diploma holder has been unfair to the image of the polytechnic product. The general impression among all sections of society and among many employing organizations is that polytechnics graduates are craftsmen. This is because in general parlance the words technician and craftsmen are often used interchangeably. The polytechnic product may better be called Diploma Engineers.

Further, it is now generally realized that the age of 15, when a student after matriculating is called upon to decide upon the profession he / she may opt for, is too young to take such a decision because the maturity level at this age is rather low. This also inhibits full advantage accruing to the student while going through the course. By the time he / she leaves the polytechnic at the age of about 18, he / she is still too young to take up even a junior level management role. Therefore, it is proposed that the entry qualification for a three year diploma course should be 10+2. The diploma course to be called Dip. Tech. should continue to be of 3 year duration and should be recognised as being equivalent to a B.Sc. Science pass course. Those with a Dip Tech. and a further three year work experience should be

able to seek admission to a further 2 & half years course at the polytechnic to obtain a Bachelor's degrees in Engineering.

These are some of the policy initiatives currently under debate and discussion. To sum up, the polytechnic of the future should offer programmes allowing opportunities for vertical growth for ITI pass-outs as well as for diploma holders, thus providing, to a large technical manpower, the freedom and the opportunities to grow while at the same time responding to the technical manpower needs at various levels.

6. FUTURE PERSPECTIVE FOR TTTIs

6.1. Programmes :

In the context of the paradigm shift in the concept of the technician and the corresponding future role of polytechnics discussed in the paragraph above, the TTTIs will be required to play an increasing role as agents of change for the management and the instructional processes of the polytechnics and related technical education systems taking cognizance of the rapid changes taking place in technology and in the technical manpower requirement.

The programmes for the TTTIs must focus on the following :

- (a) Training programmes in engineering and technology and in management and training development.
- (b) Faculty development with focus on new and emerging areas of technology being offered in the polytechnics.
- (c) Training programmes in the multiple roles expected of technical teachers.

- (d) Developing models of curricula and instructional systems relevant to the work place.
- (e) Training teachers in the technical education systems at all levels in Educational Technology, including modern instructional media, independent study techniques and the distance education mode.
- (f) Developing new educational technologies for enhancing the reach of technical institutes in the most cost effective manner.
- (g) Developing models for empowering polytechnics and other technical institutes to -
 - (1) operate as autonomous institutes offering flexible programmes,
 - (2) establish and operate industry institute interaction.
- (h) Undertake research relating to quality, management and financing of technical institutes and productivity in the industry.
 - (i) Establish links with similar institutions in India and abroad.

6.2. Enlarging Scope :

To enable polytechnics to play the role envisaged due to the paradigm shift in the technician education sub-system, mentioned earlier in this paper, TTTIs must address themselves, besides the polytechnics, also to the other related institutes and organizations. The polytechnics of the future will increasingly provide programmes in a vertical continuum, with a networked relationship with other related institutions like the IITs and Engineering Colleges. TTTIs must recognize this expected develop-

ment and respond appropriately.

TTTIs must enhance their capabilities to undertake research and to promote research culture. Researches conducted at the TTTIs should include the area of improving the quality of polytechnic education, making it relevant to the industry and improving its economic efficiency.

TTTIs must develop a deep insight in how to improve productivity in the industry. The term industry here means construction and manufacturing industry, the infrastructure sector and the service sector. In addition it also includes services and programmes connected with rural development. TTTIs must make special efforts to implant innovation and development, and introduce a research culture, in the polytechnics.

TTTIs must undertake research studies about various models of technical education, curriculum development, technical manpower training and various other issues in an effort to improve institute - industry interface to cause relevance to occur in the polytechnic education system.

TTTIs will have also to develop new and innovative methods of coding, storing retrieval and delivery of information resources in different formats by keeping themselves abreast with the latest communication technology world wide and developing the same in the Indian context by using scientific methods, including research. This is important to enable students to learn how to access information independently through the use of modern communication technologies.

Computer is increasingly becoming

an important tool in every aspect of human life. Computer culture and computer education must rapidly develop in the polytechnics. TTTIs must, therefore, continuously update themselves in the area of computer with an adequately qualified and experienced staff in this area.

In the context of what has been written above, TTTIs must play an active research and development role for improving the quality, the content and the relevance of polytechnics education system. As recommended by Amitabha Bhattacharya Committee (Oct., 1991) "Programmes in emerging technologies should be a strong component of teacher training programmes. In such areas, until it is economical to create facilities at the TTTIs, linkages in terms of faculty

support, laboratory time etc., should be established with university departments, higher technical institutes, industry and research institutions and in innovating institutions". It should be possible for the TTTIs to network with higher technological institutions for offering such programmes and in this way to avoid duplication of equipment.

TTTIs must be pro-active institutes who, in the area of technical education should see far ahead and make the system ready for changes which are bound to occur in technical manpower in rapid succession. They should enlarge their scope by interaction with the Engineering College system also to enable the latter to benefit by sharing the expertise available at the TTTIs.

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