CHITRA NATARAJAN AND SUGRA CHUNAWALA

TECHNOLOGY AND VOCATIONAL EDUCATION IN INDIA

INTRODUCTION

> Our education has got to be revolutionised. The brain must be educated through the hand. If I were a poet, I could write poetry on the possibilities of the five fingers. Why should you think that the mind is everything and the hands and feet nothing? Those who do not train their hands, who go through the ordinary rut of education, lack 'music' in their life. All their faculties are not trained. (Gandhi, 1994)

Imagine the scenario: An electrician and a plumber walk into an affordable house-under-construction, the owners articulate their needs, and service providers end up giving them switches most convenient to use and easily maintainable plumbing that gets water-on-tap. Surely the owners and the service providers must have all had an education in design. Imagine again that you are visiting an Indian metropolis and find it well laid-out. Everything around you seems to have been *designed* to work: bus routes and stops, trains, stations, airports, all artefacts and organisations, schools, and curricula. You talk to a spectrum of people from different walks of life and learn that the planning has been participatory and carried out with insight. The general education of all people in the metropolis must have included courses on design and technology, which was then extended within vocational education. This situation in India, unfortunately, is a long way coming.

The history of education in India can be traced to the 3rd century BC, when sages and scholars imparted education orally to a select few. Later, palm leaves and bark of trees were used to spread the written word. Temples and community centres served as schools accessible to a limited population. Buddhism opened up education to all people and led to the rise of educational institutions of global fame: Nalanda, Vikramshila, and Takshashila. (Nalanda University is said to have had around 10,000 resident students and teachers on its roll at one time.) Around the 11th century the Muslim rulers established elementary and secondary schools in India and universities were also established at Delhi, Lucknow, and Allahabad. During the Medieval period the Indian and Islamic traditions interacted in several knowledge areas including theology, philosophy, the fine arts, mathematics, medicine, and astronomy.

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The craft tradition has stayed outside schools. In the Hindu Varna system of society, occupations were handed down through family lines and community groups. Broadly, the *Brahmins* were keepers and disseminators of knowledge, *Vaisyas* were traders, *Kshatriyas* were warriors, and the *Sudras* were assigned menial labour. There were further divisions in terms of goldsmiths, blacksmiths, carpenters, and so on. Artisans were trained through apprenticeship in the family, while master artisans were recognised by their rigorous training and work.

The arrival of the British in India made education based on existing Western models available in the country. However, these colonial education models introduced the idea of certified and valid knowledge alienated from productive work that satisfied existing social needs. To this day, those who produce wealth by working with their hands often lack access to formal education, while formal education denigrates productive manual work and fails to provide the necessary skills for the same. In this context, it is useful to recall excerpts from Mahatma Gandhi's address to teachers at the National Education Conference held under his leadership, at Wardha on 22 October 1937:

> What I am going to place before you today is not about a vocation that is going to be imparted alongside education. Now, I wish to say that whatever is taught to children, all of it should be taught necessarily through the medium of a trade or a handicraft. . . . Look at takli [spindle] itself, for instance. The lesson of this takli will be the first lesson of our students through which they would be able to learn a substantial part of the history of cotton, Lancashire and the British empire. . . . How does this takli work? What is its utility? And what are the strengths that lie within it? Thus the child learns all this in the midst of play. Through this he also acquires some knowledge of mathematics. . . . And the beauty is that none of this becomes even a slight burden on his mind. (Gandhi, 1994)

Dilution of such ideas was evident in the conception of the education system even before independence. The following section discusses the form of technical and technology education in school and tertiary levels in post-independent India. It is a commentary on whether and how Mahatma Gandhi's ideas influenced technical education.

OVERVIEW OF TECHNICAL/VOCATIONAL EDUCATION IN POST-INDEPENDENT INDIA

After India's independence in 1947, it became a national priority to generate human resources through education to fulfil the future needs of the country, which was envisioned as an industrialising one. This led the Kothari Commission, set up in 1966, to link education to productivity and to propose that science education, work-experience, and vocational education be an integral part of school education. It is within these three subjects that education in and about technology resides rather nebulously in the context of Indian schooling, even today. A brief overview of processes of curricular change involving commissions and their recommendations, and recent national exercises of drawing up curricular frameworks is presented below.

Structure of Education

Following the recommendations of the Kothari Commission in 1968, a common structure for education was adopted in the whole country (Figure 1). Typically, schooling is for a span of 12 years: 10 years of primary and secondary schooling, and 2 years of senior/higher secondary (referred to as junior college, intermediate, or +2). College graduation is normally after 3 years of study. This is popularly denoted as the 10+2+3 pattern. The National Council of Educational Research and Training (NCERT) is the apex body that formulates the curricular framework and materials for Central schools. State Councils of Educational Research and Training (SCERTs) closely follow NCERT's framework in formulating syllabi and curricular materials for State Board affiliated schools[i]. At the end of secondary (Grade X) and higher secondary stages (Grade XII), students are assessed through public examinations conducted either by the Central or State Boards.

Science Education

Education frameworks prior to 2000 had explicitly recognised scientific and technological literacy as a goal of science education. The National Curricular

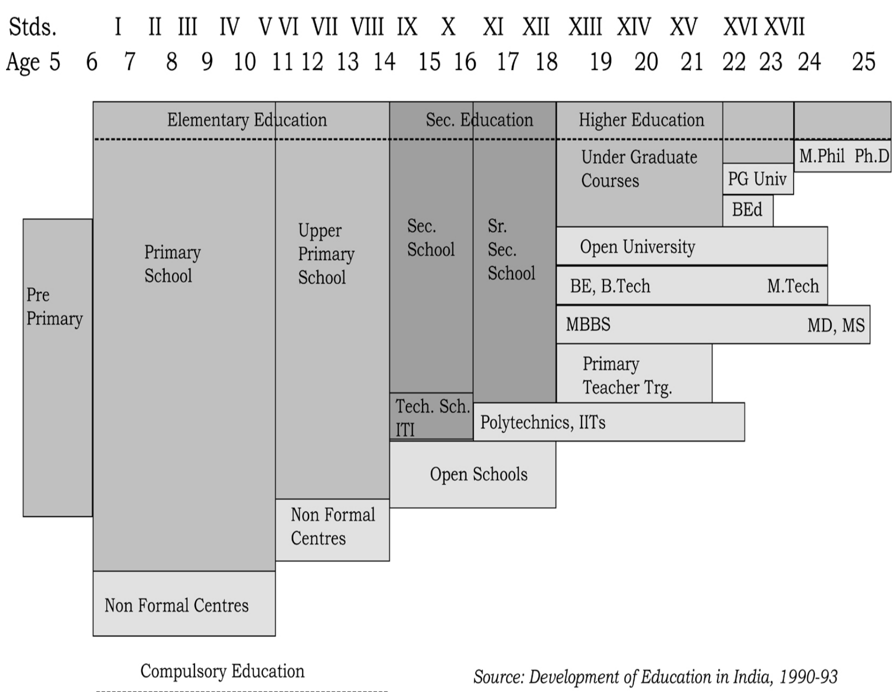

Figure 1. Structure of education in India.

Framework (NCF) was the first document to explicitly recognise science and technology (S&T) as organically linked and linked to society (NCF, 2000). The textbooks based on the framework were titled *Science and Technology* and included applications of science scattered among concepts, processes, procedures, and activities. Technology was narrowly defined as the 'application of science to meet human needs'. Through all these changes in frameworks and textbooks, it was teaching as usual in the science classes, as neither the laboratories nor the examination systems had undergone any radical change to include testing on technological literacy.

NCF 2005 for the first time referred to design and technology as part of teaching and learning science at the school level in its Position Paper of the National Focus Group on Teaching of Science (NFG-ToS, 2006). For the first time in the history of curricular frameworks there was a recognition that

> Technology as a discipline has its own autonomy and should not be regarded as a mere extension of science. . . . Technological solutions are guided as much by design, aesthetic, economic and other practical considerations as by scientific principles. (p. 2)

In the Position Paper of the National Focus Group on Work and Education (NFG-W&E, 2007), the role of productive work and design opportunities in education were linked: "A systematic study of design and technology can provide opportunities for learning a broad spectrum of generic skills and competences" (p. 30).

Work education

Work experience, as conceived in the Kothari Commission Report (GOI, 1968), was defined as "participation in productive work in the school, in the home, in a workshop, on a farm, in a factory or in any other productive situation" (p. 13). The National Policy on Education (NPE) 1986 extended work education to secondary school level. It sought to reorient Gandhi's *Basic Education* programme to activities that would cater to the needs of an S&T based society. The introduction of work experience was intended to reduce the growing distance between the 'working' classes and the 'educated' elite, and between rural and urban students. However, the existing social stratification only served to reinforce the alienation. The prevailing curricula in various school systems did not reflect an interweaving of work into education and the radical vision of Gandhi was trivialised in practice. In academic discourse, too, work experience is often confused with vocational education, something which Gandhi, as quoted above, warned us about in his Wardha Conference address.

Vocational Education

Despite vocational education being considered by all stakeholders of education as an inferior form of education at the school level, the Education Commission proposed that secondary education be vocationalised (GOI, 1968). The purpose was to enhance individual employability, reduce the mismatch between demand

and supply of skilled human resource, and provide an alternative for those pursuing higher education. It was also perceived as an important step for enriching education and making it more meaningful and attuned to the realisation of national goals. The National Working Group on Vocationalisation of Education (MHRD, 1985) reviewed the programme and recommended the development of the Centrally Sponsored Scheme (CSS) on 'Vocationalisation of Secondary Education' (VSE), which began to be implemented from 1988.

Figure 2 depicts the entry at various levels of education into the world of work and into vocational courses by NPE 1986. Of those who enrolled at Grade I, 60% were expected to complete Grade X. Of these, 25 to 30% were expected to take up vocational courses of 1 to 3 years. However, a mere 5% enrolment has been achieved in vocational courses.

The Vocational Education Programme (VEP) at different stages of education has been known by a variety of names. At the primary and middle school levels (Grades I-VIII) it was called 'work experience' or 'socially useful and productive work' and 'pre-vocational education' in Grades IX and X. Vocational education appeared either as a distinct stream or as the generic vocational programme of courses within the academic stream of education at Grades XI and XII. The latter has been a non-starter for several reasons. For one, only a few schools implemented this course. Besides, those who did adopt it allocated far less time than the 12.5 to 20% of the school time recommended. Other difficulties included challenges of assessing millions of students, insufficient funds, and non-availability of raw materials, equipment, etc.

There is also a dearth of adequately trained teachers. In most States, students are streamed into vocational education on the basis of state-level standardised examinations in Grade X. The premium placed on general secondary and higher education by students and their parents, leads one to believe that students joining

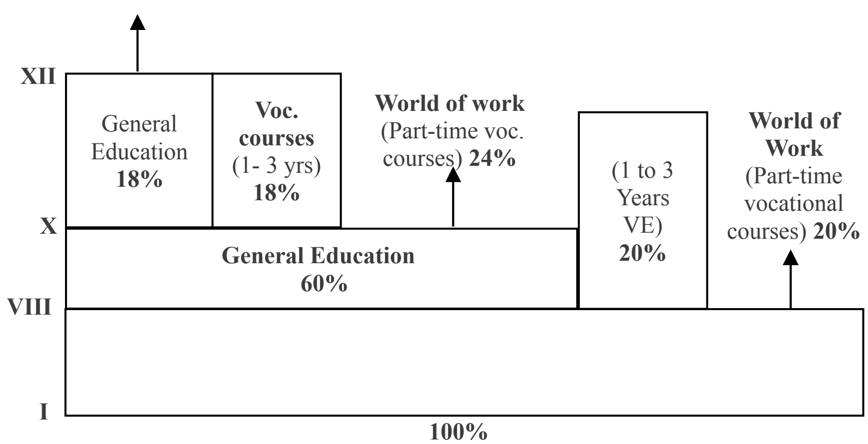

Figure 2. Entry (envisaged) into the world of work at different stages of education (NFG-W&E, 2005, p. 98).

the vocational system are possibly most likely to be those who perform poorly in the Grade X examination.

As a compelling need for living in the computerised world, over the last decade information and communication technology (ICT) has superseded in importance and urgency the earlier three facets of technology education at school: science, work education, and vocational education. In India, besides being a step towards development, ICT was also considered essential for employability. Subsequently, education about technology is often viewed as learning with and about digital technologies. Under the Private-Public-Partnership scheme, this has been translated in the classroom as basic awareness about computers, while textbooks describe proprietary software for word processing and using spread sheets. The authors think that examples from open source software would be both ethically correct and even empowering for first-time learners of computers.

CONTROLS, STANDARDS, AND THE ECONOMICS OF TECHNOLOGY EDUCATION

The major initiatives towards technical education in the country began well before independence, with the establishment of Indian Institute of Science (IISc) in Bangalore (1909); Institute for Sugar (1936), Textile (1914) and Leather Technology in Kanpur; National Council of Education in Bengal (1905); and industrial schools in several provinces. The Technical Education Committee of the Central Advisory Board of Education was constituted in 1943 and the All India Council for Technical Education (AICTE) was formed as an advisory body in 1945. Following NPE 1986, and by the AICTE Act No. 52 of 1987, AICTE was vested with statutory authority for planning, formulation, and maintenance of norms and standards, accreditation, funding, monitoring, and evaluation of technical education in the country.

Education is a concurrent subject in the Constitution. Education is split between ministries: Primary, secondary, higher, and professional education. Vocational

Table 1. Institutions, enrolment capacities, and student strengths in vocational education. (Compiled from MHRD, 2003.)

Programme	Required education	No. of courses	Enrolment capacity	Course duration	No. of institutions
(A) Formal Programme					
Vocational Education (Vocational Schools)	X	160	972,000 (enrol= 450,000)	2 yrs	6800
Vocational Training (ITIs)	VIII, X	67	672,000	1 to 2 yrs	4591
Technical Education (Polytechnics)	X	40	188,000	3 yrs	1224
Undergraduate level	XII	42	NA	3 yrs	1850
(B) Non-Formal Programme					
Jan Shiksha Sansthans	No bar	NA	NA	Short courses	108
Community Polytechnic	No bar	NA	450,000 per year	3-9 months	675

education falls under the purview of the Ministry of Human Resources Development (MHRD). The overall implementation of the vocational programme rests with the State governments, which in most cases work through the State Departments of Education. Some States have separate Directorates of Vocational Education, while others implement the programme through the Directorate of Industrial Training. Since 1994, AICTE has had several offices around the country to help oversee technical and vocational education at the national level in different regions. Facilities for the introduction of vocational courses have been created in the six major areas of agriculture, business and commerce, engineering and technology, health and paramedical, home science and humanities, and science and education. The Pandit Sunderlal Sharma Central Institute for Vocational Education, a constituent but autonomous unit under the NCERT, is responsible for developing the courses and course materials.

It took ten years after the recommendation in 1968 to introduce vocational education courses (Table 1, first row) and another ten years to have a Centrally Sponsored Scheme (CSS) in 1988 to provide financial assistance of about Rs.7 billion to the States and Union Territories for implementing vocational courses in the 6,800 schools. In addition, for the one-year apprenticeship course a stipend is paid to students, which is shared equally by the Central Government and the collaborating institutions. The financial assistance began to be discontinued in 1997-99, resulting in a setback to vocational education programme in several States (NFG-W&E, 2007). The recent report by the National Knowledge Commission (NKC, 2007) has recommended launching a National Skill Development Mission with an outlay of Rs.312 billion to increase capacity from 2.5 million to 10 million students per annum.

Unlike vocational education, vocational training programmes in India – with student intake capacity of 740,000 – fall outside the formal schooling cycle. Vocational training is institution-based, with varying entry requirements as well as course durations. The proportion of practical to theoretical instruction in vocational training programmes is also higher than in vocational education. Open to students who have completed anywhere from Grades VIII to XII, the Craftsmen Training Scheme operates through over 5000 Industrial Training Institutes (ITIs) financed and managed by the State Labour Ministries, and Industrial Training Centres (ITCs) managed by private organisations or NGOs.

Design is a relatively recent area of specialisation available only at the tertiary level and offered by Schools of Art and Architecture. The Indian Institutes of Technology (IITs), IISc (Bangalore), and the National Institute of Design (Ahmedabad) offer masters and doctorate degrees in design. Many of these institutions conduct considerable research in the area of design and design education, although all are focused at the tertiary level. Several institutions offer certificate and diploma courses in a variety of design areas like fashion (clothes), jewellery, and footwear, among a host of others.

PERCEPTIONS ABOUT ENGINEERING AND TECHNOLOGY

The various stakeholders of engineering and technology in India have differing perceptions. As mentioned earlier, the general social view in India is that vocational education is an inferior form of education. The divide between the mind and the hand is acute and the mental overrides the manual. While such attitudes are perhaps found across the world, the Indian sociocultural background privileges the intellect to a larger extent as reflected in the caste system. Thus educational policy makers are often accused of vocationalising general education and making the vocational education too generic and irrelevant for employment.

Employers have a stake in skilled labour, a large number of whom graduate from the ITIs and ITCs. Most employers in three States surveyed (World Bank, 2008) reported that ITI graduates did not perform well enough in the use of computers, practical use of machines, communications, and team work practices. A Karnataka State study found that employers felt that ITIs produce personnel who lack basic scientific/technical understanding of their trades (World Bank, 2002). Many occupations still taught are obsolete, and engineering trades – in high demand among students – have outdated syllabi and trainers who are out of touch with current technology and work organisation needs.

In addition, the quality of ITIs across the different States varies significantly. One of the reasons for the mismatch between skills of personnel and industrial needs is the lack of involvement of the industry in the management of ITIs. Whilst ITIs and ITCs rely on formal certification by an independent authority, this certification is perceived to be flawed. There has also been a tendency to create new institutions, while existing ones remain under-funded. Besides, the government has prime responsibility for formal sector training, and there is no pressure and few incentives for employers to be involved in training.

Given that professional courses in engineering and technology attract students while technical courses are looked down upon, it is useful to study school students' ideas about technology (Bhattacharya, 2004; Rajput, Pant, & Subramaniam, 1990). However, there have been far too few studies of this type. Surveys conducted at Homi Bhabha Centre for Science Education (HBCSE) probed the ideas that students hold about technology in a variety of ways. As technology is not an independent school subject, students' ideas may be influenced by a complex set of in-school and out-of-school factors. In one study, about 60 students from Grades V to IX, from 30 different schools in and around Mumbai city, participated in a poster making contest on 'images of science' and 'images of technology' (Mehrotra, Khunyakari, Chunawala, & Natarajan, 2003). The analysis showed that students perceived S&T more in terms of the objects used or created than as processes, and S&T was largely viewed as beneficial to individuals and society.

Another survey, of 654 middle school students of Grade VIII from eleven English and Marathi medium schools in and around Mumbai (Khunyakari, 2008), also indicated a positive view of technology. Students were proud of their country possessing nuclear technology, yet worried about its consequences for people and the environment. Pictorial questionnaires that presented technology through objects and activities were used among Grade VI students (Mehrotra, Khunyakari, Chunawala, & Natarajan, 2007). Findings indicate that students considered objects and activities related to communication and transport, especially modern ones, as technological. Utilitarian and human-made aspects were emphasised by students as reasons for associating objects and activities with technology.

Few studies exist that examine engineering and technology students' attitudes towards their own profession and the state of technology education.

PROFESSIONAL DEVELOPMENT OF TECHNICAL/VOCATIONAL EDUCATION TEACHERS

During 1965-67, four National Institutes of Technical Teachers' Training and Research were established in four metropolises around the country to develop, organise, and evaluate quality training programmes, research studies, and learning packages for technical and vocational education. Since they have all been accorded the Deemed University status, they function in collaboration with the AICTE to offer professional development opportunities – from certificate courses to doctorate level – to teachers of technical and vocational education. Qualifications of teachers in the generic vocational stream (Grades XI and XII) are similar to those of general secondary school teachers. Full-time teachers need to have a masters-level qualification, and teachers of vocational subjects are often the same as those who teach general subjects. In addition, part-time teachers are also hired by institutions to teach specific courses.

State directorates of school education largely work in isolation from other relevant educational departments and institutions of the State. As the State governments were cash-strapped after the discontinuation of the funding from the Centre, they resorted to appointing of part-time teachers – usually unemployed graduates without either industry background or experience in vocational/technical education. In addition, they were not given in-service training (NFG-W&E, 2007). Thus, there exists in technical and vocational education a bleak picture of staff inadequacy both in the number staff and their professional preparation. Recent reports have held the AICTE and State monitoring bodies accountable for this situation (NKC, 2007). There have been repeated attempts at improving the situation through increased funding for conducting teacher preparation courses, summer camps, etc. However, the fragmentation of higher education and a lack of coordination between the generic vocational education at school levels and vocational/technical education at higher secondary level and beyond have often negatively impacted on implementation.

LOCAL EFFORTS IN CONTEXTUALISING TECHNOLOGY/TECHNICAL EDUCATION

A number of NGOs have been providing education through skills and training to target groups that vary across out-of-school children, unemployed adults, women, and tribal and other marginalised groups. They often run short courses on technology, home science, commerce, etc. Some NGOs receive funds from the MHRD for conducting programmes in vocational education. Ministries of Social Welfare and Justice, Rural Development, Labour, as well as agencies like the Council for Advancement of People's Action and Rural Technology, also provide financial assistance to NGOs to run non-formal vocational education and training programmes (NFG-W&E, 2007). Other institutions running vocational education and training programmes in the non-formal sector include 'Krishi Vigyan Kendras'

(KVKs), Khadi and Village Industrial Commission (KVIC), Jan Shikshan Sansthan, and Community Polytechnics. Some vocational courses are also offered by National Open School through a number of institutions accredited by it. *Vigyan Ashram* at Pabal in Maharashtra State created a curriculum that allows rural students to become entrepreneurs through skill training and education using appropriate and income-generation technologies (Natarajan, Khunyakari, & Chunawala, 2004).

Some of the issues faced by the non-formal sector include lack of certification and accreditation of institutions and courses; problems of equivalence with formal education and training programmes; and lack of infrastructure, both human and material, for proper running of the programmes.

CONCEPTUALISING A SCHOOL-LEVEL DESIGN AND TECHNOLOGY EDUCATION

About 20% of the country's population of over a billion is in the school-going age group of 5 to 18. A very large number of these either have never enrolled themselves in schools or have dropped out at various stages of education: 52% of those who enrol in Grade I drop out by Grade VIII, and more than 70% drop out by Grade X. Only 20% reach Grade XII, while a mere 7% go for higher education (NFG-W&E, 2007; NKC, 2007). Only a small fraction of these enter technology or design courses. Yet those who drop out of the education system join (or aspire for) the world of work, most without acquiring employable skills.

What does school education provide in terms of employable skills such as knowledge and process, procedural, and team work skills? With an emphasis on studying theoretical principles and observing experiments conducted primarily by the teacher, school science is seldom experienced as an activity at all, let alone a participatory one. As such, students do not view science as a collaborative activity (Chunawala & Ladage, 1998). Work experience, or any of its school-based variations, involves making socially-useful objects using recipes suitable for production in large numbers. It has little scope for design or examining contexts of use.

Technology education needs to involve multidisciplinary perspectives and multiple skills. As such, school education that merely emphasises knowledge about technology can stifle innovation. In contrast, enriching school curricula with explicit opportunities for authentic problem solving and multiple expression modes valid in a variety of classroom contexts could help develop future technology innovators. Technology education thus has a scope wider than either vocational education or work experience, and it transcends science for its disciplinary grounding. As a subject in its own right, it makes links between craft, empirical indigenous knowledge, the natural sciences, and the social sciences. Design, which is the core of technological activity, is a way of seeing the world that is quite distinct from the way the sciences or the humanities see the world. Hence, technology with an emphasis on design deserves subject status in Indian general education (Cross, 2002; Roberts, 1999).

Technology education research at HBCSE has been guided by theoretical perspectives on collaborative learning; cognition and action; concerns of sociocultural and gender appropriateness; and the development of language, quantitative, and problem solving skills. This approach shifts the emphasis from the dominant views of technology education as applied science or ICT to collaborative participation of students in design and evaluation of artefacts and systems (Kimbell, Stables, & Green, 1996). Design, craft, and technology as part of general education (at the school level) will help attract a greater number and diversity (rural, girls, etc.) of students to careers in technology, as well as equip them with the trainable skills of perceiving and defining needs, and *designing* to satisfy them.

Ideally, the core of technology education at school level in the Indian context will be design and technology (D&T) activities that use a variety of skills and draw upon the knowledge of key concepts traditionally taught within other disciplines. The activities would integrate aspects of affect (wants, desires, and aesthetics) and judgements (making strategic alliances, choosing materials, and evaluating products). They will go beyond episteme (knowledge) and techné (skill), and include phronesis (practical wisdom) (Dunne, 1993). The hallmarks of technological empowerment will include the ability to design, innovate, make, evaluate, and communicate the technological goals, processes, and products through collaboration within a complex sociocultural environment as indicated in the model in Figure 3 (Choksi, Chunawala and Natarajan, 2006). A stage-wise curricular framework for a collaborative and communication-centred D&T education has also been developed at HBCSE.

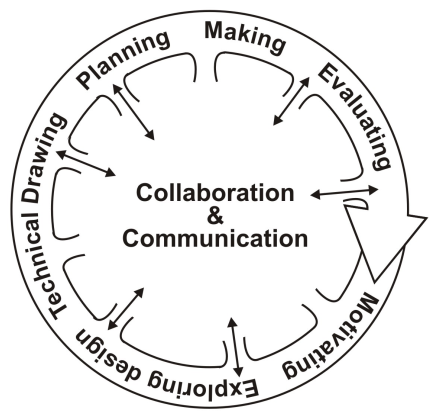

Figure 3. A model of D&T education centred on collaboration and communication.

THE CURRENT SCENARIO AND POSSIBLE FUTURE DIRECTIONS

India’s vocational education and training programmes have never adequately met the needs for which they were created. The reasons are complex and arise from academic, organisational, economic, and sociocultural contexts. Following a boost in financial outlay of the Eleventh Plan (2007-2012) for higher education, three more autonomous IITs (professional technology institutes) have been established. There has also been a greater allocation of funds for revamping the ITIs (after Grade X and XII). Recommendations over the last decade have included introduction of design in ITIs, Polytechnics, and other technical education institutes; strengthening the innovation component in technical education; and encouraging and training faculty to conduct research through seminars and workshops.

The National Knowledge Commission (NKC), constituted by the Government of India in 2005 to study the various aspects of education, at different levels, has recommended more flexibility in vocational education and training (VET). It also pointed to the need for quantifying and monitoring the impact of vocational education, and suggested re-branding to increase its perceived value and ability to command higher incomes. It further proposed a complete overhaul of the regulatory structure for higher education, with the creation of the Independent Regulatory Authority for Higher Education and abolishment of the AICTE. For technical and vocational education to gain status, it will need teachers with better professional preparation, an emphasis on creativity and entrepreneurial skills in the technical and vocational courses, and an attractive remuneration package for staff. This implies teaching elements of design and critical thinking about technology and society not only to those in the vocational education stream, but also to all students in the generic vocational courses.

Making technology education inclusive assumes significance in the complex sociocultural context of India, where there is:

- Immense innovation potential across the country among the schooled and the unschooled, the formal and non-formal sectors;
- continuing traditions of indigenous local technologies;
- wide cultural and resource differences between different parts of the country including the rural-urban divide; and
- classrooms with students from multi-lingual backgrounds.

Consider that over 80% of the students enrolling in Grade I enter the world of work with either generic or part-time vocational courses, and a considerable proportion have dropped out even before Grade VIII. This would imply that a productive and creative work force is possible only by addressing the need for innovation and creativity at as young an age as possible, preferably from the primary years. It would also be more equitable to introduce D&T education across the country. At the same time, the nature of activities within the curriculum and its contextualisation needs to be addressed in order to retain uniform standards of process and cognitive skill development.

The present education system, which does not encourage collaboration and which constrains modes of expression, can be alienating to a large proportion of learners (The PROBE Team, 1999). The D&T model developed at HBCSE proposes stage-wise increases in the complexity of activities, which are designed integrate skills and processes across knowledge domains. A well-planned D&T curriculum, especially in mixed-ability and multicultural classrooms, should be an inclusive rather than an exclusive endeavour – for the children of the rich as well as the dispossessed, for those in the indigenous or the modern mould, for girls and boys.

The educational community has a tendency to avoid radical changes, even if its present state is a scary one. Creativity and critical thinking are difficult to manage in classrooms, difficult to assess, and can threaten political systems. Parents and social systems are also often uncomfortable with it. Technology education poses an additional challenge by its sheer breadth. Engineering is neat and definable; the domain can be subdivided into mechanical, civil, etc. In addition, its acceptability is founded on its links with science and mathematics, the disciplines of prestige and power in all modern cultures. In contrast, technology as a notion is fluid and somewhat ambiguous. It is changeable with time and context – geographical, cultural, and socio-historical. Hence, it has myriad teaching possibilities that imbue the subject with possibilities of inclusivity and equity, creativity and critical thinking, ecology of thought and action. This is also what makes it an empowering school subject. The authors thus call for inclusion of design and technology in Indian school curricula, and hope that all its empowering possibilities will one day be realised.

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Chitra Natarajan
Sugra Chunawala
Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research
Mumbai, India

[i] A majority of schools in India are either affiliated to the Central Board of Secondary Education (Central schools) or to respective State Boards of Education.