THE IMPACT OF TECHNOLOGICAL CHANGE ON INDIAN EDUCATION

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The phenomenal expansion of knowledge, particularly in the fields of science and technology in the post World War II period presents both opportunities and challenges to twentieth century man. Though a major portion of the scientific and technological advances have been associated with the developed industrialized societies of Western Europe and North America, their impact has been worldwide. And countries on the periphery of a complex network of technological innovations, third world nations, in their urge towards rapid development have been eager consumers, at times with little adaptation and sometimes with dangerous results, of technological advances elsewhere.

Both the nature and pace of technological development are found to vary in the developed and the developing societies. Faced with the dilemma of limited resources and the rapidly multiplying demands on them, governments in the developing nations have perforce to lay down priorities regarding the provision of resources and facilities for research in the various areas of science and technology, as also for the adaptation and transfer of the latest advantages in these fields from elsewhere. To opt out of the scientific and technological changes taking place would no doubt be unwise. At the same time, in the transfer of technology the adaptation of 'high-technology' models per se would not bring the desired results in the developing nations. Just because a system is known to work in a highly industrialized society does not in itself guarantee that it would have the same desired result in a 'low-technology' society, unless it is adapted to the situation and the requirements of that society (1).

Further, the disparities in the nature and pace of technological change in the developed and developing nations necessitate that the problems and issues which arise in society in general and education in particular as a result of this change, are examined within each specific national context. Technological changes and innovations, whether in the fields of medicine, engineering, communications, physics or chemistry, give rise to the need for
adaptive changes in other spheres, both institutional and attitudinal. The implications of technological change for society are numerous - in terms of making choices in politics, the optimum use for leisure, new roles for women, changed pattern of family life, nature and amount of work, the quality of the labour force, population size, and the impact of new media of communication, to mention a few. Equally numerous are its implications for education. Failure of the educational system to keep pace with the changing demands of scientific and technological progress has resulted in major inconsistencies both in education and in society, necessitating a reexamination of the knowledge, skills and values transmitted by a given system of education.

Within this broad theoretical framework, the paper examines the implications of technological development for structure and organisation of education in post-independence India. To bring independent India on a par with the developed societies, national leaders place their faith on scientific and technological development as the keys to progress. Nehru in particular was a strong advocate of technological development, the introduction of modern, mechanised industry, and fostering science and the scientific temper. In a society geared towards science and technology education has a crucial role to play in producing the quality and number of trained manpower required. In turn, technological development also contributes to the effectiveness and spread of the educational provisions. Two broad issues are thus found to emerge in the Indian context.

Firstly, technological change makes imperative a set of demands on the educational system in terms of its organisation and its curricular content, as well as in terms of the values, attitudes and beliefs which it fosters.

Secondly, technological progress offers alternatives in educational methods and techniques both for improving teacher effectiveness in the formal system, and for extending educational opportunities to sections of the population hitherto left out of its purview for, among other, socio-economic reasons. These twin aspects of the impact of technological change on Indian education are examined in the following sections.

I. The demands of technological change on education.

In a rapidly developing complex world physical resources of land and raw materials, being 'passive factors', are in themselves no longer the determining forces of development. The effective use of
these resources depends on the corresponding development of the human resources — their levels and types of skills and knowledge, as well as their attitudes to development in general and work in particular. Education, being a major instrument for developing the human resources, namely, the human intellect, has to keep pace with the changing needs of a complex society. The magnitude of change required in Indian education is reflected in the observation of the Education Commission that "Indian education needs a drastic reconstruction, almost a revolution."

Two broad but related aspects of education needing urgent change can be identified. The first concerns the organisational pattern and curriculum content, and the second the value system supported and transmitted by the educational system.

The Academic Bias in Indian Education
Commenting on the state of Soviet education in the late fifties, Krushechev in a memorandum to the Central Committee of the CPSU stated that "the chief and basic defect in our secondary and higher educational establishments is the fact that they are divorced from life." This was because the schools "are at present not accomplishing the task of training the young people for life, and are only training them for entering college." (2) This observation, with little modification, can be applied to secondary and higher education in India.

The European tradition of a dichotomy between liberal education for the 'gentleman' and vocational training for the working class created a yawning gap between mental development and manual training, with separate institutions being set up, enjoying disparities of prestige, for each. During the colonial period, the English variety of the European model found its way in the content and organisation of Indian education, the curricula of secondary and tertiary education, including few if any practical subjects, and general education being separated form vocational studies. This model was reinforced by the idea of manual work being taboo for the upper castes and the glaring differences in the salary structures of manual and mental workers. Except for a few piecemeal and sporadic changes, this pattern has survived the colonial period.

In a period of rapid technological change when the economy needs not only technologists, scientists and administrators, but also technicians and skilled and semi-skilled workers, the academic bias of Indian secondary education has served little practical purpose apart from preparing students for university entrance. If secondary schools have served as mere "coveyorbelts" for
entrance into higher education, the universities themselves, by concentrating on liberal arts courses, have been converted into 'waiting rooms' where the young school leavers spend a few years till they acquire a job. Overcrowding in universities, leading to a fall in standards, and an over-production of graduates, leading to educated unemployment and underemployment, have been the major consequences.

In a system dominated by a liberal arts curriculum, the requirements of the industry for middle and lower level technical personnel are largely ignored and the educational system produces workers whose training bears little relevance to the needs of the world of work. To match the outputs of the educational system with the requirements of a technological society, several changes in the organisation and content of education become necessary. In the first place, the training of high-level specialists and middle-level technicians functioning in a technological era calls for an increased emphasis in the school curriculum on education in the pure and applied sciences. At the same time, the curricular content has to be diversified to include alternatives to a purely liberal education in line with the needs of the economy, so that for a section of school leavers secondary education would be a terminal stage preparing them for various vocations and semi-professions. Further, with rapid technological change, the manpower needs of industry also undergo continuous change thus making it "necessary for most industrial workers at the lower levels to be retrained several times during the course of their working lives"(3). Together with rapid industrialisation, increased automation and the use of electronics have changed the nature and methods of work. Workers therefore need not only the skills in operating sophisticated machinery and equipment but also greater adaptability and willingness to continuously update their training. The necessity of continuous training to keep pace with changing technology makes nonsense of the notion generally prevalent in India that education is a process restricted to one period in an individual's life and that after he 'finishes' his education he begins his working life. The concept of education as something to be imbibed at one shot needs to be replaced by the concept of continuous lifelong education. Both attitudinal and institutional changes are required to make this possible.

The Challenges of Technological Change
From the above discussion it is seen that technological change makes certain distinct demands on the structure and content of Indian education. What are the challenges that these changes pose to the restructuring of Indian education?
1. Reforms in the organisation and curricula of school education.

As an education based on the principles of science is essential for an individual to function effectively in the technological era, the general education provided in schools would need to balance a study of the humanities and the sciences, with an increasing emphasis on the latter. Since the 1970s particularly, great emphasis is being placed on making science an important part of the school curriculum, and including it on a compulsory basis in the general education at the school level. To make this science teaching meaningful and effective calls for both a reorganisation of the science curricula and a rethinking on the methods of science teaching so that pupils are not only familiarised with the principles of science but also acquire a scientific temper. Whereas the first goal is relatively easier to achieve, the second depends on changes which go beyond curricular reform.

A second change required in the curriculum is concerned with maintaining a balance between general education on the one hand and preparation for a vocation on the other. In this context, the recommendations of the Education Commission (1966), which formed the basis of National Policy on Education issued by the government of India in 1968, bear particular relevance (4).

The Education Commission recommended a uniform pattern of education in which ten years of secondary education would be followed by higher secondary education, leading for some to a three year degree course. A major reason advanced for dividing secondary education into two stages was to diversify the higher secondary school curriculum and make possible selective admissions into the academic and vocational streams at the +2 stage. Recognizing the necessity to vocationalize secondary education, the Commission suggested working towards a target wherein, by 1986, 20 per cent of the enrolment at the lower secondary stage and about 50 per cent at the higher secondary stage would be in vocational and professional courses which would be terminal, qualifying students for employment.

In the 1970s the organisation of formal education was restructured in most states into a uniform 10+2+3 pattern, and the secondary school curriculum revised to provide full or part-time vocational education with general education for a small proportion of pupils continuing beyond class VII, and a separate vocational stream at the higher secondary stage to train middle-level personnel in various fields. Such a vocationalisation of secondary education, it is hoped, would gear education to meet the manpower needs of a society undergoing technological change.
Finally, to reduce the gap between the world of work and the world of studies, and provide a much-needed corrective to the excessively academic character of Indian secondary education, the Commission envisaged a programme of work experience as an integral part of education at all stages. Drawing its inspiration mainly from experiments in Soviet schools, work experience programmes in India are expected to involve pupils in some form of productive work "under conditions approximating to those found in real life situations" (5).

The practical difficulties involved in the vocationalization of secondary education, such as the lack of resources and facilities as well as a dearth of trained personnel to teach vocational subjects, coupled with attitudinal obstacles to change have resulted in the policy being implemented effectively only in some states, and that too marginally, the numbers enrolled in the vocational stream (e.g. 12.5% in Maharashtra and 2.5% in Delhi) falling far short of the stipulated target.

The changing manpower demands in a technological era however make more urgent the task of combining general education with vocational training and making secondary education a skill-forming terminal point for some. The new educational policy currently mooted by the government concentrates therefore on examining the relevance of the curriculum to the world of work and suggesting a delinking of degrees from a great proportion of jobs. The success of these policies depends, to a greater extent than is perhaps realized, on appropriate attitudinal changes among teachers, students and parents.

2. Changes in the values and attitudes incalculable by schools

A study of attitudes is necessary to see how different groups in Indian society perceive the demands of modernization and development, and the changed role and concept of education in the process of development. In other words what are the attitudinal and value changes or modifications required in a technological society, and what is to be the role of education in bringing about these changes? An area of attitude change of particular relevance here is the realm of attitudes towards work. Two critical dichotomies, inconsistent with the needs of a technological society can be observed in the area of attitudes to work in India. The first is the mental work and manual labour dichotomy, and the second the predominantly male-female occupations dichotomy. Both these are related to the prevailing value patterns in other spheres.
Though the need for attitudinal change in the realm of work is often advocated, few studies are available in India concerning (a) the attitudes held by individuals towards work in Indian society and (b) the desirable attitudes towards work that need to be inculcated through the agency of education.

Work, as "an instrumental activity carried out by human beings to maintain or preserve life; directed at a plentiful alteration of certain features of man's environment" (b) requires not only a knowledge of what to do, and the skill of doing it, but also a 'mental-set' of attitudes for employing the knowledge and skills to the job at hand. What are these 'mental-sets' or attitudes necessary in a modernizing complex technological society for the optimum utilization of the available knowledge and skills? Values of cooperation, hard work, honesty and integrity, social responsibility, efficiency, discipline, achievement orientation and affective neutrality are some of the values found to hold special significance in the context of present day Indian society.

If the values and attitudes desirable in Indian society can be identified, schools, which transform 'playing children' into 'working adults', can serve to impart not only the knowledge and skills required, but also inculcate the values - both individual and society beneficial - required by the world of work. The task of retaining, modifying and changing attitudes needs to be taken up not only through the school curriculum, but more importantly through the atmosphere permeating the school and the approaches and behaviour of the teacher. A major aim of introducing work experience in the school curriculum was to inculcate healthy attitudes towards work, particularly manual work, and develop a 'sense of social commitment'. How far the 'hidden curriculum' of Indian schools has made possible the attainment of these objectives needs to be examined.

3. Changes in the aim and methods of teaching.

The present trend of including an ever-increasing body of knowledge and information in the Indian school curriculum needs to be arrested and even reversed for education to be meaningful. Indian education is at present characterized by excessive verbalism and a concentration on information transfer, which while overburdening the curriculum, leaves the teacher with little time to do anything else besides completing the syllabus. Under such a system pupils receive doses of information on various subjects, with little training on how and from where information may be acquired, how it can be tested and verified, and how it may be
applied. The rapid explosion of knowledge and information technology makes a cramming of the school curriculum with facts and information both impossible and unnecessary. Apart from the fact that most of this information will be obsolete by the time a pupil leaves school, the growth of information technology puts at the disposal of the learner an efficient system of information storage and retrieval which he can avail himself of an and when the need arises.

This brings us to the second aspect of the impact of technological change on Indian education, namely, the use of technology in education.

II. The Use of Technology in Education

Technological change not only makes certain demands on education, but also makes available new materials and equipment, techniques, and instructional systems, all of which hold tremendous possibilities for education in the developing societies.

Although the teacher in the Indian classroom has had available visual aids to teaching, the development of technology in recent times now provide him with audio-visual, projected and electronic devices to assist teaching, and help make it more interesting and effective. Audiovisual technology, also known as educational communications technology, by employing "technical means for efficient storage and presentation of information and visual and auditory experiences" (7) enables a more efficient and effective dissemination of information, thus leaving the teacher with more time for interacting with pupils and giving them individual attention.

Eriksen and Curl (8) identify the various roles which audiovisual technology can play in formal education as follows:
(1) extend human experience;
(2) provide meaningful sources of information;
(3) stimulate interest;
(4) guide student response;
(5) overcome physical limitations of presenting subject-matter;
(6) stimulate problem solving; and
(7) provide diagnostic and remedial tools.

Despite the obvious advantages, lack of resources has put most audiovisual technology, particularly projected and electronic devices like motion pictures, television (both ETV and CCTV),
video tapes, projectors, teaching machines, computers and the like outside the reach of a majority of Indian schools. Further, some local television stations regularly broadcast school programmes in subjects like science and English. The success of these programmes depends on the availability of teachers trained to write imaginative lessons, the provision of television sets in each school to receive the telecasts, and the capacity of the classroom teacher to supplement the televised lesson with preparation before and discussion after the telecast. In the absence of appropriate management skills on the part of the teacher, even well-prepared instructional T.V. projects cannot have the desired results (?).

Training in the use of educational technology therefore forms an important component of teacher education programmes today. With grants from the University Grants Commission many colleges of education have obtained audiovisual material for training prospective teachers in their use. As part of the programme of training teachers in the optimum use of the new technology, attention has also to be given to preparing the teacher to adapt to the new roles which the use of this technology requires. In the absence of such training, teachers may view technological aids as decorative, supplementary devices to be used sporadically. Also, the teacher training programme itself can be made more effective by the use of technological devices which facilitate simulation, role-playing, micro-teaching and interaction analysis.

Besides improving the quality of formal classroom instruction, audiovisual technology, in a society marked by unequal educational opportunities, can be harnessed to the task of widening the access to education. A feature of the inequality of educational provisions in India is the uneven distribution of schools resulting in glaring intra and inter regional imbalances in the provision of educational facilities. The use of technological media can help solve the problem of regional imbalances by facilitating distance learning. The Satellite Instructional Television (SITE) programme conducted during 1975/76 served to extend educational facilities to remote areas. With the launching of an Indian satellite the possibilities of spreading educational facilities are tremendous. For instance, from 1984 the University Grants Commission has started programmes in higher education which are telecast nation-wide through INSAT I-B.

With technological change making continuous education a necessity, and the increasing use of audiovisual technology in the process of education, the line between formal and non-formal education may soon become imperceptible.
References


