# EDUCATION, SCIENCE AND NATIONAL DEVELOPMENT

*Dadabhai Naoroji Memorial Prize Fund Lectures*

# EDUCATION, SCIENCE AND NATIONAL DEVELOPMENT

D. S. KOTHARI
*Chairman, University Grants Commission*
*New Delhi*

ASIA PUBLISHING HOUSE
BOMBAY · CALCUTTA · NEW DELHI · MADRAS
LUCKNOW · BANGALORE · LONDON · NEW YORK

SBN 210.22225.5



BY G. G. PA .)
PRIVATE LT IY
P. S. JAY ASIA PUBLISHING HOUSE,
BOMBAY-1

# PREFATORY NOTE

THE TRUSTEES of the Dadabhai Naoroji Memorial Prize Fund have pleasure in presenting to the general public the two lectures on *Education, Science and National Development* which were delivered by Dr. D. S. Kothari, Chairman, University Grants Commission in Bombay, in April 1968.

*Bombay,* 1 *May* 1969

# INTRODUCTION

DADABHAI NAOROJI ranks amongst the greatest names in our country's recent history. He stands as a towering personality amongst those who laid the foundation of the freedom movement which from small beginnings became a mighty torrent under Gandhiji's leadership. Dadabhai Naoroji was born in Bombay on September 4, 1825. He lived up to the age of 91. He came from a poor family. About his early education he wrote: "Had there been levied the (school) fees of the present day, my mother would not have been able to pay them. This incident made me an ardent advocate of free education and of the principle that every child should have the opportunity of receiving all the education it is capable of assimilating, whether it is born poor or with a silver spoon in its mouth." He was a student of the Elphinstone Institution in Bombay founded in 1840 (on the basis of a private endowment in 1827). The Institution later became the Elphinstone College. His main interests at college were mathematics and English literature.

From the very beginning, service of the people was an overwhelming passion of his life. He said: "I realized that I had been educated at the expense of the poor to whom I myself belong. . . . The thought developed itself in my mind that as my education and all the benefits arising therefrom came from the people, I must return to them the best I had in me. I must devote myself to the service of the people." On the completion of his course at the Institution, he became an assistant master, and soon after professor of mathematics and natural philosophy at the Institution. He was the first Indian to hold a chair, and he always regarded this as perhaps the greatest honour that had come to him in his long life. Dadabhai always did his utmost to put into practice his ideas and ideals. He recognised the great importance of female education. While a student at the college he taught reading and writing to a large number of poor girls at their homes. He was deeply conscious of the abject poverty of India, and to a large measure he attributed this to the imposition on India of "the most bureaucratic and costliest administration in the world".

He was a pioneer in the use of statistics in social studies. Perhaps, the first estimate of the *per capita* income in India is due to Dadabhai Naoroji. He arrived at a figure of Rs. 20 (2 pound sterling) a person a year for India of 1870. Lord Curzon's estimate for the country thirty years later was Rs. 30. Not unexpectedly, these early estimates suffered from large uncertainties. For instance, if we take the national income for the UK quoted by Dadabhai in his monumental book, *Poverty and Un-British Rule in India* (reprinted 1962), the ratio of the *per capita* income for the UK and India in 1870 was 20, a value not much different from what it is today. But this is most unlikely. [Amongst the recent studies on the subject, mention may be made of S. J. Patel. (*The Journal of Modern African Studies*, Cambridge, Volume 2, 1964, pp. 329-49). Patel observes that the average *per capita* income in 1850 at present-day prices, was about 150 dollars in countries today classed as "developed" and 100 dollars in what are called "developing countries". The respective figures for 1960 are $1,100 and $120. Earlier to the middle of the nineteenth century the economic differences between countries were relatively small. But, averaged over the past hundred years, the yearly growth rate in *per capita* income has been 1.8 per cent in the industrial countries as against a near stagnation, 0.1 per cent or so, in the pre-industrial ones.]

Dadabhai's interests and work covered almost every facet of the nation's life. His personal contribution was of the greatest value and significance. His work and example will ever remain a source of unfailing inspiration and courage in the supreme task of economic and social progress of our country.

D. S. KOTHARI

*Chairman*
*University Grants Commission*
*New Delhi*
April 1968

# CONTENTS

CHAPTER I

# INDIAN EDUCATION: SIZE AND GROWTH

## I

INDIA TODAY has one of the largest educational systems in the world with a total enrolment exceeding 70 million. Teachers number over 2 million. In higher education alone there are a little less than 2 million students of which some half-a-million are women. The number engaged in research is about 10,000. As against this the total enrolment, in undivided India, at all stages of education, a hundred years ago, was only one million. In 1900 it was 4.5 million of which no more than 16,000 were in higher education, the number of women being only about 250.* The total

* Fifteen years earlier (in 1886) the total enrolment was 3.3 million, in 127,000 institutions. In higher education there were 11,500 students (10 women) in 114 colleges. These included 4 medical colleges with 654 students, 4 engineering colleges with 474 students and 16 law colleges with 1,602 students. The expenditure on higher education at the time was about Rs. 300 a student a year. The number of first degrees awarded in 1884-85 was 691, and M.A. degrees 23.

The rate of growth of enrolment in higher education, averaged over the last 70 years, is about 7 per cent a year, which corresponds to a doubling period of 10 years. (*Review* yearly expenditure from all sources on education in 1900 was about Rs. 4 crores.† It is Rs. 600 crores to-day. The total number of schools is about 0.5 million, of which 26,500 are secondary schools. One out of every hundred of the working population is employed in education.

There has been an upsurge in education since Independence (1947), but it is only the beginning of an education revolution crucial to the economic and social development of the country. I shall present a brief survey of education, and consider some of the major problems we face.

Sir Charles Wood's famous despatch of 1854 set out, and in a sense sealed, the British educational policy in India. We have still not quite got out of the dismal limitations and orthodoxy of that imposed system. Its key-notes were diffusion of western knowledge and culture, and training of people for subordinate administration and secretarial services in a government controlled and directed by the British rulers. Oriental studies were ignored. *Shakespeare* was more important than *Ramayana* and *Shakuntala*: Greek and Latin more prestigious than Sanskrit and Arabic. The great cultural and spiritual thought of India, confluence of many cultural streams, found no place in the universities first established in the country hundred years ago. With the passage of time, ignorance of their own herit-

*of Indian Education* in 1886 by Sir Alfred Croft; Government Press, Calcutta, 1888).

† 1 Crore = 10 million = 100 lakhs.

age led people to believe that it was not worthy of serious study and attention. The centre of gravity of India's intellectual life, whatever it was, moved away from India, and has not been recaptured yet.

The system turned out 'educated' Indians, but without roots in their soil and culture. It discouraged identification with the community. It provided 'English education' but smothered the souls. There were, of course, great exceptions, but an educational system can hardly take the credit for exceptional individuals who come out of it, or in spite of it. The system lacked, even rejected, 'Indianness', and the country is paying dearly for that neglect and aberration. Ramendra Sunder Trivedi, a distinguished and percipient scholar, said in his memorandum to the Sadler Commission (1917-19): "Western education has given us much, we have been great gainers: but there has been a cost, a cost as regards culture, a cost as regards respect for self and reverence for others, a cost as regards the nobility and dignity of life."

## II

In spite of the very large growth in elementary education, following Independence, India, of all countries, has the largest number of illiterates. The number is increasing and not decreasing, as the halting effort to eradicate adult illiteracy is out-paced by a rapid rise in population and also as the inadequately educated lapse back into illiteracy. Seventy out of every 100 adults are illiterate—but of course not without culture and robust common sense. Out of every 100 who enter primary schools nearly half do not go beyond class IV. Curiously enough the same phenomenon in varying degrees is met with in nearly all developing countries. It arises from a complex of educational and social causes not well understood, such as poor motivation of illiterate parents towards education of their children, poor quality of primary school teachers, and the apparently feeble links between formal education and the real needs of the community.

Thirty out of every thousand of the population in the relevant age group are in higher education. Seventy years ago the proportion was one in a thousand, and for women one in sixty thousand. But, if we consider only that part of the total enrolment which could be regarded as university-level work by international standards, then at present it is no more than 5 per 1,000 of the age group, *one of the lowest in the world.* The highest proportion is in the USA where more than a third of the age group goes in for higher education.

Over the past two decades student numbers in higher education have been increasing at a rate of nearly 10 per cent a year. Ten per cent yearly growth rate corresponds to a doubling period of 7 years. As it takes much more than 10 years to double the number of *competent* teachers, a certain slackness in standards becomes inevitable in a phase of rapid expansion.

Most of the expansion at the secondary school and university levels has been along traditional lines little related to the agricultural and industrial needs of the country. For instance, the enrolment in agriculture, forestry and veterinary science is only 3 per cent of the total enrolment in higher education. This is almost the same as the figure for the United Kingdom, though the role of agriculture in the national economies of the two countries is entirely different in size.

There are today 70 universities in the country with over 2,700 affiliated colleges. At the time of Independence the number of universities was only 20 with a little over 600 colleges. Twenty-four per cent of the colleges are maintained by the state, the rest are privately managed receiving grants from the state. Amongst the 70 universities, seven are almost entirely devoted to agriculture. These have been set up with the United States' assistance. Their conspicuous feature is the emphasis on field work; and the combination in one institution, of education, research and extension work.

Besides the universities there are 18 institutions of "university status". There are five Institutes of Technology—at Kharagpur (near Calcutta), Bombay, Kanpur, Delhi and Madras, established under an Act of Parliament. They are maintained by the Central Government. The Institutes were set up with sizable foreign assistance and provide a splendid example of international cooperation in technical education. The Institutes of Medical Sciences at Delhi and Chandigarh, as also the Indian Statistical Institute, Calcutta, are empowered to grant degrees under Acts of Parliament. Under a special provision of the University Grants Commission Act (1956) institutions of higher education can be 'deemed to be universities' for the purpose of the Act, empowered to grant degrees and eligible for UGC grants. Under this category are 10 institutions which include the Indian Institute of Science at Bangalore and the Indian Agricultural Research Institute, Delhi. The Vidyapith at Ahmedabad, founded by Mahatma Gandhi at the height of the non-cooperation movement in 1920, was given the status of a 'deemed university' in 1963. (Gandhiji was the Chancellor of the Vidyapith till his death in 1948.) A list of the universities with numbers of their affiliated colleges and of institutions deemed to be universities under the UGC Act is given at the end of the book.

Over 85 per cent of all enrolment in higher education is in the affiliated colleges, taught by teachers who have little say either in deciding course contents or in the conduct of examinations. This results in distortion of education with abnormal emphasis on covering the course. It makes teaching dull, to say the least.

In numbers of students the universities of Calcutta, Kerala, Madras, Panjab and Gujarat with their affiliated colleges including pre-university classes, rank as the first five. Calcutta University has about 160,000 students and Gujarat half as many. The University of Delhi with its more than 40 colleges (all in Delhi-New Delhi) has a total enrolment of about 40,000. The annual expenditure of the university and its colleges is about Rs. 4 crores (Rs. 6 crores including medicine and engineering). The average staff-student ratio in our universities and colleges is one to 17. If for a moment we think of the international spectrum of higher education, we stand near one end of it and at the other very far end are universities such as Oxbridge; Lomonosov University in Moscow; the University of California with about 131,000 students (with more than a dozen campuses all over the state, the largest with 27,000 students), a staff of 40,000 and an annual budget of 500 million dollars, and the Manhattan's Rockefeller University with less than 150 students, twice as many faculty members and a budget of 16 million dollars.

## III

A notable feature of Indian higher education since Independence has been the expansion of education for engineering and technology, largely through the efforts of the Central Government, so much so that the proportion of E and T students to the total enrolment has remained nearly constant in spite of a very rapid rise in the total population in higher education. Yet the available places fall short of the demand—*demand* as distinct from national *needs*. This represents a growing awareness and desire for study of science and science-based courses. It is also stimulated by the larger possibilities, on the whole, of employment open to graduates of science and technology. In the case of the I.I.T's the number admitted is a tenth of that qualifying at the common admission examination. As regards medical education, the rate of growth has been appreciably lower than for engineering. Demand for it is no less. Education for agriculture has undergone great expansion, but, unfortunately, agriculture is nearly at the bottom of students' choice for professional courses.

The distribution of enrolment in higher education according to subjects or faculties is shown in Table I. Diploma courses are not included.

More meaningful than total enrolments are numbers of degrees awarded. Table II gives the numbers of degrees for 1950 and 1966, also expressed as percentage of the corresponding age-groups. The numbers of the bachelor of science degrees rose from about 10,000 in 1950 to over 38,000 in 1965. The out-put of M.Sc.s for the same period increased from nearly 1,000 to over 7,000. The bachelor's degrees awarded in engineering and technology were six fold more in 1965 than in 1950. Over the same period for agriculture and veterinary science the rise was five and ten times respectively. The numbers of doctorate degrees in science and technology increased from about 100 in 1950 to 550 in 1965.

The average age at which students pass the bachelor's degree examination in science subjects is about 20 to 21 years. The master's degree is taken at the age of about 22 to 23 years. That is also about the age of students passing the bachelor's degree examina-

| Subject | 1950-51 Enrolment | 1950-51 Percentage of total | 1960-61 Enrolment | 1960-61 Percentage of total | 1966-67 Enrolment | 1966-67 Percentage of total |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Arts | 67.695 | 39.0 | 220,932 | 38.4 | 479,792 | 39.7 |
| Science | 36,194 | 20.8 | 133,761 | 23.2 | 310,344 | 25.7 |
| Commerce | 17,915 | 10.3 | 66,463 | 11.5 | 125,220 | 10.3 |
| Education | 4,135 | 2.4 | 19,005 | 3.3 | 38,241 | 3.2 |
| Engineering & technology | 12,094 | 7.0 | 45,389 | 7.9 | 95,422 | 7.9 |
| Medicine | 15,260 | 8.8 | 35,215 | 6.1 | 77,286 | 6.4 |
| Agriculture | 3,131 | 1.8 | 11,798 | 2.1 | 28,830 | 2.4 |
| Veterinary science | 1,101 | 0.6 | 5,385 | 0.9 | 6,553 | 0.5 |
| Law | 13,649 | 7.9 | 27,251 | 4.7 | 44,970 | 3.7 |
| Others | 2,522 | 1.4 | 10,893 | 1.9 | 2,915 | 0.2 |
| Total | 173,696 | 100.0 | 576,092 | 100.0 | 1,209,573 | 100.0 |

| Degree | Number of degrees awarded | | Percentage of the corresponding age group | | Average annual (compound) rate of growth (Percentage) |
|---|---|---|---|---|---|
| | 1949-50 | 1965-66 | 1949-50 | 1965-66 | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| B. Sc. .. .. .. | 9,628 | 43,808 | 0.14 | 0.45 | 9.9 |
| M.Sc. (excluding mathematics) | 851 | 6,186 | 0.013 | 0.074 | 13.2 |
| M.A./M.Sc. (mathematics) .. | 251 | 2,116 | 0.004 | 0.025 | 14.2 |
| Bachelor degree in technology (engineering and other subjects) .. .. | 1,660 | 9,823 | 0.026 | 0.12 | 11.8 |
| Bachelor degree in agriculture and veterinary science .. | 1,100 | 5,855 | 0.017 | 0.07 | 11.0 |
| Bachelor degree in medicine | 1,725 | 4,903 | 0.027 | 0.06 | 6.8 |
| Doctorate degree in science and technology .. .. | 100 | 722 | — | — | 13.2 |

tion in engineering and other professional courses. It should be noted that for a meaningful comparison of science and technology degrees in our country in terms of academic attainment, comprehension and total duration of study after the secondary school, it is the M.Sc. degree, that is, the *second* degree in science and mathematics which can be compared with the *first* degree (bachelor's degree) in engineering and technology, medicine or agriculture. The average age at which a doctorate degree is earned is likely to be about 26 years, but the variance in the distribution will be much more than for a bachelor's degree.

In 1965 the number of persons awarded *first* degrees in engineering and technology, and *second* degrees in science and mathematics, *expressed as a percentage of the relevant age group,* was about 0.2 per cent—it was only a fifth of this 15 years earlier. The corresponding figure for the USA is 4 per cent, 2.5 per cent for science and 1.5 for technology. For the USSR it is about 4 per cent, and for Japan 2 per cent, and in both cases almost the entire out-put is in technology. It may be observed that the current out-put of M.Sc.s in our country is less than the out-put in the USA of doctorates in science and technology. The number of doctorates in science and technology awarded in the USA rose from 400 in 1920 to 6,600 in 1960, and is expected to go beyond 13,000 by 1970. This implies a doubling in a period of about 10 years. The number of new Ph.D.s in physics alone is now nearly a thousand a year in the USA.

We may notice (Table I) that the proportion of all science students for bachelors and masters courses is about a fourth of the total enrolment. It is three times more than for engineering and technology. However, if we compare the out-put of engineers with that of M.Sc.s in science subjects, the engineers exceed the scientists.

The distribution according to faculties or subjects of the total enrolment in higher education in some of the industrialized countries is given in Table III.

It is worth reminding ourselves that in several of the scientifically advanced countries, specially in the UK, the *proportion* of science and technology students —but not their absolute number—is declining in the post-world-war II years. This recent swing away from science is a cause of serious concern to the developed countries. In England last year, despite some relaxation of admission standards, two thousand university places in science and technology remained unutilized. As against this the rush for courses in social sciences and humanities is rapidly increasing. A recent report by a panel of the UK Council for Scientific Policy, under the chairmanship of Dr. F. S. Dainton, Vice-Chancellor of Nottingham University, points out that if the present trend continues, the growth rate in the annual supply of scientists and technologists is unlikely to reach 5 per cent a year, whereas it should be 2 to 3 times larger to meet even the minimum requirements of expanding education and industry. Analysing reasons for the drift away from science at the sixth-

TABLE III

STUDENT ENROLMENT BY FACULTIES OR SUBJECTS

| *Name of the country* | *Total number* | *Percentage of the total* | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | *Arts** | *Social sciences* | *Science* | *Technology*** | *Medicine* | *Law* | *Others* |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Czechoslovakia (1958) | 75,306 | 27.9 | 10.1 | 2.1 | 45.8 | 11.6 | 2.4 | — |
| France (1958) | 226,173 | 27.7 | — | 35.1 | — | 18.2 | 16.5 | 2.5 |
| West Germany (1958) | 180,561 | 26.2 | 12.5 | 14.2 | 21.4 | 14.2 | 11.5 | — |
| Yugoslavia (1958) | 97,325 | 29.0 | 18.6 | 4.5 | 23.0 | 11.7 | 13.0 | — |
| United States (1951-53) | 1,021,100 | 34.5 | 24.5 | 9.8 | 14.9 | 2.7 | 3.7 | 9.9 |
| United Kingdom (1956-57) | 89,866 | 43.1 | (a) | 22.2 | 17.3 | 17.4 | (a) | — |
| (1964-65) | 113,114 | 31.3 | 13.0 | 25.6 | 16.8 | 13.3 | — | — |
| India (1966-67) | 1,209,573 | 42.9 | 10.3(b) | 25.7 | 10.8 | 6.4 | 3.7 | 0.2 |

Source: Joseph Ben-David: *Fundamental Research and the Universities.* OECD. 1968; UK—UGC *Annual Survey; UGC Annual Report* (for Indian figures).

* Includes humanities, education and fine arts. ** Includes engineering and agriculture.

(a) Included under Arts. (b) Commerce.

form stage,* the report assigns a major responsibility to failures in mathematics. It makes a vigorous plea for strengthening of mathematics teaching in schools, in-service training, and refresher courses for mathematics teachers. It strongly urges that all pupils in schools should study mathematics. It favours replacement of the present specialization characteristic of the English sixth-form education by a broad-based science-arts combination of three or four main subjects with one subject elected for specialization, in addition to mathematics.

In a sense we face a somewhat similar problem in our secondary schools. Mathematics is very much of a neglected subject. The course contents are perhaps no different from what they were at the beginning of the scientific revolution. Apart from this, there is at far too early an age a streaming of pupils into completely separate, impermeable, arts, science and other specialized channels. To force a pupil, or rather the parents, to choose irrevocably at the tender age of 13 or so his or her life's profession, whether science, medicine, arts or what not, is disastrous for the child

* The "sixth form" is a special feature of secondary education in England and Wales (but not Scotland). Students after six years of elementary school enter secondary school at the age of eleven plus. Some 80 per cent of them do not proceed beyond the fifth form (age 16 plus). The sixth form provides for those seeking university entry specialized options ('advanced' or A-level courses as these are called to distinguish from 'ordinary' or O-level). Students usually stay for two to three years in the sixth form.

and for society. It is a kind of 'child marriage'—a child getting wedded to a profession he hardly knows anything about—and it is no more defensible. It is something of an educational scandal. *The so-called 'integrated courses' in engineering, medicine, and also agriculture, introduced a few years ago in many of our universities suffer from all the disadvantages of putting students at too early an age into 'water-tight' streams of specialized education. Many swim along the streams, but many, far too many, sink.* An additional draw-back is that integrated courses substantially raise the total cost of professional education. In fact instead of an 'integrated course' which includes a pre-university part, it would be a distinct advantage in some ways if entry to engineering and also medical colleges took place after a *first degree* in science (three years following secondary school). This would lower the burden on the professional colleges with an accompanying reduction in cost. It would be a good thing if in the near future something like half of the admissions to engineering and medical courses could be of students who have taken their first degrees in science. The whole question needs careful examination including the possibility and desirability of awarding a B.Sc. degree as something like part I of the present pattern of degree courses in engineering, medicine and agriculture.

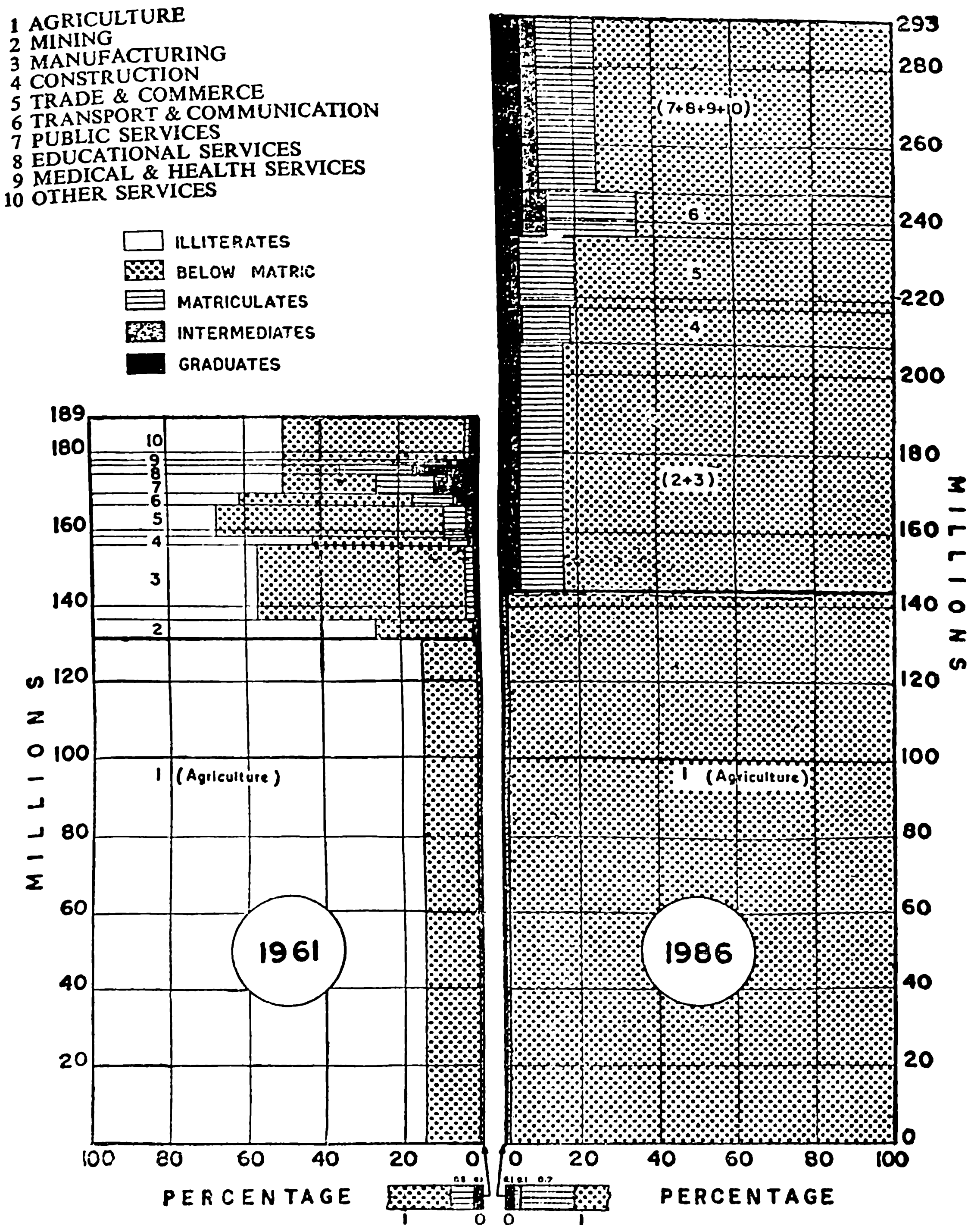
CHAPTER 2

# RECONSTRUCTION OF EDUCATION

## I

THE MODERN world is science and technology based, and this, more than anything else, has made education, as never before, a most important element in the life and progress of a nation. Economic development, welfare and security are all closely dependent on the extent and quality of education. Knowledge and survival now literally go together. This, in a broad sense, is the central theme of the report of the Education Commission (1964-66).

The Education Commission's report urges that by 1986 *illiteracy should be nearly completely eradicated as a step vital to industrialisation and development of agriculture.* The universities can make, and ought to, an important contribution towards the attainment of this major national goal. The report has laid special stress on pursuit of quality and excellence in education at all levels and in all sectors, whether it be the education of a scholar or of an artisan, of a scientist or a farmer. It has recommended a several-fold expansion of enrolment over the next two decades in agriculture and engineering and in postgraduate courses in science subjects. It is illuminating to compare the


1 AGRICULTURE
2 MINING
3 MANUFACTURING
4 CONSTRUCTION
5 TRADE & COMMERCE
6 TRANSPORT & COMMUNICATION
7 PUBLIC SERVICES
8 EDUCATIONAL SERVICES
9 MEDICAL & HEALTH SERVICES
10 OTHER SERVICES
ILLITERATES
BELOW MATRIC
MATRICULATES
INTERMEDIATES
GRADUATES
1961
1986
1 (Agriculture)
(2+3)
(7+8+9+10)
MILLIONS
PERCENTAGE
PERCENTAGE
MILLIONS
189
293

educational picture as it is today with what it should be, according to the Education Commission, two decades from now.

Table IV gives the stock of educated manpower based on the 1961 census.

The 1986 picture is inevitably uncertain and vague in many essential respects, but its basic outlines cannot be ignored. On the assumption of about 6 per cent rate of growth a year in the national economy—admittedly a very optimistic assumption—the Commission's projections for professional manpower are indicated in Table V (see also the diagram facing this page).

The Commission has underscored the extreme importance of introducing in the educational policy and system some built-in element of flexibility so that it can adjust continually to changing circumstances. In the rapidly changing world of today, one thing is certain: yesterday's educational system will not meet today's, and even less so, the needs of tomorrow.

The Commission has emphasized that the educational reconstruction should be based on:

Introduction of work experience and social service as an integral part of general education at more or less all levels. Work experience can take various forms, the essential element being productive activity involving manual skill, on farms, in workshops and factories or organized in schools and colleges;

· Stress on moral education and inculcation of a sense of social responsibility;

TABLE IV

STOCK OF EDUCATED MANPOWER IN INDIA 1961

[*Total Population* = 439.2 *Million*]

| *Industry* | *Below Matric* | *Matri-culates* | *Inter-mediates* | *Gradu-ates* | *workers Total*† |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| | | | | (*Figures in thousands*) | |
| 1. Agriculture .. | 130,648 | 381 | 46 | 67 | 131,142 |
| 2. Mining, etc. .. | 5,143 | 68 | 5 | 6 | 5,222 |
| 3. Manufacturing .. | 19,377 | 436 | 89 | 104 | 20,006 |
| 4. Construction .. .. | 1,911 | 99 | 30 | 19 | 2,059 |
| 5. Trade and commerce .. | 7,009 | 452 | 101 | 92 | 7,654 |
| 6. Transport and communi-cations .. .. | 2,528 | 318 | 80 | 93 | 3,019 |
| 7. Services (other) .. | 16,895 | 1,509 | 405 | 765 | 19,574 |
| Public services .. | 3,711 | 722 | 245 | 296 | 4,974 |
| Educational services .. | 1,584 | 467 | 103 | 289 | 2,443 |
| Medical and health ser-vices .. .. | 765 | 124 | 27 | 48 | 964 |
| Religious and welfare services .. .. | 1,082 | 38 | 6 | 26 | 1,152 |
| Legal services .. | 119 | 39 | 1 | 60 | 219 |

| | | | | | |
|---|---|---|---|---|---|
| Business, trade, labour association and community services .. | 191 | 37 | 6 | 7 | 241 |
| Recreation, personal and other services .. | 9,443 | 81 | 18 | 37 | 9,579 |
| Total† .. | 183,511 | 3,262 | 756 | 1,147 | 188,676 |
| | | | | | *(Percentages)* |
| 1. Agriculture .. | 99.6 | 0.3 | — | 0.1 | 100.0 |
| 2. Mining, etc. .. | 98.5 | 1.3 | 0.1 | 0.1 | 100.0 |
| 3. Manufacturing .. | 96.9 | 2.2 | 0.4 | 0.5 | 100.0 |
| 4. Construction .. .. | 92.8 | 4.8 | 1.5 | 0.9 | 100.0 |
| 5. Trade and commerce .. | 91.6 | 5.9 | 1.3 | 1.2 | 100.0 |
| 6. Transport and communications .. .. | 83.7 | 10.5 | 2.7 | 3.1 | 100.0 |
| 7. Services (other) .. | 86.3 | 7.7 | 2.1 | 3.9 | 100.0 |
| Total .. | 97.3 | 1.7 | 0.4 | 0.6 | 100.0 |

† The figures have been rounded. Hence a slight difference in totals.

Source: *Report of the Education Commission* (1964-66), p. 93.

*Notice that* 97.3 *per cent of the total working population has educational qualification 'below matric', and out of this some* 80 *per cent is illiterate.*

TABLE V (a)

## ESTIMATED REQUIREMENT OF MATRICULATES AND ABOVE BY INDUSTRY IN INDIA 1960-61 TO 1985-86

| *Industry* | 1960-61 (*Actual*) | | | 1975-76 | | | 1985-86 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Matric* | *Inter-mediate* | *Gra-duate* | *Matric* | *Inter-mediate* | *Gra-duate* | *Matric* | *Inter-mediate* | *Gra-duate* |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | | | | | | | (*Figures in Thousands*) | | |
| 1. Agriculture | 381 | 46 | 67 | 681 | 83 | 120 | 984 | 120 | 174 |
| 2. Mining | 67 | 5 | 6 | 282 | 20 | 27 | 632 | 45 | 61 |
| 3. Manufacturing | 436 | 90 | 103 | 2,880 | 584 | 707 | 6,681 | 1,355 | 1,642 |
| 4. Construction | 99 | 30 | 19 | 503 | 150 | 97 | 1,131 | 337 | 218 |
| 5. Trade and Commerce | 452 | 100 | 92 | 1,181 | 262 | 240 | 2,565 | 570 | 522 |
| 6. Transport and Communications | 318 | 80 | 94 | 1,200 | 301 | 354 | 2,608 | 654 | 769 |
| 7. Services (Other) | 1,509 | 404 | 765 | 4,147 | 1,040 | 1,754 | 6,677 | 1,653 | 3,156 |
| Public Services | 723 | 245 | 296 | 1,299 | 441 | 533 | 1,923 | 652 | 789 |
| Educational Services | 467 | 102 | 290 | 2,112 | 463 | 877 | 3,041 | 668 | 1,728 |
| Medical and Health Services | 124 | 27 | 47 | 379 | 82 | 175 | 1,139 | 248 | 360 |
| Other Services | 195 | 30 | 132 | 357 | 54 | 169 | 574 | 85 | 279 |
| Total | 3,262 | 755 | 1,146 | 10,874 | 2,440 | 3,299 | 21,278 | 4,734 | 6,542 |

Source—*Education Commission Report (1964-66), p. 94.*

TABLE V (b)

OUT-TURN, INTAKE AND ENROLMENT OF SPECIALISTS IN INDIA 1960-61 TO 1985-86

| Speciality | *Out-turn* | | | *Intake* | | | *Enrolment* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1960-61 | 1975-76 | 1985-86 | 1960-61 | 1975-76 | 1985-86 | 1960-61 | 1975-76 | 1985-86 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | | (*Figures in Thousands*) | | |
| Engineering | | | | | | | | | |
| First Degree | 7 | 43 | 92 | 14 | 65 | 129 | 40 | 229 | 473 |
| Diploma | 10 | 67 | 139 | 26 | 110 | 224 | 46 | 297 | 573 |
| Agriculture | | | | | | | | | |
| First Degree | 3 | 13 | 42 | 5 | 23 | 64 | 12 | 39 | 115 |
| Medicine | | | | | | | | | |
| First Degree | 5 | 16 | 34 | 6 | 23 | 43 | 35 | 125 | 245 |
| Teachers' Training | | | | | | | | | |
| Graduates | 18 | 73 | 115 | 20 | 81 | 128 | 22 | 88 | 139 |
| Non-graduates | 89 | 211 | 169 | 116 | 230 | 183 | 148 | 453 | 402 |

Source—*Education Commission Report* (1964-66), p. 304.

Schools should recognize their responsibility in facilitating the transition of youth from the world of school to the world of work and life;

Vocationalization of secondary education;

Strengthening of the "centres of advanced study" and setting up of 'clusters' of centres;

Special emphasis on the training and quality of teachers for schools;

Education for agriculture, and research in agriculture and allied sciences should be given a high priority in the scheme of educational reconstruction; and

Development of quality and pace-setting institutions at all stages of education.

Autonomy to outstanding colleges in the framing of courses and evaluation of students' performance.

Educational reconstruction needs ideas, but these generally are not in short supply (with all respect to contrary views held at the top level sometimes). What is usually missing is determination, identification of priorities, concentration of effort and provision of adequate resources exceeding a certain critical size, and not unoften even a meagre appreciation of the many arduous steps and difficulties in transforming 'ideas' into action at the ground level and actual 'achievements'. And educational reconstruction on a massive scale always takes time. It cannot be hurried beyond a certain point.

A number of statements which are currently made regarding what needs to be done to improve education have been repeated before in countless reports. Sometimes these are expressed in words as if they were written today. Good intentions have a long ancestry. Their transformation into action is a slow and often a very frustrating process. A radical reform of education would mean a radical change in every class room, every teacher and every student, and inevitably is a time-consuming enterprise even under the best of conditions, but nothing is likely to happen, if the will, leadership and resources are lacking. The Government of India issued in March 1904 a Resolution on Indian Educational Policy, followed by another Resolution in February 1913. These Resolutions declare, and I apologize for the length of the excerpts:

> "The wider extension of education in India is chiefly a matter of increased expenditure; and any material improvement of quality is largely dependent upon the same condition. (1904, p. 6).
>
> * * *
>
> "The defects of educational systems in India are well known and need not be re-stated. They have been largely due to want of funds. Of late years there has been real progress in removing them. In the last decade the total expenditure from all sources on education has risen from 4 crores to nearly 7½ crores. (1913, p. 2).
>
> * * *
>
> "The question of religious and moral instruction was discussed at the local conference held in Bombay and subsequently at the imperial conference

held in Allahabad in February 1911....

* * *

"For the present the Government of India must be content to watch experiments and keep the matter prominently in view. (pp. 4-5).

* * *

"Provision should be made for higher studies and research in India, so that Indian students may have every facility for higher work without having to go abroad. (p. 8).

* * *

"[In primary schools] Trained teachers should receive not less than Rs. 12 per month. . . . No teacher should be called on to instruct more than 50 pupils, preferably the number should be 30 or 40. (p. 12).

* * *

"Secondary education of one grade or another is the basis of all professional or industrial training in India. The inferior output of secondary schools invades colleges and technical institutions and hinders the development of higher education. At the Allahabad conference the directors of public instruction unanimously regarded the reform of secondary English schools as the most urgent of educational problems. (p. 16).

* * *

"No branch of education at present evokes greater public interest than technical and industrial instruction. Considerable progress has been made since 1904. Existing educational institutions have been overhauled and equipped for new courses. (p. 24).

* * *

"Few reforms are more urgently needed than the extension and improvement of the training of teachers, for both primary and secondary schools in all subjects including, in the case of the latter schools, science and oriental studies. The object must steadily be kept in view that eventually under modern systems of education no teacher should be allowed to teach without a certificate that he is qualified to do so. (p. 37).

* * *

"The Government of India have for some time had under consideration the improvement of the pay and prospects of the educational services, Indian, provincial and subordinate. . . . The Government of India recognise that improvement in the position of all the educational services is required, so as to attract first class men in increasing numbers, and while leaving questions of reorganisation for the consideration of the commission, are considering minor proposals for the improvement of the position of these services. They attach the greatest importance to provision for the old age of teachers, either by pension or provident fund. . . . It is not possible to have a healthy moral atmosphere in any school, primary or secondary, or at any college when the teacher is discontented and anxious about the future." (pp. 39-40).

* * *

Referring to Government's policy on primary education, Indian Educational Policy Resolution of 1904 observed:

"The Government of India fully accept the proposition that the active extension of primary education is one of the most important duties of the State....In the 1901 census it was found that only one in ten of the male population, and only seven in a thousand of the female population were literate. ....[Out of the relevant age group] a little more than one-sixth are actually receiving primary education. If the statistics are arranged by provinces, it appears that out of a hundred boys of an age to go to school, the number attending primary schools of some kind ranges from between eight and nine in the Punjab and the United Provinces, to twenty-two and twenty-three in Bombay and Bengal." (pp. 15-16).

The 1913 Resolution affirmed:

"The propositions that illiteracy must be broken down and that primary education has, in the present circumstances of India, a predominant claim upon the public funds, represent accepted policy no longer open to discussion. For financial and administrative reasons of decisive weight the Government of

India have refused to recognise the principle of compulsory education; but they desire the widest possible extension of primary education on a voluntary basis." (p. 9).

## II

It is commonplace that many of the *current* ideas and proposals for educational reform, including plea for innovation, are not new, and go back to many decades, if not earlier. Several of the recommendations to reform education are no more than an expression of outworn platitudes and slogans. Teachers and educationists have often tended to continue unquestioned the practices and errors of their predecessors. This lends a sanctity to what is old. The significance of the current educational ferment witnessed in many countries is the questioning of old dogmas, practices and prejudices. The spirit of scientific questioning, subjecting everything to observation and experiment, is at last invading educational practices and organizations. But any real scientific understanding of education—science of education as it were—lies very much in the future. Even, to mention the most commonplace things, we do not quite know what is the optimum size of a school or a college class. What is the significance, in terms of 'educational efficiency', of staff-student ratio? Is there a maximum size to a university (as also a minimum size) beyond which it loses its basic character and integrity? Examinations, even under the best of conditions, are afflicted by a very large element of uncertainty and error, and yet their role in determining the future of youth is crucial. There is too much glib talk about deciding student-admissions and teacher-recruitments on "merit", and yet how deplorably inadequate and unreliable are the "instruments" for assessing merit—not to speak of the difficulty of defining it. We preach, and rightly, of the virtues of objectivity and scientific attitude, and yet we would be hard pressed to justify the rationale or validity of most of the current educational procedures and practices. Some are frankly fantastic and even fraudulent (not deliberately). The distressingly wide gap between proclamations and practices, between assertions and expectations on the one hand and the reality of the situation on the other, imposes a strain on the educational system much aggravated because of widespread lessening of respect for tradition, age and authority, and a phenomenal expansion of the educational system itself. There is no easy or immediate answer to many of these problems. They afflict nearly all educational systems in all countries, advanced and developing. We shall, of course, if we persevere, achieve some day a "science of education", but great effort and research over a very long period would be necessary.

## III

A perennial and formidable difficulty facing educational reconstruction is lack of resources. The Education

Commission has recommended that the total expenditure on education which is at present about 3 per cent of the gross national product should go up to 6 per cent by 1986. This can only come about if there is an acute awareness at the highest political level and amongst people generally of the vital role of education in every sphere of national life and progress. The major issues of educational policy go beyond education; and several of them are intensely sociological and political. This is often not appreciated fully.

Without some minimum and inescapable provision of basic tools of education, books being the most important, plans of educational development can be little more than wishful thinking. These could even be dangerous. It cannot be gainsaid that expenditure on higher education has to be much more than what we are spending currently. The increase in expenditure has to take into account not only the rapidly rising enrolment but also the greater cost of books, equipment and other essential facilities. An important factor in the rising cost of education is the knowledge explosion itself. The present stage of development of education is critical for the country's progress, and it is therefore important that over the next five to ten years the yearly growth of expenditure on higher education should be at least 20 per cent a year.

In 1962-63, the total development grant to the University Grants Commission was Rs. 7.9 crores. The grant for 1966-67 was Rs. 11.3 crores which, expressed in *rupees per student per year,* is slightly less than the

1962-63 grant: in 'purchasing power' as regards laboratory equipment, books, and buildings, it is no more than half of what it was five years ago. It is disconcerting to find that the *total* per capita expenditure on higher education is no more than *half* of the annual grant for books alone to every student in the UK. We spend some Rs. 500 a student a year, in higher education. In the UK, the recurring cost of higher education, including maintenance grant to students, is nearly £1,000 a student a year. This is 40 times larger than the Indian figure. The cost of secondary school education in the UK is about £150, and of primary education about half of it, a pupil a year. The corresponding Indian figures are about Rs. 107 and Rs. 30 respectively.

At Rs. 1,000 *capital* expenditure a student, it will cost Rs. 20 crores a year for the additional places we have to provide every year in our universities and colleges. If our university and college students were paid a book grant as, say, all students in the UK receive, it would cost some Rs. 100 crores a year.

As an instance of the frightening 'educational-expenditure gap' between 'rich' and 'poor' countries, we may notice that in India today the yearly expenditure on all levels of education and research is about Rs. 12 (less than two dollars) *per capita*. The corresponding figure for the USA is $300 per person a year. By the end of the century the Indian figure may go up to $20 whereas the USA figure will certainly rise to $1,000 per person a year. The frightening gap would be wider still. It will be wrong, and in any case of no avail, to draw a pessimistic conclusion from this picture. The real lesson to draw, and to act upon with firm conviction is that education has never been more important in the life of the nation than it is today. We cannot afford to be hesitant or go slow in educational improvement and to make it science-based. On it, more than anything else, depends national development, welfare and security. Industrial growth and educational development are closely coupled together: The one feeds and accelerates the other.

Education, as repeatedly stressed here, is essential to the progress of the national economy. But education needs resources, and it cannot progress without an improvement in the economy as that alone can, in the end, make possible increased resources for education. It is becoming increasingly clear that education on a large scale, and with any pretence to quality, can be supported only if education itself makes a direct contribution to national productivity. There is a symbiotic dependence between education and national productivity.

Gandhiji wrote in 1947, referring to his scheme of basic education through handicrafts, that it was not dependent on money, and that the running expenses should come from the educational process itself. He said: "Whatever the criticisms may be, I know that the only education is that which is self-supporting." This is perhaps an extreme position, but it serves to underline the importance of making education workoriented and related to the needs of agriculture and industry, and to the economic and social goals of the country.

In contemplating the various economic, educational, technological, management, and what not, 'gaps' between the developed and developing countries, a word of caution is necessary. The big 'gaps', and predictions of still bigger 'gaps' in the future, represent a somewhat mechanical projection of statistical trends, and current 'fashion' in economic thinking and planning in a highly complex field of social and economic behaviour of which there is very little real understanding. The 'gaps' ignore differences in value systems of different societies; but, above all, they do not take into account, because it cannot be quantified, firstly the limitless potentialities of a determined people inspired by great ideals and tuned to great and enduring goals; and secondly the unbounded capabilities of modern science and technology. All great enterprises are ultimately an expression of the spirit and resolution of the people.

## IV

The modern world is characterized by an extremely rapid pace of change. In some essential ways the shape of the world changes beyond recognition within the life time of a generation. Such a rapid rate of change is a new thing in man's history. So rapid is the growth of knowledge that a graduate is nearly obsolescent on the day of his graduation. A degree, like a passport, would need to be revalidated every five or ten years. A research paper, if a good one, is often out-of-date on the day of its publication. An expensive research tool is out of fashion by the time it is procured. A sophisticated military weapon is out of date if it works.

All countries make a contribution to new knowledge; but obviously the size of the contribution varies widely, as it depends essentially upon the level of a country's economy and the degree of industrialization. The largest contribution, more than half of the world-total, comes from the United States (the USA will be spending this year $23,800 million on research and development which is equivalent to some Rs. 18,000 crores). The second largest contribution is of the USSR. Even an industrially advanced country like the UK which is currently spending £1,000 million a year on R & D work cannot contribute more than a fraction, perhaps less than 10 per cent, of the world flow of science and technology. The current Indian contribution is likely to be less than even one per cent—we are late starters in science and technology. Most importantly, we need to be in close touch with the world flow of rapidly expanding knowledge because of its relevance to our industrial growth, and of its direct impact on the quality and direction of our research effort in universities and elsewhere. All this has an important bearing on the language policy in higher education.

CHAPTER 3

# MEDIUM OF EDUCATION

## I

IN THE past, because of compulsion of historical events, English has generally been the core and heart of the system of education in the country. This produced a certain imbalance especially in higher education, and it tended to place too much emphasis on *form* as distinguished from *substance,* on the container rather than the contents. This somewhat out-of-proportion emphasis on English had its cramping influence on the style and content of Indian thought. Creativity and originality suffered. There was hardly any awareness especially amongst scientists and technologists of the country's great cultural heritage, philosophy and literature. Sir Eric Ashby recently observed that the British can be justly proud of many legacies of British rule in India, but the system of education which they established in the country is not one of them. What we need today is to inject, as I said earlier, a certain 'Indianness' in our education. We need to give to our languages a prominent place in education at all levels. This should not mean denying ourselves the use of English as a very powerful instrument of education, development and international communication. Knowledge of the English language has brought to the country distinct benefits. These should not be thrown away especially at this critical phase in development, but exploited fully to our advantage. The need and desirability of change in the medium of education from English to regional languages is beyond question. But the change-over should be used as a means to raise the quality of education, and to make it more suited to our needs and goals. As the Education Commission pointed out, the success of the change in the medium of education should be judged in terms of the contribution it makes to raising the quality of education.

So rapid is the growth of new knowledge that most books in science and technology have a useful life of only five years or so. In science and technology more than a million original papers and some fifty thousand books, and about the same number of reports, are at present published every year. It is out of question that we could contemplate translating into our own languages anything more than an extremely small fraction of the out-put of current knowledge. The only possible way of keeping in touch with current knowledge is to learn the world library languages, the most important of which is English and next Russian. Any other course is likely to be not only academically inefficient, but also prohibitively, impossibly, expensive.

A large proportion, more than half, of children over the next decade are likely to receive no more than an effective primary education of four to five years' duration. When today hundreds of millions in the country are illiterate in their own mother tongue—and this desperate situation is not likely to improve for the next decade or two—the real need is to concentrate all our effort on elimination of illiteracy and the dismally high rate of drop-out in the first years of primary education. A link language for the country is of the utmost importance, but so far as the bulk of the population is concerned, a link language has little relevance till the massive illiteracy that prevails in the country has been eradicated.

Addressing the vice-chancellors' conference in 1961 Jawaharlal Nehru declared: "We are carrying on and we should be carrying on a campaign of war, educationally I mean: war against illiteracy is there, but much more so a war in which people's minds, thoughts and feelings etc., are concerned. In this war, the vice-chancellors are like 'commanders' and an enormous responsibility rests upon them. And I am sure, I repeat, that the material in India is good, broadly speaking, and if you deal with it competently, we will get good results." And Panditji after referring to the desirability of a change over to the regional languages as medium of education at the university level and the need to ensure adequate knowledge of English and Hindi, observed: "Now, even if you agree with the principles that I have suggested, yet a great deal remains to be done in the manner of doing it, that more than others these things should be decided by educationists, I think, and not by political decisions. Broad principles being laid down should be worked out by educationists of universities themselves. But I hope that in doing so they will always keep in mind the necessity of not isolating themselves from other universities."

## II

School education is, as it ought to be, imparted in the regional languages. But one's school education will be *fundamentally incomplete* if one has not learnt at school the common or *link language* of the country (or whatever may be the nearest approximation to it), and also a *foreign language* of world standing to serve as a 'window' to the outside world. In the latter respect we have a distinct advantage as regards the English language which would be fully exploited in our national interest. Knowledge of English will facilitate use of the international vocabulary of scientific terms. I shall say more about this later. The Education Commission has recommended that every effort be made to ensure that nearly all completing secondary education learn English as well as Hindi for a *minimum* period of three to four years.*

* It is interesting to recall the observations of L. Hogben (*Essential World English*, published by W. W. Norton & Co. Inc., 555th Ave., New York N.Y. 10003, 1962, p. 23): "In the case of the Ogden's Basic English about 1,000 words may suffice. From another standpoint, that is of technology and of writers like James Joyce, the half a million words of the lexicologists are too few; for the occidentalizing oriental, the 10,000 words of the man in the street are too many. To

(It is interesting to recall that in the UK an attempt extending over a couple of years to get the 45 universities to agree that university entrants should have passed a sixth-form test has not succeeded. More than half of the universities do not insist on a pass in English as a requirement for admission—probably many students will fail to get entry if this was not so).

At the undergraduate stage, education should be largely through the medium of the regional language, and in many universities it is so in the arts subjects. However, a part of the work may be done in English so that students acquire a reasonable facility in its use as a *library language*. Some study of Indian literature in our languages could profitably be a requirement for all students. The process of change-over to regional languages may be carried out in five to ten years depending on the degree of preparatory work already done: some states, and some professional subjects, may need more time than others.

At the postgraduate and research level the question of medium of education loses its usual meaning. Whatever may be the medium of classroom communication,

read an ordinary issue of the Times newspaper with profit, a vocabulary of over 50,000 words is implied. Actually many readers get along with 25,000 or less. A conscientious foreigner is apt to have to memorise about 15,000 by way of insurance, before he can understand a particular 1,000—even if he will never have occasion to speak or write English himself. Let us suppose that this requires from two to four years' hard labour; the problem of an Auxiliary Language is to reduce his labour to two weeks—or, at most, two months."

students will have to depend largely on books and journals in English (and to an increasing extent on Russian). At the postgraduate level in several subjects the *total* demand for most of the foreign books is not likely to exceed a few hundred copies. Translations in regional languages will be prohibitively expensive.

Special provision, and incentive, should be provided for those going into research and teaching in institutions of higher education, who acquire good proficiency not only in English but also in one more world library language. We cannot afford to ignore what is becoming an educational imperative in the world of science and technology.

Further, it would be of great value if selected students of one university are encouraged to do a part of their course at another university. Mobility of teachers and students is essential for development of a healthy and vigorous corporate intellectual life in the country.

In the case of all-India institutions which admit in considerable numbers students from all over the country, the Education Commission has observed that these should continue the use of English as the medium of education. The Commission has further said,* "A change-over to Hindi may be considered in due course provided two conditions are fulfilled. The first is the effective development of Hindi as a medium of education at this level. This is a matter which can be left to the UGC and the institutions concerned to decide. The second is the equally important political consider-

* Page 14 (Report).

ation that, in such a change-over, the chances of students from non-Hindi areas should not be adversely affected, and that the proposal should have the support of the non-Hindi states. The latter principle has been already conceded by the Goevrnment of India even in the larger sphere of the use of Hindi in official communications between the states and the centre."

We are educating the youth for the 20th and the 21st century. They will be citizens of a world which is rapidly becoming a 'one world', and before the close of the century, man may succeed in contacting intelligent life outside the earth. In this world of extremely rapid change and immense possibilities, a person can hardly call himself educated, if he does not know at least one world library language. The educational trend everywhere is for foreign language getting an important place in the school curriculum. Nearly all Russian children are now learning English. In all likelihood, soon, in a few years, there will be more English-knowing people in the USSR than in India. Also Russian is finding an increasing place in schools in the USA and UK. In this situation not only more of our youth, than ever before, should learn English, but a good proportion of them should also learn Russian and other important foreign languages.

It should be our national goal that at not too distant a future Hindi, and may be also other Indian languages, attain an international standing and count amongst the great library languages of the world. Nothing less can satisfy a country of our size, native talent and unique heritage. However, the way to that goal is hard work and dedication, and to raise the level of the national economy, enlarge the volume of our original contribution to world science and technology.

At the postgraduate and research stage it is important to have a measure of coordination between courses provided by one university and another. We cannot reach high peaks of excellence in all subjects in all universities. In its very nature a university cannot aim to be self-sufficient. At the postgraduate and research level it has to concentrate its resources on a small number of carefully selected subjects, so that excellence comparable to international standards can be achieved. The peaks of excellence of one university will supplement the peaks of another. This implies that admissions will have to be made *not* on a local but on a much broader basis—inter-state generally, and in the case of top university departments on an all-India basis. This would not entail any difficulty, if a sensible view is taken of the medium of education. Medium of education is not a dogma but an instrument for national integration and educational progress.

The language problem is multi-dimensional. What applies to one sector of education and to a relatively advanced region, may not apply to another region, or to another sector of education. A rigid plan which does not take into account the varying needs and circumstances of different areas of the country, and different fields of study, may defeat the very purpose we have in view. Detailed thought and careful preparation are essential for success. There are parts of the country which have a great potential for industrial development but lack professional manpower. Their immediate need over the next few years is strengthening and expansion of facilities of technical education. An already difficult situation is likely to be further aggravated, if recruitment of teachers is limited to only those with proficiency in the local language. In such a situation, paradoxical though it may seem, a quick and effective way of change-over to the regional language would be to strengthen education in the English medium as an interim programme.

It is an essential function of universities to cut across linguistic and regional barriers that most unfortunately exist in the country. It is an obligation of universities that they should think, and function, not in local terms only, but also in inter-state terms, and in fact in terms of the country as a whole. In organizing our pattern of higher education, this aspect needs to be explicitly stressed. Universities belong to the local community, but even more to the whole country, and to a measure belong to the international world of learning.

The most scarce, but the most precious, resource of a university is its exceptionally gifted teacher or rather teacher-researcher. A great teacher—a great university—belongs to the entire country and not only to his city, or his state. The educational system must be such as would encourage the most gifted pupils wherever they are, and the most gifted teachers, wherever they are, to come together. If an educational system and organization is such as to discourage or hinder in any way this kind of creative and fertile 'meeting together', then the country is failing to make good use of its most valuable asset for advancement and national development.

## III

In view of the importance and interest of the subject let me quote from the *Statement Adopted by the Conference of Vice-Chancellors* in September 1967:

"The conference considered the question of place of regional languages in higher education and *affirmed its conviction that energetic development of Indian languages and literature is vital for the promotion of higher education and of national culture generally.* The subject of change-over of medium of education to regional languages, the conference stressed, could only be considered as an integral part of a deliberate policy and plan with a view to improving the quality of education, to promoting creativity and national integration and bringing education closer to the needs and aspirations of the community.

*"The conference was in general agreement with the recommendations of the Education Commission with regard to change-over in the medium of education.* But, higher education is a closely integrated system, and any modification such as a change in the medium of education, would have a direct effect on other parts of the system. The conference recognised that the

change-over in the medium of education *if properly carried out* would be a major step towards improvement of higher education and towards strengthening of its roots in our soil. The programme should be pursued in a sustained and systematic manner. The conference endorsed the statement of the Education Minister that 'the programme of change-over to regional languages as media of education will have to vary from university to university, from subject to subject, and even from institution to institution, in the same university. The criteria in each case should be that the change-over helps, at every stage, to raise standards.' The manner and speed of the change-over should be left to the university system. This was in accordance with the recommendation of the Education Commission and was reiterated by the Education Minister in his address to the conference.

"The conference felt that at the undergraduate stage the change-over in the medium of education to regional languages could be carried through in about five to ten years, depending on the degree of preparatory work already done, on the nature of the subject and other relevant factors. In the programme of change-over the importance of English should be fully recognised and adequate arrangements for its study made at the undergraduate level.

"At the postgraduate and research level the question of 'medium of education' loses its usual meaning, as students will have to depend, for instance, in science, medicine and technology, on books and journals in

English and other important world languages (because of the universality and rapid growth of knowledge).

"In the case of all-India institutions, the present arrangements regarding the medium of education may continue as recommended by the Education Commission. In the case of large cities with multi-lingual population, the medium of education may continue to be English in addition to the regional languages which the university would provide."

It may, perhaps, help to view the language problem in a proper perspective if we see it in the light of the lesson of biological evolution. The continuity and onward progress of evolution depends, *firstly,* upon the stability of organisms (their genes) which provide transmission of hereditary characteristics, unchanged from one generation to the next and, *secondly,* upon the organisms possessing a reserve of plasticity (variability, arising from gene mutations) to adjust to the environment when it changes with passage of time, and to exploit the changed situation to advantage.

The process of biological transformation runs in three successive stages called *clodogenesis, anagenesis* and *stasigenesis*. The first means evolution by branching out from one successful type of organism: Branching gives rise to variety and divergence essential to meet the challenge when the environment changes. Anagenesis implies further development of the different branches, and the third stage is reached when there is no possibility of further improvement in the prevailing environment. If the environment undergoes a radical change, some of the branches of the then successful type can manage to bring about some basic improvement in organization to achieve evolutionary success in the new environment, and undergo again the three stages mentioned above, and later the process further repeats itself throwing out new successful types of organisms. Evolution of a higher species from a lower one proceeds through such a series of steps. Let us now revert to the language problem.

The Indian civilization is a living and a growing thing, unlike many a great ancient civilization now existing only in the pages of history books. A fortunate characteristic of Indian culture is its inner coherence and its diversity. The many regional languages that we have today are a part of the process of psycho-social evolution and have probably contributed significantly to the vitality and survival of the Indian civilization.

In the pre-scientific and industrial environment where mobility was severely limited and culture largely local, a large number of languages branched out, as it were, from some parent languages. The regional cultures reached a stage of 'stasigenesis' when little further improvement was possible. We are now faced with a totally new environmental situation dominated by science and technology. The old role of regional languages cannot continue in the changed situation without throwing into jeopardy the entire process of the country's progress and development. A large country of the size of India has potentialities of development denied to small countries. There are several scientific and technical goals which are beyond the capacities of countries with small populations and natural resources. The immense natural advantages we have in terms of size, resources and heritage can only be availed of and exploited only if we get out of the outmoded framework suited to the pre-scientific age. To continue with the old framework in the atomic age would impose a dead-load which would imperil all future progress. We certainly need regional languages and to develop them further, but even more so we need to give them a new strength and a new purpose by making them part of a framework in which an important role would be that of the 'world languages' and of an internal 'link' language. The language problem has to be seen as part of a large sociological and evolutionary problem. Passions and prejudices should not be allowed to blind our views and corrupt action. In all such discussions the guiding consideration should be the interests of the millions of our countrymen in great poverty and distress. Any solution which does not help to improve their lot is meaningless. And if on the contrary, it adds to their burden and, by diverting scarce resources to trivial purposes, adds to their misery, it is folly and much worse. Gandhiji said that for him the touchstone for judging the merit of a proposal or an action was the benefit, how so little, it would bring to the lowliest man in the country. And for education itself there can be no more meaningful and challenging touchstone than the one of Gandhiji.

CHAPTER 4

# SCIENTIFIC AND TECHNICAL TERMINOLOGY

## I

THE BASIS of scientific thinking and communication is the use of a precisely defined terminology more or less special to each branch of science. In the case of a *scienitfic term,* the meaning or content given to it is, by definition, unambiguously specified. The meaning given to a term remains the same though the words employed may be different in different languages, e.g. 'velocity' in English is 'geschwindigkeit' in German, 'vitasse' in French, and 'sokudo' in Japanese. In the case of scientific terms the meaning is *completely conserved* when we go from one language to another. But this is not quite true outside the field of science. To quote J. C. Weightman (*On Language and Learning,* 1947): "there does not exist in English a single translation of any French poem that conveys more than half the force of the original.... Except in scientific writing, no one term in French corresponds in all circumstances to one and the same term in English." (Interestingly, the word *Science* itself is not a scientific term. The Russian word *Nauka* and the German *Wis-*

*senchaft* are commonly translated as *Science,* but the word *Science* in English has a much restricted meaning as compared to *Nauka,* or even *Wissenchaft.* There is no English word which is an exact equivalent to *Nauka.*)

It is important to recognize that science fixes the meaning of a term, but language fixes the word. The meaning of a scientific term belongs to science, but the word representing the term in any language is a part of that language, and is subject to its rules of grammar and syntax. The meaning of a scientific term is universal, but not so, in general, is the word describing it. It is in this sense that we speak of a common or universal language of science in a multi-lingual world.

An important part of scientific vocabulary consists of words that are the same, or nearly the same, in most of the European languages (derived from Greek and Latin). This is sometimes referred to as the 'international terminology'; and it consists largely of names of physical *units* and *constants,* names of chemical elements and compounds, mathematical signs and symbols; medical and pharmacological terms, and biological classifications—names of plants, animals, and their parts. It should be mentioned that the words describing many scientific concepts are different in different languages, as these usually are denoted by words current in common speech, but in the process of the growth of science these words have been assigned a precise meaning in accordance with the demands of science. Such words are, of course, not a part of the international terminology (e.g. work, force, power, mass, heat). Altogether, the international vocabulary of scientific terms contains today more than three million items, and the vocabulary is expanding. As against this, the largest language dictionary has much less than a *million words.* To be at ease, 'at home', with the international vocabulary we do not need to know Greek and Latin, but a knowledge only of a few hundred current roots based on Greek words and a few hundred from Latin words. A knowledge of these basic roots should be a part of the college science curriculum, as providing not only a short-cut to international scientific terminology but essential to its proficient use. The evolution and growth of the international scienitfic terminology represents an integral part of the history of science. The advantages of a common terminology may not be fully appreciated by those who are not actively engaged in science, but it has played an important role in the rapid growth of science and its dissemination. It is now a part of world culture of our times, and its benefits are so real and immense that no country can afford to ignore.

It may be mentioned that development of the national languages in Europe received a great impetus from the scientific revolution. Science encourages contacts between 'thinkers' and 'workers', and it flourishes on an inter-communication between them. It is worth recalling that Newton, following tradition, wrote the great *Principia* in Latin, published in 1687. Its English translation appeared in 1729, but the *Opticks,* largely an experimental work, was first published in English, and its Latin version two years later (1706). It was a great departure from established custom for a man of Newton's unique stature to write an epochal book in his vernacular. Before him Galileo, the great pioneer of science, had initiated a new fashion in Padua by lecturing to his disciples in his native Italian. It is entirely possible that considering the nature of Galileo's discourses concerned with new mechanical concepts and experimental approach to natural phenomena, he found the vernacular an easier and more intimate vehicle for his lectures, even to students from abroad, than classical Latin which often, under a mighty torrent of rhetoric, submerged everything and everybody. The example of Italian men of science spread to other countries. The Royal Society of London and the French Academy of Sciences also contributed notably, by conducting in native languages their scientific meetings and presentation of papers, to the replacement of Latin by vernaculars. (Sir L. Hogben, *The Mother Tongue,* Secker and Warburg, London, 1964).

## II

At this place, it is of interest to recall the recommendation of the Education Commission (1964-66) that the Roman alphabet should be taught in our primary schools to introduce children to the symbolism of science. Whatever may be one's language—English, Russian or Chinese—the universal symbol for water is $H_2O$. The symbol is not in the nature of an arbitrary label, but very much more than that—it says far more about water than the word water. One need not know the word water, but one need to know the symbol $H_2O$. Today farmers need to know some rudiments of the chemistry of fertilizers. Everybody is interested, or ought to be, in atomic energy, inter-continental missiles, and so on. Whatever may be one's language, in the modern world no one can afford to be ignorant of the symbolism of science. Modern science is a collective, cooperative activity of mankind as a whole. There is, most unfortunately, and very often, a clash of interests as regards the uses to which science is put, but science is universal and so is its symbolism—it is common in all languages and a part of world culture. It is largely for this reason that the Roman alphabet should be included as a part of effective primary education even for children not studying these, or later, English as a language. It would also provide other incidental benefits. It would make it possible to use throughout the country common maps, mathematical tables, charts, road signs and so on, resulting in great convenience and saving in expenditure. (The universal symbol for water could be $\text{उ}_{२}\text{आ}$, but we are three hundred years too late).

The Commission on Scientific and Technical Terminology under the Ministry of Education, working for some years now, has published a vocabulary of technical terms in Hindi adequate for school and undergraduate studies. A very large part of the vocabulary, it is expected, will be common in nearly all the Indian languages. Let me add again that the 'international vocabulary' has been adopted (without translation) as an integral part of the Hindi terminology.

CHAPTER 5

# INDIGENOUS PRODUCTION OF BOOKS

## I

TODAY HIGHER education in the country, and specially in science, technology, agriculture and medicine, is almost entirely dependent on books by foreign authors, largely imported except for a very small proportion now reprinted in India. The Education Commission (1964-66) in its chapter on Science Education and Research has observed: "It is unfortunate that most of the quality books in science and technology, even at the undergraduate stage, are still very largely imported. All imported books are not quality books. A large-scale import of textbooks in science and technology, is not only expensive and costs foreign exchange, but it is bad for our intellectual morale. The country has the talent and other resources required to produce first-rate books, but it appears that what is lacking is determination and planned effort. The Inter-University Board and the UGC should take a lead in the matter so that by the end of the Fourth Plan most of the books required at the undergraduate level and a considerable number at the postgraduate level are produced within the country. It is important that learned and professional societies in the country lend active support and encouragement to the preparation of outstanding books and monographs, and give high professional recognition to such works—it should enjoy a status usually accorded to research."

In recent years the knowledge-explosion in the scientifically advanced countries has led to a terrific growth in the output of new publications—books, monographs, journals, reviews and reports. In several fields of science and technology the number of new publications appearing in a year is doubling in a period of less than ten years. The price of books, except in the USSR, has also been rising very rapidly. (A scientific Soviet publication priced at a small fraction of comparable USA or European publication.) In our case, the difficulties of procurement have been further accentuated because of severe limitations as regards foreign exchange. It is a dismal fact that most university and college libraries, as judged by indispensable books that they should possess, are far poorer today than, say, a decade ago. A very large proportion of students, and also teachers, cannot afford to buy books required for their study; and this is largely responsible for poor standards. In considering the question of accessibility of books it is worth repeating here that the yearly state book-grant to practically every student in higher education in the UK exceeds the *total* cost per student in higher education in our country.

## II

In the context of the prevailing situation it is of utmost importance that every effort is made to produce books in the country. This applies to writing of original books, translations into Indian languages of important foreign books, as also reprinting in India (in our languages and English) of advanced books and books of reference at economic prices. A rapid expansion of the book industry is vital to the progress of education in the country. The total number of book-titles published in India is about 25,000 a year, and it has remained nearly the same over the last decade. The *number* of titles is comparable to that for 'advanced countries', but our coverage in the field of science and technology is almost totally negligible; and further the volume of publication (average number of copies per title) is very small. This, in a broad sense, is evidenced by the fact that the yearly consumption of paper, per capita, is less than 3 pounds in our country as against about 130 pounds in Japan, 200 pounds in the UK, and more than 450 pounds in the USA.

In the academic and professional life in the country the writing of books, unfortunately, has so far received scant attention. The key factor in the entire process is to interest outstanding teachers and researchers to take a lead in the preparation of quality books. This will set a 'fashion', as it were, and also quality standards. In certain fields of biological sciences, agriculture and medicine, books imported from other countries do not deal adequately, and sometimes not at all, with materials and problems of direct interest to us. They sometimes describe things which hardly come within the experience of our people and ignore things which are directly relevant to us. Also, if students read books by Indian authors, it would help to promote a sense of confidence and closeness to their subjects of study.

In the interest of upgrading education and research it is necessary that writing of quality books, reviews and monographs is given adequate professional status. This, more than anything else, will promote a 'climate' conducive to production of quality publication in the country. The nature of work involved in the preparation of an outstanding book is comparable to serious research effort, and deserves to be accorded high professional recognition. It would be an important step in this direction if the National Institute of Sciences, the Medical Research Council, the Council of Scientific and Industrial Research, the Institution of Engineers, the Indian Council of Agricultural Research, as also other leading professional societies, institute a small number of national awards to be given every year to authors of outstanding books (including textbooks). It is suggested that a sum of about rupees five lakhs a year may be provided for this purpose.

It is important that the scheme of production of books in Hindi, other Indian languages, and English, at the university level is conceived as a national programme and treated as a national concern. In higher education, quality is so important that nothing but the best possible books manageable with the total resources of the country should be provided to our students. The universities, the UGC, and the central and state governments should provide every possible encouragement and incentive to bring about participation of outstanding teachers and scholars in production of books. A considerable measure of flexibility is essential in any scheme for books at the university level: a rigid or centralized approach would not be conducive to efficient and expeditious implementation.

In the nature of things it is difficult to make any precise estimate of books, including translations, which would meet, reasonably and adequately, the needs of (undergraduate) education in various subjects, including technology, medicine and agriculture. There is a continuing interaction between supply and demand, and the demand will rise rapidly with increasing emphasis on improvement of standards. A target for the next three to four years could be to produce about five hundred titles in each of the 'major' Indian languages. This should be regarded as an immediate objective, and as providing a foundation for later developments. The grants (basic and special) to universities would be required to meet the cost of preparation of books under the proposed scheme and also to create an adequate machinery for continuation and future expansion of the programme.

We have so far considered only the manuscript stage of the process. What should be the organization and channels for printing and distribution of books, would need expert examination by competent bodies. Wherever possible, publication and distribution of books may be, perhaps, entrusted to the publishing industry. It would be desirable to bring out a student edition and also a library edition. The price of the student edition may be about two-and-a-half times the cost of production, whereas that of the library edition may be three to four times the production cost. A part of the profit on the library edition could be utilised to subsidize the student edition. In some cases there may be a special foreign edition intended for export.

An important part of the scheme should be to make adequate provision for supply to university and college libraries of books published under the scheme. In the case of most titles it would be necessary to provide multiple copies to libraries. An assured demand of a fairly good size would be an important element in the operation of any machinery of price control of books published under the scheme.

The important thing is to make a beginning and create a favourable climate in the country for production of quality books by Indian authors. A considerable amount of initiative, thinking and planning would be necessary on the part of the universities. A 'basic grant' to universities would help to start the process. Equally important it is that the top professional agencies in the country, such as the National Institute of Sciences, the Medical Research Council, the Indian

Council of Agricultural Research and the Institution of Engineers adopt a positive role, and activate and support indigenous production of quality books and monographs by instituting national awards and in other appropriate ways.

CHAPTER 6

# UNIVERSITY MATTERS, AND CENTRES OF EXCELLENCE

## I

IN THE governance of universities the role of a vice-chancellor is crucial, and more so at a time when our universities are in a state of transition. Always a difficult role, the difficulties are further accentuated because of a certain peculiarity of our university organization—a result of historical accretion—which we do not find in other countries. In our set-up the executive and financial functions and powers reside in the executive council (syndicate) of the university. The chairman of the council is the vice-chancellor. He is the university's chief executive functionary, responsible for its working and well-being, but he has no powers apart from those delegated by the council. There is a measure of division here between power and responsibility which at times makes the position of a vice-chancellor embarrassing and awkward. There is no early or obvious solution to this problem. It may be recalled that in universities in the UK, as in most other countries, the vice-chancellor is not the chairman of the governing body (which corresponds to our executive council), but is an appointee of the council. The chairman of the council is elected by the council from one of its members, and is usually an eminent layman interested in education.

In our present set-up and circumstances, it seems to me, the appointment of rectors (or pro-vice-chancellors) has become almost a necessity. It would be an advantage to have two rectors, one for academic work and another for administration. The rectors would function under the general direction of the vice-chancellor. And, if there be proper delegation of authority and functions to rectors, it may be easier for a vice-chancellor to function as a real head and guide of the university, deeply committed to the university and yet relatively detached from 'internal politics'. If conflicts arise at any level, a vice-chancellor's position and stature should be such that the two sides would have confidence in his impartiality and judgment, and not look upon him as a party in the dispute.

*It is the chief responsibility of a vice-chancellor to preserve the autonomy of the university from external control, and to promote self-government within, ensuring effective participation of the academic community (specially the younger members) in the formulation and implementation of academic policy and plans.* A vice-chancellor needs for his task uncommon courage, energy and humility, and above all patience and fortitude, and a sense of identification with those over whom he presides. He has to be open-minded and receptive to new ideas, no matter at what level they originate in the academic hierarchy.

"No other enterprise would impose on its chairman the variety and burden of work that the modern university requires of its vice-chancellor," states Lord Robbins (*Report on Higher Education in the UK* 1963). Clark Kerr, former president of one of the world's great universities, the University of California, observes that "... a university president should be firm and gentle, sensitive to others but insensitive to himself, have vision, affability, broad perspective, and be a seeker of truth where the truth may not hurt too much;....He should sound like a mouse at home and look like a lion abroad." Another distinguished US university president believes that it should be the other way round. Apart from what the ideal mouse-lion proportions should be, a vice-chancellor "must reconcile himself to the harsh reality that successes are shrouded in silence while failures are spotlighted in notoriety."

There is no simple or infallible method of seeking and selecting a vice-chancellor. A procedure good for one university may not apply to another, or at another time. However, one thing is clear; no method will succeed if there be brought in, even to a microscopic degree, considerations any other than the true interests and well-being of the university.

## II

A step of considerable significance, aimed at concentration of resources and strengthening of postgraduate studies and research, has been the establishment by the UGC, in consultation with the universities, of what have come to be known as 'centres of advanced study'. These are university departments selected for special assistance on the basis of their achievements and promise for further growth. At present there are 16 centres in science and 11 in humanities and social sciences. They function on an all-India basis, and are intended to serve as breeders of more such centres in the future —excellence breeding more excellence. There are centres at the Universities of Delhi, Bombay, Madras and Calcutta, amongst others. Many of the centres have received valuable support from UNESCO, the Soviet Union and the UK. It is most important that by concentration of effort and through co-operation between universities, the centres should develop standards comparable to the best anywhere in the world.

It should be recognized that if for any reason we do not build centres of excellence within the universities, then such institutions will inevitably grow or be provided outside the university system. The result would be grossly disadvantageous to universities and would seriously weaken them. To some extent this has already happened in the country. As the Education Commission's report has strongly recommended, university-type of research, unless there be compelling reasons to the contrary, should not be done outside universities. Even advanced countries do not have the resources to do this, and it is a luxury we certainly cannot afford. There is need to strengthen contacts between universities, national laboratories and industry (including agriculture). The possibility of appointments held jointly between university centres and industry may be also worth exploring.

### III

It is now widely acknowledged that improvement and strengthening of universities should receive the highest priority and be treated as a fundamental national goal. If the universities are weak, as several of them are, they cannot and should not absolve themselves of their share of responsibility. This does not mean, however, that the government and the public and other agencies concerned are less responsible for the unhappy situation. A national goal can only be achieved on a national basis and through active collaboration and participation of all the elements concerned. The attainment of a national objective has to be conceived as a national responsibility.

It is important to raise quality at all levels of education, but in the strategy of educational development postgraduate courses occupy a key position. It is a sector of rather manageable dimensions. Improvement of postgraduate education will have an immediate impact on the quality of teachers; and good teachers have a large 'multiplying or amplifying effect' on the quality and standard of the entire educational system. Better postgraduate education will also lead to better research.

In several parts of the country there is at present too much fragmentation of facilities at the postgraduate level. Perhaps, a single most important step towards strengthening of postgraduate education would be to pool together the available resources. There are far too many colleges and university departments in close proximity to one another (in a few cases separated by no more than the width of a public road) providing postgraduate courses in the same subject; and almost invariably the facilities at each place in terms of staff, laboratory equipment and library are deplorably inadequate. There are postgraduate departments which hardly subscribe a single professional journal. There are instances where students are given or rather subjected to as much as four to five hours of formal lectures each day of the week. If under such conditions any appreciable proportion of students still retain their initiative and zest for their chosen subject, it indicates their innate strength and is nothing short of miraculous.

There is an urgent need for effective coordination and rationalization of postgraduate education and elimination of wasteful fragmentation. Concentration of effort and rational deployment of the available resources, and elimination of small ineffective 'portals' (departments) of postgraduate work, would bring about a distinct improvement in quality, at present deplorably low in several places. The problems a university faces in this respect have certain features peculiar to each university. In some universities the situation is near desperate and calls for immediate remedial measures and reform. With sustained effort on the part of the universities and the UGC, the difficulties should not be unsurmountable.

## IV

May I refer to the need to raise the level of teaching and research in mathematics. A new dimension has been added to this subject, as we stand on the threshold of a scientific revolution, based on cybernetics and automation, likely to be in full swing by the end of the century. Its impact on man may be even greater than anything that has happened so far in history. A concerted effort should be made, as the Education Commission has recommended, to place India in the near future on the world map of mathematics. An important element in the programme would be provision on a phased basis of electronic computer facilities in universities. In advanced countries electronic computers are being introduced as a part of general mathematical and scientific education in universities, and even in secondary schools. It is time that elements of computer science, and computer language and logic, found a place in undergraduate courses in our country.

To take an example of the wide applicability of computer science we may refer to public health service. If benefits of modern medicine and health care are to become available to people in a poor country, it may be necessary to exploit the electronic methods of data-collection and information handling about patients and epidemics, clinical examinations and diagnosis. Again, thermo-nuclear devices and space flights have become possible only because of availability of high speed electronic computers to carry out the many complex and elaborate mathematical calculations. Investigations in several fields of physical and also biological sciences now require the use of electronic computers as an indispensable tool. To understand and gain insight into nature—search of pure knowledge—technology is essential. *Apart from more mundane reasons, this is another plea, and at a fundamental level, for technology and industrialization.*

V

A matter of great importance and urgency is the development of university and college, and also school, libraries. The situation in universities and colleges regarding availability of even indispensable books and journals which has always been far from satisfactory is now as near as deplorable. There are postgraduate departments in colleges which hardly subscribe to any learned journal. Incidentally, the dollar subscription for what may be called 'inescapable physics journals' for a postgraduate physics department amounts to $500 *for US journals alone.* In this context I would like to refer to a recent report of the UK-UGC Committee on University Libraries. The report has recommended that for an established library of 50,000 volumes in a university of 3,000 undergraduates, 1,000 research students and 500 teaching staff, the expenditure on the library should be of the order of £ 100,000 a year—this excludes the cost on library staff. (As regards special problems of science libraries and services, a report, *Scientific Library Services,* has been recently brought out by the UK Library Association). A recent expert study of the Delhi University Library revealed that its collection of books and journals is no more than one-tenth of what it should be to meet adequately the needs of advanced study and research. A special grant to universities and colleges for development of libraries, phased over a period of five to ten years, is a matter of the highest priority.

## VI

In our system of higher education a much greater role than at present has to be assigned to non-formal education, i.e., part-time courses, correspondence courses, evening classes and private study by persons in employment. Facilities for part-time education should also include courses in science and technology. Non-formal education constitutes an important part of the system of education in a developing country. It not only makes contribution to productivity by improving the knowledge and skill of those in employment, but it also helps to reduce the pressure on facilities for full-time education. In some of the educationally advanced countries a considerable portion of enrolment in higher education is in part-time courses. It should be made possible to obtain postgraduate and research degrees through part-time and own-time study. This would benefit specially persons working in industry. The UK has recently set up a *Council for Academic Awards outside the Universities*. It confers not only bachelor's but also research degrees.

## VII

Let me, at this place, say a few words about the UGC. The Commission was set up by an Act of Parliament in 1956 in pursuance of the recommendation of the Radhakrishnan Commission on Higher Education (1948). The UGC-concept in India owes much to our revered leader Jawaharlal Nehru. He observed: "The purpose of having a high-powered University Grants Commission is to make them responsible for the division of the money available for the purpose among the universities concerned, which means all universities in India, including the central universities. For this purpose, the Commission should be practically autonomous. . . . So far as this division of grants to universities is concerned, this is the special work of the Commission and they are the best qualified to judge. Even the cabinet is not in a better position to judge this because they cannot keep in intimate touch with the universities and their work. . . . It is for the government to determine the total amount to be placed at the disposal of the Commission for grants-in-aid to the universities. In this matter the Commission's advice might be sought, but the decision must be that of government. After the total sum is decided upon and the Commission is informed accordingly the Commission will then give grants within that sum."

The Commission consists of nine members (including the chairman). According to the provisions of the Act, the scope of the Commission's responsibilities covers all sectors of higher education, but in practice (and unlike the UGC in the UK) the Commission has not been (seriously) concerned with agriculture and medicine. It is important for a balanced and coherent development of the whole educational system that education for agriculture and medicine are also made the responsibility of bodies constituted on the same lines as the UGC. The basic concept underlying the UGC is that development plans and formulation of policy is left to a 'judgment by peers'. It is a system which enables universities to have an effective share in determining education policies, priorities and allocation of funds. This is made possible not only by university people being on the Commission, but by the Commission functioning through committees (review committees, visiting committees and other special committees), which are composed largely of university men.

It is felt that, in view of the increasing responsibilities of the Commission, and the size of the university system in the country, it would be desirable to expand the Commission from nine to, say, twelve members. It would also be of advantage to have a deputy chairman. The Commission, under the present Act, can give maintenance grants to central universities only. It will be desirable if in the case of programmes of special importance, it was made possible for the Commission to give maintenance grants to state universities and institutions deemed to be universities under the UGC Act—of course, such a provision will have meaning only if reasonably adequate funds are made available to the Commission. An amendment of the UGC Act on these lines is before the Parliament. It is most important for the proper functioning of the UGC that there is a close understanding and continuous contacts between the Commission and the universities. We all have to be always vigilant that in the functioning of the UGC 'bureaucracy' and any trace of 'patronage' do not raise their heads.

Our resources devoted to education are severely limited. That we need more resources is beyond question, but what is equally, if not more, important is that the best use is made of whatever resources are available to us. To do this needs careful thought, innovation, and determination of relative priorities. Hard choices between alternative programmes become inevitable. Many schemes, all of which may be good, have to be rejected so that some can be carried through effectively. Unless the effort on a particular programme exceeds a certain critical size, no worth-while results are likely to be achieved within a given time. Allocation of priorities between competing programmes is a task as difficult as it is inevitable. It is a task which has to be done jointly by the UGC and the universities.

It is apparent that a university is likely to be the best judge of its own special needs and circumstances. It is therefore important that in the universities we have (working directly with the vice-chancellors) development panels to give thought to determination of priorities and best utilization of teaching and physical resources and funds. The panels, should of course include in their deliberations the needs of colleges. The panels could also devote some thought to the difficult problem of linking university enrolment with man-power needs of industry, education and government.

The members of the panels would have to be carefully chosen from amongst outstanding teachers with commitment and zest for educational reconstruction. Participation in an appropriate way of students in the working of the panels is essential to their success. There could be a joint committee of teachers and students to deal with specific projects and programmes. The panels in some cases may find it of value to set up what may be called 'extension cells'. Advice about planning of laboratories and libraries, procurement of equipment, use of new teaching and laboratory aids, and even such things as provision of good blackboards, can be much facilitated if expert guidance is readily available. An extension service working in close cooperation with expert educational bodies/institutions to support development of education (somewhat similar in the concept to the extension service for development of agriculture) could play a very useful role. This would be of special value to colleges in remote areas.

## VIII

It is important to recognize that one of the characteristics of science is that things of quality need not necessarily be expensive. If enough thought is devoted it should be possible to have education of quality and yet 'cheap' enough to be within our means. Science brings today within the reach of the common man things which at one time were not available except to the very rich. The same can apply to education, but to bring this about would need hard work and much serious thinking and research into the process of education. Lord Rutherford, the great pioneer of nuclear physics, said in the robust way of his, when he was told that America was going ahead in nuclear physics because they had a lot of money: "Americans have money. We do not have it, and so we have got to think". There is no substitute for hard and serious thinking; and with sustained and serious effort we should be able to go a long way even with our meagre resources and capital.

As I said earlier, the strengthening of education and research at all levels has to be conceived as a national goal and a national responsibility. In considering all these matters, the words of the famous Seaborg Report (1960) come to our mind. This was a report made to the US President by the President's Science Advisory Committee. The report says, "Both basic research and graduate education must be supported in terms of the welfare of society as a whole. It is in this large sense that the role of the Federal Government is inevitably central. The truth is as simple as it is important.

CHAPTER 7

# KNOWLEDGE AND COMMITMENT

## I

RESOURCES ARE important but even more so is a sense of commitment. Knowledge is vitally important. But, if it is to transform society from a state of stagnation to one of dynamism and progress, there must be a general willingness and determination to make use of knowledge in the service of the community. We need strong and progressive universities. These not only should be vigorous centres for imparting and advancing knowledge, but also promote in their members a sense of social responsibility and identification with the community. *Knowledge and commitment must go together.* How to achieve this is a great and urgent task facing Indian education, and in a sense world education. Introduction of 'work experience', and moral education can be important steps in that direction.

What Sir Eric Ashby, one of the great contemporary educationists, says with regard to the new African universities is of considerable interest in relation to our own situation. He says (*African Universities and Western Tradition,* Harvard University Press, 1964):

"For an African the impact of a university education is something inconceivable to a European. It separates him from his family and his village (though he will, with intense feeling and loyalty, return regularly to his home and accept what are often crushing family responsibilities). It obliges him to live in a Western way, whether he likes it or not. It stretches his nerve between two spiritual worlds, two systems of ethics, two horizons of thought. In his hands he holds the terrifying instrument of Western civilization: the instrument which created Jefferson's speeches, the philosophy of Marx, the mathematics and chemistry of atomic destruction. His problem is how to apply this instrument to the welfare of his own people. But he has no opportunity to reflect on this problem. For one thing, the gap between himself and his people is very great . . . the universities and their graduates are isolated from the life of the common people in a way which has had no parallel in England since the middle ages. This is the peculiar dilemma of the African University."

These are wise and powerful words, and they apply to us no less.

The basic role of higher education in our country should be, as urged by the Education Commission, (1964-66), *to promote a sense of common citizenship and culture, and to further national integration: to make a direct contribution to national productivity: and to contribute, in howsoever modest a measure, to the* *world stock of rapidly expanding knowledge and technology.*

It is the universities which provide the focal points for importing and also exporting knowledge and transmitting it to the local community. They alone, or at any rate, much more than any other agency, function as the 'ports of commerce' in the great ocean of 'international knowledge', and particularly science and technology. They act as powerful 'pumps' drawing knowledge from 'advanced' countries, and creating more in the process, and spreading it wide to irrigate the native soil. As industry and agriculture become increasingly science-based, the role of universities in regional and national development becomes increasingly of crucial importance. *But if the universities in a developing country are to truly serve their country, they must be close to the native soil, close to the poor and the needy.* They must be close to the people and to their aspirations, and close to the government; and the state should assure adequate resources to the universities to match their obligations and responsibilities. As society's most powerful instrument for development, and one without a substitute, but as yet used very imperfectly, it needs to be nurtured carefully and sympathetically. In the very nature of things a university cannot serve effectively the true interests of knowledge and society if it is 'pressurised' from within (whether by students or teachers), or if it is "controlled" from outside, whatever be the outside agency. Its governance and policy, within a broad national framework, should primarily be its own concern, and all its members, teachers and students, should have some share in it and a sense of participation.

## II

At this point let me say a word about the internationalization of universities. In the modern world, while the universities serve special and specific needs of their respective countries, they also constitute an international community. They share a common stock of knowledge, a common style, a common attitude and approach towards preservation, dissemination and advancement of knowledge. This, to a large measure, is due to the importance of science and technology in the life of the universities. The universality of science is reflected in the universalization of the universities. I may add in passing that ancient and medieval science was not universal, oecumenical, in the sense that modern science is. Science, before Galileo and Newton, was nearly as much local and ethnic as language, culture and religion. Why modern science is universal? As everyone knows, science is not universal in the sense that dissent is prohibited—science is not dogma. Science encourages vigorous criticism and continuing reappraisal. There are conflicting interpretations of experiments, and there are conflicting theories, each passionately propounded and defended. But whatever the disagreement, it is always resolvable or at any rate so in principle. This is largely because the theoretical basis of modern science is mathematical (and mathematics is universal—it is same in all cultures), it deals with natural and not supra-natural or super-natural phenomena; and above all because science is open-minded and not a closed system, and it is observational and experimental—the criterion of validity of scientific concepts and theories is agreement with experiment and *not* conformity with any individual's opinion or authority, how so mighty or learned.

Before the scientific revolution universities could not and did not make a world community in any true sense. The universities of medieval Europe were linked together because of Christianity and Latin which was then the universal language of learning throughout Christendom. In the Muslim world of the time the link between universities were Islam and Arabic. The University of Ghazni founded by Mahmud of Ghazni (A.D. 998-1030), a name well-known in Indian history, was perhaps as famous at the time as Bologna and Padua of medieval Europe. Other famous centres of Islamic learning in close contact with India were Shiraz and Samarkhand. In India the great ancient universities of Taxila and Nalanda were held in the highest esteem throughout the known world. Taxila was a world renowned seat of Hindu learning over many centuries known specially for its medical school. Nalanda, the most famous of the Buddhist seats of learning, was founded shortly after Buddha's death. It was destroyed by warring invaders at the close of the 12th century. Amongst other places of higher learning may be mentioned Ujjain and Ajanta, the former specialized in astronomy and the latter in the fine arts. Jaunpur was a centre of Islamic learning from about the 15th to the end of the 18th century. It could be compared to Shiraz and Paris of the time. Besides Jaunpur, there were many other great Muslim universities, but these declined with the rise of the scientific and industrial revolution of Europe.

Abul Fazl, the famed scholar at Akbar's court, records that sciences were taught to pupils in the following order: "morality, arithmetic, accounts, agriculture, geometry, astronomy, geomancy, economics, the art of government, physic, logic, natural philosophy, abstract mathematics, divinity and history. The Hindus read the following books on their subjects of learning, viz: *Vyakarana, Vedanta* and *Patanjali,* every one being educated according to his particular views of life and his own circumstances". In Akbar's time, according to Abul Fazl, schools were given a new form, and became lights and ornaments of the empire.

It is important to recognize that the universalization of universities is a relatively new phenomenon. It has given to them a new dimension, a new role and significance that these had never before. It is consequence of the scientific revolution, a result of the increasing role of science and technology in the life of the people, and also it has been considerably supported by the spread of the English language in recent decades almost all over the globe.

## III

In the West during the last three centuries, the study of nature has been pursued with unsurpassed vigour, using the method of experiment and observation. But there is need today, as never before, for a creative interaction between science and spiritual thought and insight. It was unfortunate, in a historical sense, that at the time of the beginning of the scientific revolution in Europe, the West did not know about the culture and philosophic thought of the East, and especially India. It was only at the end of the 18th century when Sir William Jones (1746-94), and one or two other pioneers, discovered Sanskrit writings and introduced the West to a new spiritual world. Goethe, on reading *Shakuntala* (in translation), proclaimed that "Wouldst thou the Earth and Heaven itself on one sole name combine; I name thee, *O Shakuntala,* and all at once is said." Max Muller declared (1883) in his lectures on *India, What Can It Teach Us*: "If I were to look over the whole world to find out the country most richly endowed with all the wealth, power, and beauty that nature can bestow—in some parts a very paradise on earth—I should point to India. If I were asked under what sky the human mind has most fully developed some of its choicest gifts, has most deeply pondered on the greatest problems of life and has found solutions of some of them which well deserve the attention even of those who have studied Plato and Kant—I should point to India. And if I were to ask myself from what literature we, here in Europe, we who have been nurtured almost exclusively on the thoughts of Greeks and Romans, and of one Semitic race, the Jewish, may draw that corrective which is most wanted in order to make our inner life more perfect, more comprehensive, more universal, in fact more truly human, a life, not for this life only, but a transfigured and eternal life—again I should point to India."

Even more pertinent and telling is the observation of the great historian of science George Sarton (1884-1956). In his book, *The Appreciation of Ancient and Medieval Science during the Renaissance* 1450-1600, (University of Pennsylvania Press, 1955), he writes (pp. 173-5):

> "From 1450 to the end of the eighteenth century, that is, throughout the Renaissance and two centuries beyond it, civilization was largely understood in the sense of Western civilization, and humanism meant the knowledge of classical antiquities. The Bible, represented by the *Vulgate,* was an essential part of Latin culture. A new Oriental renaissance occurred only by the end of the eighteenth century when Anquetil-Duperron and Sir William Jones discovered Zend and Sanskrit writings and the complicated pattern of Indic cultures. This introduced a new kind of humanism, more catholic than the Renaissance humanism. Their discovery of a new spiritual world was infinitely more important than the discovery of a new material world by Columbus,

Vasco da Gama, Magellan, *e tutti quanti,* but it attracted less attention, and to this day the great majority of the so-called humanists (meaning the teachers of Latin and Greek) are still on the Renaissance level or below. . . . After the Renaissance, the West was fully equipped to continue and complete its conquest of the material world. This implied colonial expansion and the subjection of Eastern peoples to Western needs and greed. The Western nations did not simply exploit and enslave their Eastern brothers; they did much worse, they failed to appreciate their spiritual heritage and tried to deprive them of it; it was not enough for them to conquer their material goods, they wanted to conquer their very souls. We are today paying the cost of their greed and of their stupidity. . . .

"Ours is a golden age of science, which is fine, but it is also a golden age of technology, business, management, an age of over-organisation and dehumanisation, and that is ominous and degrading. . . . It would suffice to admit that material profits are not as desirable as many good people have been led to believe, and that there is infinitely more virtue and glory in creating beauty, justice, happiness than in creating wealth.

"Will the leaders understand that? I am afraid not. Fortunately, whatever their greed for power and wealth may be, there will always be room for artists, philosophers, men of science, historians, humanists, if these be satisfied, as they should, to live in a bare competency or better still in blessed poverty."

The world today is at cross-roads of history. For the first time in history, and within a period of less than two centuries, the average span of human life has doubled itself in industrialized countries (inscriptions on Roman tombstones indicate that at the height of the Roman civilization the average age was no more than about 30 years). Several countries today enjoy a level of material prosperity and affluence never attained before; and what is more, the per capita income is rising exponentially at about 4 per cent a year. But we also have intercontinental missiles with thermonuclear warheads and preparations for anti-ballistic missile defence, colossal poverty, disease and ignorance afflicting a thousand million people; Vietnam, and Marijuana. Man is the only species in nature whose members kill one-another, and in the end for nothing. To slaughter his own kind, man has not learnt from *nature*. It is his own discovery and unique contribution. It was foolish and barbaric to do so in the tribal period of man's history. But to continue with that primitive behaviour in the nuclear age can only lead to universal disaster and doom. All this poses a new challenge for education. Man, each one of us—there is no mistake about it—represents the front, the crest, of the ever-moving evolutionary process that has gone on for ten thousand million years; and has a future equally long, if not *longer*. He is on his way to be a citizen of the *universe*—it is almost certain that intelligent life exists outside the solar system. The evolutionary process with the emergence of the human brain, and mind, has entered a phase when its future course is in man's own hands. *Man faces himself.* And, now as never before, at this time of unprecedented crisis, when the powers of science magnify a million-fold the crisis that man faced in tribal societies, he needs all the courage and skill, and above all, the combined wisdom of the West and the East.

Niels Bohr, the incomparable master of modern physics, used to refer sometimes to an old Danish story while speaking of the epistomological aspects of the complementarity principle of quantum physics. (The story reflects thoughts somewhat similar to those in chapter 16 of the *Bhagwat Gita*). There were two brothers, a philosopher and a business man. The business man collected a big fortune and was fond of saying: "I have acquired this property today, tomorrow I shall acquire that, and so on." He would tell his philosopher brother who had practically nothing and was living from hand to mouth: "Why not join me in business, and I can easily help you to acquire much wealth for *yourself.*" To this exhortation frequently repeated, the philosopher after much deliberation one day replied: "Can you tell me, brother, what is this 'I' for which you are collecting these things, big and small, with so much effort, trouble and anxiety? Can you tell me where you come from, why are you here, and whither are you going?" The fact seems to be that those who are feverishly engaged in collecting huge fortunes for their *selves* do not know what these *selves* are. Those, and they are not many of them, who are seriously and steadfastly engaged in searching the true meaning of 'I' have hardly any time for anything else. The 'godly life' and the 'worldly life' have a complementarity which in some ways reminds us of the complementarity of the particle and wave aspects in physics: when one aspect is in focus, the other is very much blurred. Erwin Schroedinger has remarked that the ultimate aim of all science is to make a contribution, how so modest, towards the understanding of the deepest and oldest of all questions: What am I and why I am here? We find somewhat similar thoughts expressed by Theodosius Dobzhansky (*Science,* 29th November, 1963). In speaking about some of the recent work in the field of molecular biology he says: "One thing, however, seems safe to say: genetics, both molecular and organismic, is now in a period of rapid development. Its development promises to lead to a better understanding of life and to a better understanding of man. To help man understand himself and his place in the universe, may be the ultimate purpose of genetics, of biology, and perhaps of all science."

One of India's greatest contributions to world civilization has been the concept of *ahimsa* or non-violence, to which, in our times, Mahatma Gandhi added a new dimension of far-reaching significance. The greatest contribution of the West is no doubt science and technology. What the world desperately needs today is a creative and symbiotic combination of science and non-violence—science and spiritualism—so that man can progress towards the realization of what Huxley has called the 'fulfilment society', based not on power and exploitation, but on scientific knowledge, humanism and humaneness. The world has to learn anew, and in the present nuclear context, the great lesson that Asoka, one of the greatest emperors in world history, learned in Kalinga.

All these considerations reinforce the extreme importance and crucial role of science as central to man's survival and progress in the atomic age; to promote cooperation and universal peace; and even more so to add new vigour and possibilities to man's endeavour to examine and understand his own self. And, indeed, science has given a new emphasis and dimension to the supreme lesson that *"for man an unexamined life is not worth living"*.

# LIST OF UNIVERSITIES

*Figures in brackets indicate the number of colleges of the University as on* 1-1-1969

| *Year* | *S.No.* | *University* | *Student Enrolment* 1967-68 |
|---|---|---|---|
| 1857 | (1) | Calcutta University (189) | 1,75,379 |
| | (2) | Bombay University (56) | 75,312 |
| | (3) | Madras University (95) | 92,137 |
| 1887 | (4) | Allahabad University (6) | 12,862 |
| 1916 | (5) | Banaras Hindu University (Varanasi) (7) | 11,689 |
| | (6) | Mysore University (81) | 48,851 |
| 1917 | (7) | Patna University (10) | 12,776 |
| 1918 | (8) | Osmania University (Hyderabad) (54) | 41,230 |
| 1921 | (9) | Aligarh Muslim University (4) | 6,700 |
| | (10) | Lucknow University (18) | 19,754 |
| 1922 | (11) | Delhi University (42) | 43,243 |
| 1923 | (12) | Nagpur University (68) | 58,379 |
| 1926 | (13) | Andhra University (Waltair) (50) | 47,789 |
| 1927 | (14) | Agra University (59) | 33,356 |
| 1929 | (15) | Annamalai University (Annamalainagar) | 5,349 |
| 1937 | (16) | Kerala University (Trivandrum) (74) | 1,38,695 |
| 1943 | (17) | Utkal University (Bhubaneswar) (45) | 25,303 |
| 1946 | (18) | Saugar University (44) | 24,111 |
| 1947 | (19) | Rajasthan University (Jaipur) (96) | 40,958 |
| | (20) | Panjab University (Chandigarh) (167) | 1,27,517 |
| 1948 | (21) | Gauhati University (51) | 48,329 |

| Year | S.No. | University | Student Enrolment 1967-68 |
|---|---|---|---|
| | (22) | Jammu & Kashmir University (Srinagar) (26) | 17,657 |
| 1949 | (23) | Roorkee University | 2,309 |
| | (24) | Poona University (51) | 46,326 |
| | (25) | M.S. University of Baroda (5) | 15,265 |
| | (26) | Karnatak University (Dharwar) (66) | 39,159 |
| 1950 | (27) | Gujarat University (Ahmedabad) (92) | 57,997 |
| 1951 | (28) | S.N.D.T. Women's University (Bombay) (15) | 6,773 |
| | (29) | Visva-Bharati (Santiniketan) (5) | 1,101 |
| 1952 | (30) | Bihar University (Muzaffarpur) (44) | 49,642 |
| 1954 | (31) | Sri Venkateswara University (Tirupati) (31) | 21,763 |
| 1955 | (32) | Sardar Patel University (Vallabh Vidyanagar) (11) | 9,790 |
| | (33) | Jadavpur University (Calcutta) (1) | 5,525 |
| 1956 | (34) | Kuruksetra University (Kurukshetra) (4) | 3,535 |
| | (35) | Indira Kala Sangit Vishvavidyalaya (Khairagarh) | 111 |
| 1957 | (36) | Vikram University (Ujjain) (48) | 28,956 |
| | (37) | Gorakhpur University (53) | 22,484 |
| | (38) | Jabalpur University (21) | 16,472 |
| 1958 | (39) | Varanaseya Sanskrit Vishvavidyalaya (Varanasi) | 647 |
| | (40) | Marathwada University (Aurangabad) (30) | 21,282 |
| 1960 | (41) | U.P. Agricultural University (Nainital) (3) | 1,317 |
| | (42) | Burdwan University (38) | 32,282 |
| | (43) | Kalyani University (4) | 1,673 |
| | (44) | Bhagalpur University (47) | 31,717 |
| | (45) | Ranchi University (37) | 32,048 |
| 1961 | (46) | K.S. Darbhanga Sanskrit Vishvavidyalaya | * |

*Not available.

| *Year* | *S.No.* | *University* | *Student Enrolment* 1967-68 |
|---|---|---|---|
| 1962 | (47) | Punjab Agricultural University (Ludhiana) (8) | 2,862 |
| | (48) | Punjabi University (Patiala) (10) | 7,823 |
| 1962 | (49) | Orissa University of Agriculture and Technology (Bhubaneswar) (4) | 1,191 |
| | (50) | North Bengal University (Siliguri) (20) | 17,262 |
| | (51) | Rabindra Bharati (Calcutta) | 1,350 |
| | (52) | Magadh University (Gaya) (37) | 34,183 |
| | (53) | Jodhpur University (2) | 7,539 |
| | (54) | Udaipur University (13) | 6,418 |
| | (55) | Shivaji University (Kolhapur) (50) | 32,491 |
| 1964 | (56) | Indore University (18) | 15,377 |
| | (57) | Jiwaji University (Gwalior) (31) | 17,689 |
| | (58) | Ravi Shankar University (Raipur) (45) | 17,243 |
| | (59) | University of Agricultural Sciences (Bangalore) (3) | 1,570 |
| | (60) | Andhra Pradesh Agricultural University (Hyderabad) (6) | 2,607 |
| | (61) | Bangalore University (30) | 27,675 |
| | (62) | Jawaharlal Nehru Krishi Vishvavidyalaya (Jabalpur) (9) | 1,761 |
| 1965 | (63) | Dibrugarh University (30) | 17,337 |
| 1966 | (64) | Kanpur University (44) | 23,237 |
| | (65) | Meerut University (53) | 30,837 |
| | (66) | Madurai University (55) | 42,943 |
| | (67) | Saurashtra University (Rajkot) (35) | 19,791 |
| | (68) | South Gujarat University (Surat) (21) | 14,121 |
| 1967 | (69) | Berhampur University (12) | 4,265 |
| | (70) | Sambalpur University (22) | 8,035 |
| | (71) | Gujarat Ayurveda University (Jamnagar) | — |
| 1968 | (72) | Awadhesh Pratap Singh University (Rewa) (31) | * |
| | (73) | Calicut University (34) | ** |

*Included in Saugar University.
**Included in Kerala University.

| Year | S.No. | University | Student Enrolment 1967-68 |
|---|---|---|---|
| | (74) | Maharashtra Krishi Vidyapith (Rahuri) | — |

## INSTITUTIONS DEEMED TO BE UNIVERSITIES UNDER U.G.C. ACT

| | | | |
|---|---|---|---|
| 1958 | (1) | Indian Institute of Science (Bangalore) | 845 |
| | (2) | Indian Agricultural Research Institute (New Delhi) | 513 |
| 1961 | (3) | Indian School of International Studies (New Delhi) | 143 |
| 1962 | (4) | Gurukul Kangri Vishvavidyalaya (Hardwar) (1) | 130 |
| | (5) | Jamia Millia Islamia (New Delhi) | 1,040 |
| 1963 | (6) | Gujarat Vidyapith (Ahmedabad) | 478 |
| | (7) | Kashi Vidyapith (Varanasi) | 1,815 |
| 1964 | (8) | Tata Institute of Social Sciences (Bombay) | 131 |
| | (9) | Birla Institute of Technology and Science (Pilani) | 2,286 |
| 1967 | (10) | Indian School of Mines (Dhanbad) | 434 |

## INDIAN INSTITUTES OF TECHNOLOGY ESTABLISHED BY ACTS OF PARLIAMENT

| | | |
|---|---|---|
| 1956 | (1) | Indian Institute of Technology (Kharagpur) |
| 1961 | (2) | Indian Institute of Technology (Bombay) |
| | (3) | Indian Institute of Technology (Kanpur) |
| | (4) | Indian Institute of Technology (Madras) |
| 1963 | (5) | Indian Institute of Technology (Delhi) |

# INDEX