

**REPORT OF  
THE TASK FORCE ON  
ADULT EDUCATION**



**UNIVERSITY GRANTS COMMISSION**

**University Grants Commission Building**

**Chadur Shah Zafar Marg**

**NEW DELHI**

REPORT  
ON  
ADULT EDUCATION

SUBMITTED  
BY  
TASK FORCE ON ADULT EDUCATION

EDUCATION COMMISSION  
UNIVERSITY GRANTS COMMISSION BUILDING  
BAHADUR SHAH ZAFAR MARG  
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## Preface

1. The Task Force on Adult Education was constituted by the Commission in November, 1964 to consider the functions of adult education in the national system of education and to recommend measures necessary for their fulfilment. The Task Force consisted of the following members:-

1. Dr. K.G. Saiyidain  
Member, Education Commission
2. Shri J.P. Naik,  
Member-Secretary, Education Commission
3. Shrimati Durgabai Deshmukh,  
New Delhi
4. Mrs. Welthy Fisher,  
Literacy House, Lucknow
5. Dr. M.S. Mehta,  
Vice-Chancellor, Rajasthan University,  
Jaipur
6. Dr. M.S. Randhawa,  
Ministry of Food & Agriculture,  
New Delhi.
7. Shri Abdul Qadir,  
Director General of Employment & Training,  
New Delhi.
8. Shri G.K. Chandiramani,  
Additional Secretary,  
Ministry of Education
9. Shri A.R. Deshpande,  
Formerly Adviser (Social Education),  
Ministry of Education.
10. Shri Sohan Singh,  
Asia Foundation, New Delhi.
11. Shri D.R. Kalia,  
Director, Delhi Public Library, Delhi.
12. Shri K.L. Joshi,  
Secretary, University Grants Commission, New Delhi.
13. Dr. T.A. Koshy,  
Director, National Fundamental Education Centre,  
New Delhi.
14. Dr. Hans Simons,  
Consultant, Ford Foundation, New Delhi.
15. Mrs. A.R. Moore,  
Regional Adviser, Health Education,  
World Health Organisation, New Delhi.

16. Mr. J. McDougall,  
Associate Secretary, Education Commission

17. Dr. V.S. Jha,  
Member, Education Commission ... Convenor

2. Several thinkers and workers in the field of adult education were invited to participate in the deliberations of the Task Force and they included:

1. Shri K.N. Srivastava, Director, Literacy House, Lucknow
2. Mr. H.L. Elvin, Member, Education Commission
3. Dr. B.P. Pal, Director, Indian Agricultural Research Institute, New Delhi.
4. Dr. J.R. Kidd, Project Director, Department of Adult Education, University of Rajasthan, Jaipur.
5. Dr. J. Friesen, Director, Adult Education, Rajasthan University
6. Shri M.C. Nanavaty, Director, Social Education, Ministry of Community Development, New Delhi.
7. Dr. P. Shasrebudhe, Director, Bal Bhavan and National Children's Museum.
8. Shri S.R. Pathik, Secretary, All India Mass Education Society, New Delhi.

3. At its first meeting held on the 23rd November, 1964, the Task Force constituted four study-groups to report on the following problems:

- (1) Literacy Education;
- (2) Role of Universities and Institutes for Higher Education in Adult Education;
- (3) Education of the Workers in the Rural and Urban Areas; and
- (4) Role of Cultural Institutions in Adult Education.

The personnel of each group and its terms of reference are given in Appendix I. Each group held several meetings, formal and informal, and invited many interested thinkers and workers to participate in its discussions. Thus an attempt was made to involve as many persons as possible in thinking on the subject and to let in the wide range of views held on several relevant themes. The groups did admirable work for which they merit gratitude.

4. The work of the Task Force was considerably lightened by the following Conferences:

- (1) The Camp Conference on Adult Education, organised by the University of Rajasthan, The Indian Adult Education Association and the Education Commission and held at Mount Abu on the 7th to 11th April, 1965.
- (2) Conference on the Role of Universities in Adult Education organised by the University of Rajasthan, Indian Adult Education Association and the Education Commission and held at Bhopal from 5th July, 1965 to 8th July, 1965; and
- (3) National Seminar on the Gram Shikshan Mohim organised by the Planning Commission at Poona at 8th to 10th November, 1965.

Some members of the Task Force participated in these Conferences and were glad to be able to share views with the leading thinkers, workers and administrators in the country. One cannot be too grateful to the organisers of these conferences for their timely and valuable efforts. The <sup>serious</sup> thinking done on the different aspects of adult education in the course of the deliberations and the recommendations embodied in the admirable reports of these conferences have considerably influenced thinking in the Task Force.

5. The Task Force held four meetings on 23rd November, 1964, 18th December, 1964, 5th May, 1965 and 25th January, 1966. A draft report was considered by the members at its last meeting and the convener was authorised to modify the draft in the light of the discussions and to submit the Report to the Commission. As the Convenor, I have modified the Report in accordance with the wishes of the Task Force and I have much pleasure in placing it in the hands of the Commission.

I am deeply beholden to the members of the Task Force and other collaborators for the valuable contribution which they have made to the thinking on the subject and in formulating the recommendations embodied in this Report. Dr. S.M.S. Chari, Deputy Educational Adviser had to shoulder the heavy responsibility of

organising a vast variety of material and of sharing in the drafting of the Report. I am most thankful to him for his able assistance. Mr. S.N. Lal, Assistant Education Officer was with the Commission till 30th September, 1965 and he was of great help in many ways. I acknowledge gratefully the work he did for the Task Force.

I had to rely considerably for assistance on the National Fundamental Education Centre and the Indian Adult Education Association. Their rich experience and valuable records have been of immense value. I have drawn on Dr. Koshy, Dr. H.P. Saksena of National Fundamental Education Centre and Shri S.C. Dutta of Indian Adult Education Association for assistance frequently and I have received unstinted assistance for which I am grateful. Shri Sohan Singh of Asia Foundation was particularly kind and he was always available for discussion or for any other help he was requested to render. I am very thankful to him.

The Chairman of the Commission, Dr. D.S. Kothari, undertook the responsibility of inaugurating the work of the Task Force on the 23rd November, 1964. This was significant, because it was much more than a polite formality. It was a deliberate assertion of - what alas was a sadly denied so far - the principle that adult education had a rightful place in the national system of education. I am grateful for the lead he gave and for the hopes he aroused.

Shri J.P. Naik, Member-Secretary, has been of help to the Task Force and to me personally in a thousand ways and it is difficult for me to say my thanks to him adequately.

V.S. Jha  
Convener  
Task Force on Adult Education

CHAPTER I

ADULT EDUCATION

Objectives and Scope of Adult Education

1. The aim of adult education in a democracy is to provide every adult citizen opportunities for education of the type which he wishes to have for his personal enrichment and professional betterment and for effective participation in social life.

2. From the national point of view adult education should aim to create attitudes in the mind of the adults and to enable them to acquire knowledge and skills which will enable them to participate intelligently and effectively in the national endeavour to meet challenges which effect national life and security. Programmes of adult education should be specifically adapted to the following urgent requirements of the developing Indian Nationhood:

(a) The most urgent need of the country is its economic growth and it is vital that the work force of the country receives education and learns techniques which are essential to promote agricultural and industrial production. W. Arthur Lewis observes: "Some Governments may be tempted to try to coerce the farmers to adopt better practices; use fertilizers and better seeds; - cut the diseased trees; or even to join cooperatives and collectives. They would not be wise to do so . . . Increased agricultural productivity is absolutely essential to economic progress, but it can be achieved only by the normal means of education, example and economic incentive." The farmer who tills the soil and the worker who turns the machine

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1. Beyond African Dictatorship. The Crisis of the One Party State, ENCOUNTER, August, 1965.



must understand the nature of the soil and of the machine and acquire some acquaintance with the more important scientific processes involved in production. He should be mentally prepared to appreciate the scientific basis of the new practices and learn to adopt them and to improve upon them. Increase of production results from inventiveness of the mind of the worker and not from mere imitative repetition of what he is told. Thus viewed, the problems related to development of agricultural and industrial production are problems of adult education.

(b) The same principle applies to all social problems. By way of illustration, mention may be made of the need of family planning. The growth of population which is heading the country towards disaster cannot be arrested by mere production and distribution of control devices. A clear appreciation of the implications of growth, some knowledge of the laws of life and determined and intelligent participation of the individual in the programme are essential prerequisites of success of family planning in the country. There can be no social transformation without social education.

(c) At any time, in the history of a nation; its security, internal and external, is a problem above all; but at the present time, and in the existing circumstances of this country in which its integrity is seriously threatened, under-rating the significance of the problems of security will not remain unpunished. No wise nation leaves its security to the army and police alone; nor is national security a purely military and police problem. In the last analysis, the security of a country depends upon the education of each citizen; his knowledge of the

affairs, his character and sense of discipline and devotion to duty, and his ability to participate intelligently and efficiently in the national security measures. These considerations must determine orientation of adult education programmes.

(d) Nationalistic attitudes must have relevance to the international context. Modern life has brought us closer to the other inhabitants of the world more than ever before and created conditions in which the mankind has to make a choice to live in peace with them or to face extinction. The art of living together and appreciation of the variety of forms of life and thought which enrich the world are values which require assiduous pursuit both in the formal and informal educational avenues.

(e) Uneducated people cannot make a real democracy. Democracy requires participation by the people in organising the civic life and in important decision-taking. It means responsible living. It demands of the people not merely acceptance of well defined idealistic attitudes and moral commitments; it demands specific thought and behaviour patterns on the part of the people for its success. Adult education must, therefore, aim to cultivate in the minds of the people democratic values and problem-solving techniques.

(f) Man does not live by bread alone, however necessary it is for life. The Indian tradition has always prized active, enlightened and emancipated mind above the absorbing though tiring quest for satisfying the ever-growing wants of life. He seeks knowledge not merely because it is power; but also because it is virtue - what is good in itself.

He seeks what enobles his life and refines his tastes and gives him happiness such as mere comforts of life cannot give.

However concerned adult education may be with the problems of immediacy - more food, more clothes, more shelter, more security; it cannot afford to bypass what is essential to the growth of the human spirit and to a full and happy life.

3. Adult education is the most powerful media for transforming and modernising social attitudes and behaviour and for cultivation of "value-consciousness".

4. In the context of the educational development in the country, eradication of illiteracy is a matter of the most immediate concern. The aims of adult education referred to in the preceding paragraphs can be only partially realised until all adults become literate. Postponement of effort to eradicate illiteracy will not only increase its difficult magnitude, it will also retard national production and weaken national security. Full utilisation of human resources is the determining factor in development and it depends upon the level of literacy and the quality of education received by the people. Eradication of illiteracy should, therefore, be the most important function of adult education activities.

5. Education does not end with schooling; much less with acquisition of the tools of literacy. The stresses of fast changing socio-economic pattern of life make it necessary for a person that while he must work for a living he must continue to learn. Even those who have had very high academic and professional attainments must renew their knowledge lest explosion of knowledge should render them

obsolete. Education of a modern man does not end. The system of adult education should, therefore, provide opportunities for "Continuing Education" of a variety of types which will answer different needs. It is likely that some of the adults would like to devote the hours of their leisure to pursue education on formal lines leading to university degrees while others would prefer special courses especially designed to meet their special needs. One of the ingredients of the adult education system should be to provide every one a chance to continue his education.

6. The education of the workers who are engaged in the work of production in farms and factories, mines and forests, and in other productive fields must have a very high place in the programmes of adult education. The worker should not only be literate; he should also learn the skills of his trade and he should also be conscious of his civic and professional responsibilities. The quality of production depends upon the quality of the worker and well conceived programmes for his education should be considered to be worthwhile investment.

7. The scope of adult education is wide: as wide as life itself. Its requirements are bound to be somewhat different from those of formal school system. Many agencies are involved in adult education and there is always the need of exploring new agencies to perform new functions. The work of these agencies requires coordination and direction. Adult education also depends upon the support it receives from a variety of institutions, for example, libraries, museums, galleries, the stage. The many problems of adult education necessitate consideration of an administrative

machinery for planning adult education programmes, utilisation of the resources available, creation of opportunities and ensuring progress. The scheme of adult education should consider an effective machinery and means which will answer its peculiar requirements.

In brief the scope of adult education should embrace:

- (a) Eradication of illiteracy;
- (b) Continuing Education; including education of top academic and professional personnel and
- (c) Education of the workers.

No consideration of adult education will be complete until it considers the agencies involved in the programmes, particularly the universities, non-official organisations, Panchayati Raj Institutions, important supporting institutions such as libraries and museums and an effective administrative machinery.

CHAPTER II

ERADICATION OF ILLITERACY

A. The Magnitude of the Problem

1. According to the 1961 Census figures, 187 millions of people above the age of 14 are illiterate. If the 'work force' is taken to be the 15-44 age-group, the number of illiterates in the group is a little more than 140 millions.
2. While it is not proposed in this paper to analyse the state of illiteracy in the country, it would yet be relevant to draw attention to the serious situation obtaining in the districts lying on the borders of the country. Literacy almost does not exist in these districts. Barring Mizo Hills (50%); United Khasi and Jaintia Hills (67%), the 24 Parganas (67.57%), illiteracy nowhere is less than 70%, in most of them it is nearly 90% and in three districts more than 90%. This situation prevailing right on our border districts affects our security.
3. There has so far been no real national effort to eradicate illiteracy; the best of the efforts have been local and their intensity and enthusiasm have never been sustained. (Fuller mention of the major attempts and achievements made so far are not attempted in this paper).
4. While literacy is the result of a complex series of political, social and economic factors, it is also a major factor in the economic, social, technological and cultural advancement.

"Map of illiteracy corresponds to the map of poverty". This reflects the dilemma; the greater the problem, the lesser the ability to finance its eradication.

5. Illiteracy is the cause and effect of under-development, and a characteristic of the countries with low national incomes. Mass illiteracy impedes participation of the people in the process of socio-economic development; it cannot be ignored without peril.

B. Development of Primary Education is not an Adequate Remedy.

6. Is concentration on compulsory school attendance the answer to the problem of eradication of illiteracy? Theoretically, the growth of the compulsory school system will at some late stage in the future eliminate illiteracy. Why hasten a dying phenomenon?

The answer is

(i) In the developing countries provision of school education cannot be too rapid in spite of the maximum effort and maximum budget allocations for the purpose.

Populations grow as fast <sup>as</sup> the budget and the growth slows down education yields.

(ii) With normal pressures for expansion and financial restrictions, there is less attention to improving the quality of education and introduction of new techniques and methods of teaching.

Improvement of the teacher competence also cannot receive much attention. The result is wastage, stagnation and relapse into illiteracy.

(iii) Illiterate environment and consequently enfeebled parent participation in school education slows down the effectiveness of the school system.

If we depend only upon programmes of universal primary education to solve literacy, the possibility of universal literacy will not be within the foreseeable future. According to the projections worked out by the National Fundamental Education Centre (which will need to be checked when full report is available), with the growth of primary education the position of illiteracy in 1961-72 will be :

	<u>1961</u>	<u>1966</u>	<u>1971</u>
	<u>in millions</u>		
<u>Age-group</u>			
10-14	28	28.5	26.1
15-44	140	139	136.4

7. The problem is further complicated by the growth of population which is reflected in the dilemma that with all the effort and progress in school education during 1951-61 there were 36 million more adult illiterates at the end of the decade.

8. It will be hazardous to depend upon development of the school system for elimination



of illiteracy. There will continue to be vast masses of adult illiterates which cannot be allowed to suffer inferior and ignorant existence. The Universal Declaration of Human Rights, Article 26 of which states that every one has a right to education, applies equally to the adults of the future as to those of the present. Moreover, it would be imprudent to allow wastage of manpower resources by delaying attainment of universal literacy, enfeebling mass participation in national development and integration programmes and accentuating cultural and social inequilibrium. Further, national security will suffer to the extent that communication among the masses of people is weak and uncertain and that there continues to be resistance to change. The simplest security measure such as rationing of food presupposes literacy among the masses of people; the alternative is exploitation of the illiterate and denial to him social justice.

C: Experience in other Countries

9. There are certain countries in which campaigns against illiteracy have succeeded and according to the Unesco expert the following common characteristics are noted in the successful campaigns:

"the firm intention of governments to give high priority to the eradication of illiteracy and to make it one of the fundamental tasks inherent in national development or revival; the allocation by the public authorities of the human and material resources required for the conduct of large-scale literacy campaigns within the prescribed time-limits a close relationship between literacy work and the aims and spirit of national development plans; sustained, systematic efforts to establish the necessary services (administrative, educational, scientific, etc.), means, teaching material, and so on; psychological action based on strong political and economic motivations, to galvanise energies and mobilize all resources, uniting organizers, instructors and pupils in one and the same cause; and, lastly, efficient coordination, at every level, of all the resources used, thus making it possible to ensure the convergence of the various activities and the indispensable concentration of available means."

10. Similarly the characteristics of some efforts which have not produced desired results and which have resulted in wastage are summed up.

"This disproportion between ends and means, this narrowness of vision, and this failure of continuity in the efforts made, have all too often simply reflected the absence of a real determination on the part of governments and the various authorities in charge of literacy work to eradicate illiteracy."

Because of the shortage of funds, those responsible for literacy work have often been tempted to teach people "to read and write by makeshift means, using only the services of unpaid or poorly paid teachers, or of volunteers drawn from the educated sections of the population. It has not been possible to provide the adult students with textbooks specially designed for them or with follow-up reading material, or to give them access to libraries. Radio and television, and perhaps even the simplest audio-visual aids, could not be used as widely as would have been desirable. Illiterates could not have the benefit of the services of instructors specially trained for teaching them. It has not been possible to undertake the sociological and

educational research necessary for devising methods suited to adults or for the preparation and launching of programmes.

In other words, literacy work has remained a secondary sector, a substitute for primary schooling, which is itself inadequate."

#### D: Concept of Literacy

It is generally agreed that literacy in the context of adult education should be more than what it has often been interpreted to mean in the past e.g. 'ability to read' or 'ability to write one's own name'. Even the criterion laid down by the Expert Committee on Standardisation of Educational Statistics in 1951, namely, "ability to read with understanding and write simple statement on his every day life" is now considered insufficient. Literacy, it is argued, must be 'functional' in the sense that the literate should acquire adequate mastery to use the tools of literacy to pursue his own interests and ends. The International Committee of Experts on Literacy, meeting in Paris in June, 1962, defined the literate person thus:

"A person is literate when he has acquired the essential knowledge and skills which enable him to engage all those activities in which literacy is required for effective functioning in his group and community, and whose attainments in reading, writing and arithmetic make it possible for him to continue to use these skill towards his own and the community's development".

12. The World Congress of Education Ministers on the Eradication of Illiteracy organised by Unesco at Tehran (1965) concluded "that rather

than an end in itself, literacy should be regarded as a way of preparing man for a social, civic and economic role that goes far beyond the limits of rudimentary literacy training consisting merely in the teaching of reading and writing. The process of learning to read and write should be made an opportunity for acquiring information that can immediately be used to improve living standards; reading and writing should lead not only to elementary general knowledge but to training for work, increased productivity, a greater participation in civil life, a better understanding of the surrounding world and should, ultimately, open the way to basic human culture."

13. Demands on "literacy" increase as time moves on. This is inevitable. The competitive pressures of international life call for accelerated economic production and continued social renewal which in turn depend largely upon the impact of the growth of the scientific and technological knowledge among the people. If literacy is worthwhile at all, it must further the processes of national reconstruction. This emphasis apparently seems to subordinate literacy as a human right to its pragmatic and economic function; but this need not be so. It is realized that the tools of literacy, reading, writing and elementary arithmetic must be acquired by all, but the process of adult education should not rest with this acquisition.

The methods and teaching and programmes of adult education should inspire and enable the adult to use the tools for his own further education if he so desires. At the initial stages many persons would be content with literacy which would just enable better social communication and give ability to keep himself informed, for example, by reading newspapers. This by itself will be no mean gain. There would always be a few who would be spurred by their occupational or other interests to learn more and to go ahead to acquire more knowledge by joining special classes of continuation courses for formal education. Adult literacy programmes should provide avenues for all. Apart from the inability to make a positive contribution to socio-economic development, the illiterate is unable to enjoy his normal civic rights and he continues to be rated as an inferior citizen. One of the elementary functions of literacy is remedial to the extent that it enables social communication necessary for civic existence.

14. Nothing but disappointment will be reaped if one hopes to attain in the near future high standards of functional literacy. Given a poor start it will take time for the standards to build up. Gains in illiteracy will certainly be reflected in the social as well as in economic life to the extent that education affects the quality of life and attitudes of people, but if

measurable improvements in the quantum of economic output as a result of investment in literacy are expected, one would be advised to be cautious. Even in the most advanced circumstances significant and direct correlation between literacy and economic output has not been fully established. On the other hand, it should be recalled that "the map of illiteracy is the map of poverty" and the price which the country has to pay for illiteracy is by no means small.

E: Objectives of Literacy Programmes

15. Where adult literacy has been considered as an end itself, it has led to disappointments. The quality and content of literacy education are essential factors for its success; it is psychologically, the best of motivation for the illiterate adult as well as to those who control allocation of public funds.

16. Solutions to the problem of illiteracy are complex; the solutions must consider the varying social and economic structures, development of education in the locality, the local attitudes and problems, the customs and traditions as well as faiths and beliefs and a host of other factors relating to the lines of the people. There can be no single answer for all varieties of situations and the tendency to over-simplify solutions which have highly complex psychological, sociological and economic implications will not help success. Each situation provides scope

for study and research as well as experimentation and provision for opportunities for these is one of the essential requirements of literacy programmes.

17. While the patterning of programmes must vary, each programme should in varying degrees have the following ingredients;

- (a) It must be 'work-based' aimed to create attitudes and interests and to impart skills and informations which will help a person to do his job efficiently;
- (b) It must help the adult illiterate to interest himself in the vital national problems and to participate effectively in the social and national life of the country;
- (c) It must impart such skills in reading, writing and arithmetic as would enable them, if they so wish, to continue their education through continuation classes or other avenues of formal or informal instruction.

A wide variety of programmes can be visualised depending upon the institutions where education is provided, the competence of the teaching personnel, other opportunities available in the locality, and the nature of leadership. Adult literacy classes, if conducted in a good secondary school, or in an agricultural demonstration farm or in a factory are bound to have different approaches. It will be small advantage to tie up all programmes to a

common pattern. There must be flexibility of approach and room for initiative and experimentation. Above all, there must be opportunities for doing the best that can be done in a given set of given circumstances. According to the resolution of the Education Ministers' Conference on the Eradication of Illiteracy at Bangkok "The literacy and adult education techniques, the reading materials, and the texts used need greater diversification so as to adapt to the various needs of each society".

F: Strategy of Approach

18. The magnitude of prevailing illiteracy is indeed disconcerting particularly when measured against the limited human and material resources available in the country. The situation demands an unconventional strategy and application of new techniques.

19. Experience of valuable work in other parts of the world reveals interesting experience. Methods which have been successful in one set of circumstances have not shown equally good results in others. Educational objectives differ according to the level of development and socio-cultural development in different countries and the international experts are of the view that no one solution can be adopted for all countries.\*

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\* Recommendations of the Commission No. I, World Conference of Education Ministers on the Eradication of Illiteracy, Tehran, 1965. p. I.



20. The studies made by Unesco experts (Literacy as a factor in development 1965 - a background paper for the Conference of Education Ministers favours "selective and intensive" approach, selective in order to limit undertaking to manageable proportions and intensive in order to ensure quality of education and to link up literacy with economic and social development and manpower needs. "Mass" approach which in some cases is understood to be less successful is associated with diffusion of resources. Each country, however, must adopt strategy which will be best adapted to its peculiar social conditions, national aspirations and availability of resources.

G: Remedial Measure: Compulsory Part-time schooling for age-group 10-14.

21. The Education Commission has already accepted in principle that the major adult education offensive should be in the direction of arresting the swelling of the future ranks of the illiterates by subjecting these who escape the school system or drop off upto the age of 14. The leaks must be plugged and the sources of illiteracy nipped in the bud. The Directive Principle of the Constitution relating to Education applies to the persons of the age of 14 and below and literacy for them is a matter of priority. In concrete terms even this is an enormous undertaking. The age-group 10-14 alone, according to

the Census Report of 1961, consists of 28.46 million illiterates out of a total of 49.30. The standard of literacy of those who are classed as literates cannot be assumed to answer the criteria of functional literacy even in its modest sense. The school system must be adapted and strengthened in order to cope with this important responsibility of providing those below 15 years of age part-time education or education in special evening classes. Responsibility of extending opportunities for education to the youth below 15 outside the schools must be squarely placed on the schools in respect of the population in its vicinity. The teachers should be remunerated for teaching and other activities related to the education of the youth below 15 years of age outside the school. Some form of compulsion of boys and girls below 15 to attend part-time classes is very necessary.

#### H: Selective and Intensive Approach

22. Selective approach aims to cut the problem to manageable proportions and to ensure desired results. A suggestion in one of the background papers by Unesco "Perspective of Educational Development in Asia" - A Draft Asian Model - by Unesco Regional Office in Asia, Bangkok, 1965, is that one of the objectives of the programme should be to eradicate illiteracy to the extent of 75% of 15-29. (75% of 15-29 age-group works out to 59.0 millions (1961 Census figures). In

the conditions obtaining in India it would be difficult to confine literacy programmes to a particular age-group. Age-wise approach imposes two-fold responsibilities; to reach education to all in the select group and to prevent those outside the age-group from crowding the limited places meant for the selected. The adult education administration will be hard put to face both the situations. Similarly it will not be possible to move from area to area, because political consciousness will insist on equality of opportunities.

23. The selective approach is comparatively easy to operate in conditions which can be controlled in some measure. The following examples are illustrative:-

(a) There are several agencies, industrial, agricultural, commercial and official which employ a number of illiterate workers. It should be possible to persuade the employers, or even to bring some pressure on them, social or, if necessary legal, and get their cooperation for making the illiterate employees literate. Factories should be encouraged to provide on-the-job training with a view to raising the efficiency of the workers and thus link literacy with the acquisition of vocational and technical skills. The big industrial plants in the public sector can set the pace and eradicate illiteracy among the employees as well as train them in skills which would improve their quality as workers. The

employers should be asked to set aside some time during the working hours for literacy work and show that they favour workers who become literate. As in Yugoslavia, it should be the responsibility of every employer to see that every illiterate employee is trained and made literate within a stated period of time which may be two or three years. The literacy programmes should be closely linked with building up of attitudes, cultivation of skills and imparting of knowledge which would improve the professional efficiency of the workers. Every worker even at the domestic level could be educated if the cooperation of the employer is forthcoming.

(b) All economic and social development plans have their human aspect and every project should include provision for literacy and training of the personnel. Tehran Conference recommends that "all adult literacy operations be conceived as an integral part of the development plan and linked with vocational, social and cultural training". Functional literacy must indeed be linked with and assist process of economic development; it is no less true that literacy and training of the human material should be built in all development projects. There is considerable force in the argument put forward in the Unesco document "Literacy as a factor in Development" which makes a "distinction between literacy campaign which aims at being universal and would hence be regarded as an item of consumption expenditure with a social purpose to be chargeable to the education budget, and literacy campaign designed solely to increase productivity of certain development projects, and hence appropriately financed from the allocations made for the economic development".

(c) There are several schemes introduced by various departments and organisations such as those of Agriculture, Cottage Industries, Community Development, Khadi and Village Industries which have launched schemes of social significance and involve large illiterate populations. It is realised that linking of literacy with these will not only provide powerful motivation for literacy but also assist in improving the efficiency of the schemes. For example, the khadi spinning scheme of the Khadi Gramodyog organisation involves several lakhs of women who are taught to spin yarn and to sell to the organisation what they spin. These women could not only be made literate but better workers for the khadi development scheme, if literacy programmes are incorporated in the project. The Community Development Department has launched with the support of international organisations the applied nutrition schemes. The problems of nutrition and child-care could serve as strong motivation for literacy and association of literacy training with the scheme of applied nutrition will undoubtedly render it more effective. There are several such schemes which will succeed much better if they are connected with literacy programmes.

(d) Literacy programmes can be made media of initiating valuable economic developments. Mr. J.C. Mathur has presented an excellent scheme

"Farmers Self-study Project" or "Krishak Swadhyaya Mandal Project". His main thesis is that a group of farmers could be inspired to get together and constitute a sort of a club for the study of their common problems and for exchange of experience. When groups of 10 or 20 farmers is formed and meet for discussions, opportunity should be taken for adult literacy work by giving them information which will widen their interests and create the right mental attitude for acquiring more knowledge and experience of value. They should be encouraged to learn to read and write. Interest in literacy can be developed with the help of pamphlets and literature of value to the farmers, information relating to agriculture and other topics communicated through radio and other media of mass communication, and extension programmes and demonstrations by the department of agriculture. The process should further lead at least some members of the study groups to seek further education through the system of continuing education. The village level workers could play a valuable role in establishment and servicing of such circles. This is laudable approach and its application can be extended to other occupational interests besides agriculture.

I : Conscription for National Service

24. In Iran the task of adult education is made easy by the national policy of conscription of the youth for military service. Those among the

conscripts who have had the benefits of education are utilised as teachers for literacy programmes. Illiteracy among the conscripted age-groups is effectively eradicated during the period of training. India has no such programme at the moment, but forces of circumstances are compelling thinking in the direction of some form of conscription. The Commission is already considering the possibility of requiring compulsory national service in some form from the youth in the schools and colleges as a part of their education. If this trend continues, and indications favour its continuance, what is regarded as an unpleasant course may be considered inevitable and the youth of an age-group, say 19 years, may be called to undertake training for national defence and to render some service in the form of labour for one or another of the important projects such as building dams, roads, canals, etc. One major form of such service should be teaching the illiterate. A decision of this nature does not rest with education; education can perhaps encourage it. Its realisation may seem a remote possibility, but when national attitudes are subjected to severe stresses by the growing challenges, a revolutionary change in outlook cannot be ruled out.

J: Limitations of Selective Approach

25. Selective and intensive programmes of functional literacy for the adults should have an

important place in the national system of education. Their bearing on economic development entitles them to special consideration. It has, however, to be admitted that the impact of these programmes on eradication of illiteracy cannot be considerable. One cannot depend upon the 'selective approach' to eliminate illiteracy in the near future; even the results of the massive growth of primary education have been rendered ineffective by the growth of population. Literacy has significance which goes beyond economic considerations. It is a human problem. Literacy is essential for the emancipation of the human spirit from the bondages and exploitation which cripple the ignorant and make him lead inferior existence. Literacy should symbolise liberation even if in the initial stages it just enables social communication and opens the door to knowledge through the written word. A thousand national problems, such as those of national integration and of operation of vital national policies including the educational are slowed down because masses are illiterate. It hurts national prestige to be classed as a nation of illiterates. The nation can ill-afford to delay mounting of a crash programmes for elimination of illiteracy within ten or fifteen years. It is a task well worth it. It can be done: given the national will and willingness to pay the price.

K : Mass Approach

26. Mass movements to combat illiteracy have been



tried in the past but they were neither well-planned nor sustained with enthusiasm and material support. The most unique of them which was launched in the recent years is the Maharashtra Gram Shikshan Mohim - Village Education Movement. The scheme has attracted much public attention and while some experts have rightly found room for betterment, its success has been conceded in a large measure. The scheme is simple in conception and depends upon the local village patriotism and determination to eliminate illiteracy among the illiterate men and women in the village with the help of the local school teachers and of those others who have received education. There is competition among the villages which celebrate banishment of illiteracy with great enthusiasm. The cost of the scheme is very little; about Re.1 per head, it is claimed. The weakness of the scheme is said to be insufficient follow-up work which results in relapse into illiteracy; which according to one estimate is 40%. The gains of the Mohim are more than mere literacy; it knits the village community closely, resolves the barriers which occasion group tensions and lead them to better understanding of and participation in the civic life. It is said that the social conditions in the rural Maharashtra are particularly favourable for the "Mohim" approach. A recent Seminar organised by the Planning Commission at Poona reviewed the results of the Mohim and has come to the conclusion that with

certain improvements and safeguards it can provide a basis for a national programme for elimination of illiteracy. It will indeed have to be adapted to the varied social traditions and state of development; but here is an experience which provides a direction for further efforts.

L : Conditions necessary for Mass Approach

27. World experience and our own experience reveals that the adult literacy campaigns should be launched very thoughtfully and methodically. In the particular context of our country, no programmes should be launched at all until as a precautionary measure certain conditions are ensured and certain necessary preparations vital to their success are made in advance. The more important of the series of stages which must be gone through are :

- (1) A firm assertion of the will of the people to eradicate illiteracy is absolutely essential. The lip-sympathy and sentimental slogans are all that the issue has received so far from the leadership of the country. This national resolve should be expressed not merely as a decision of the Central and State Governments but in practical involvement of the leadership of all political parties as well as social organisations and leading industrialists merchants, traders and citizens. Governments should not only take decisions but organise

practical participation of all active elements in the entire country in the illiteracy eradication campaign. At the Government level it should be appreciated in practical terms from the very start that adult literacy is not the function of a single administrative department in charge of it; there is hardly a department including, even for example the Defence Services, which are involved and committed to the campaign against illiteracy.

- (2) Before a big campaign is launched the people should be psychologically prepared for it; they must know what the campaign is for, what it aims at and what gains to expect of it. This aspect of mass education should be systematically persevered through radio, and other powerful media of mass communication, talks and statements by leaders, support of films and newspapers. Every possible means should be utilised to prepare people's mind and to inspire them to co-operate. Education of masses should be treated as a matter of national emergency.
- (3) A careful study of the area where the campaign is planned should be made. A survey of the men and women who need training and of their social and economic conditions as well as of factors material and human which are likely to further or inhibit the literacy campaign should be carefully made, a list of the educated persons who

would be able to assist in the work should be drawn up and a note taken of schools, farms, factories and other such institutions which could be of help. There should be a thorough assessment of the situation.

- (4) A detailed plan of action should be prepared in advance and every step involved should be anticipated and provided for. Those involved should be acquainted with every detail of the action planned in order to make sure of intelligent and practical co-operation.
- (5) The material required for carrying out the plans should be kept ready. Textbooks, teaching materials and all that is considered necessary should be available when the scheme is launched.
- (6) Local leadership which is required for organisational assistance should be first organised, trained and acquainted with their respective functions. In fact one of the preparations for the campaign should be to involve the illiterate adults themselves in the plans for making them literate. They should be constituted in classes or teams or groups and should know what role they have to play in the organisation of the campaign. Their co-operation is of the essence.
- (7) Where necessary, the scheme may be tested out in pilot project with a view to take remedial

- ~~measures and apply correctives~~ before major plans are launched.
- (8) Arrangements should be made from the outset for recording all information which will be necessary for evaluation. The scheme should be examining itself as it works and correcting flaws which are noticed.
- (9) The staff for teaching and other staff required should, whether consisting of teachers in schools or educated persons who volunteer their services should be pedagogically briefed in the methods of teaching and treating adults.
- (10) Planning of the programmes should include the following services :
- (i) Helpful programmes on the All India Radio broadcasted according to time schedule arranged in consultation with the A.I.R.
  - (ii) Extension services by various departments e.g. Agriculture, Cottage Industries, Health, Co-operatives, etc., and the neighbouring universities.
  - (iii) Demonstration e.g. agricultural, scientific, industrial.
  - (iv) Educational films, and where possible exhibition of material of educational value.
- (11) Preparations for follow up should be ready when the plans are launched. This is not what should be taken up after the literacy courses have ended. Those in charge of the follow up should

be associated with the attitudes and habits as well as of the reaction of the adults when exposed to educational influences.

(12) Planning should visualise what permanent activities would continue even after the intensity of campaign dies out. It is essential to plan methods whereby the neo-literates will with the help of one another continue to learn on their own and constitute self-study groups, clubs; recreational groups and other such associations. The campaign should enable a person to appreciate that learning work and life are a single process.

(13) Provision should be made for competitions, national recognition and awards for good work done by the organisers, teachers, learners or any other agency.

(14) An efficient administrative and supervision machinery as well as a machinery for training are essential ingredients of preparation. The administrative machinery should include psychologists, sociologists, sociometries along with educationists. Helpful supervision and timely assistance must be provided in the system.

(15) The goals of the campaign should be kept within the knowledge and even of the sight of the adult illiterates. They should realise from the very outset that after they have learnt to read and

write, the other doors to learning will open out to them. They can know more about whatever they wish to. There are books in the library which they can consult; there are also other courses which can be organised to tell them more about their own occupational matters. They may even take continuing classes and can step by step, if they have the will and perseverance, take a university degree, or a technical diploma later in life.

- (16) Adult literacy campaigns presuppose compulsory school education for children and checks to prevent growth of illiterate population in the future.

M : Teaching Personnel

28. The rate of elimination of illiteracy will depend upon the teaching personnel which can be mobilised for the purpose. The essence of the campaign approach is that the task should be accomplished in as brief a period of time as possible, it requires an enormous effort to sustain enthusiasm for a campaign of this magnitude. From this point of view, the larger the personnel which can be harnessed for teaching the adult illiterate, the better for quick accomplishment of the task. The large army of the teachers required should consist of the following :-

- (i) Teachers in primary, middle and high schools - with some special training;

(ii) Pupils in

- (a) class VII of the middle schools;
- (b) high school classes;
- (c) the undergraduate classes of universities and colleges with appropriate training;

(iii) Educated persons who volunteer to teach with training.

29. Teachers in schools will in future be called upon several forms of service which they have not been asked to do so far, e.g. taking part-time classes for age-group 10-15 which are not in schools and teaching in continuing classes. It may, however, be assumed that one-third of the teaching force will be available for adult literacy programmes: this, according to 1965 figures, would mean about 0.69 millions.

30. It is necessary to involve pupils in class VII of middle as well as those in secondary schools in the campaign. There can be understandable divergence of views on this approach, though there would be little objection to using students in colleges and universities for the purpose. The Commission is considering some kind of national service from the students as a part of their education and if this is conceded, working for literacy should be a more acceptable form of service. At any rate, for many students this will be a means



to improve their own knowledge. From the point of view of the campaign the advantage of using students would be that they could deliver literacy at the homes of the people, particularly of women, who are shy of being taught by men in regular class-room atmosphere. Boys and girls coming from homes where adults are unlettered could be used as means for removing ignorance from the homes. If the students are given a little training by their teachers who also organise, guide and supervise their activities, adult literacy programmes will arouse no small interest. According to 1965 figures the categories of students under discussion number 11.5 millions. If only a third of these are available for work each year, the teaching force would number about 3.8 million.

31. The teachers and students are known entities and they can be to a certain extent controlled. The number of educated volunteers who will offer to work for adult literacy programmes cannot be estimated; that will much depend upon the enthusiasm which the leadership is able to arouse. There would be, of course, some response and, with the teachers and pupils it should not be difficult to build up a teaching force of about 5 million persons. This is an assumption which cannot be regarded as impractical. It must,

however, be appreciated that a force of this magnitude can be created if the nation decides to do so. This is a test of national leadership.

32. The teachers should be paid for extra-work and it is suggested that they should be given a pay of Rs. 30 per month if they teach about 20 adults regularly on every working day. The teachers should also receive proper training for teaching adults and in turn train students and other volunteers.

33. In order to cut down costs it is necessary that the students activities in adult-literacy programme should be carried out in their own homes and in the vicinities in which they live. They should be helped by the adult education administration in fixing the homes they should visit and giving them all assistance and guidance. It is true that this suggestion might create imbalance in the plan because there would be more volunteer teachers and students in areas where education is advanced than where it is less developed; but this has to be accepted as a fact of life.

34. If on a rough assumption on an average every teacher teaches successfully 5 illiterate adults in

each year, illiteracy should disappear in about six years; even making allowance for setbacks, it should not take more than ten years to do so. The nation should resolve that there shall be no illiterate in 1976. The task can be done; there need be no despair. The will to do so is what is needed.

N: Two Stages of Literacy Programme

It is pertinent to plan for adult literacy with due regard to the fact that the teaching force is a mixed force consisting on one hand of qualified school teachers and on the other of students and volunteers. In the face of the existing situation and of the national urgency of eradication of illiteracy, there is no assistance which should be considered to be too mean. A good organisation should dovetail all assistance to build up a well-directed effort. It would be wise to conceive of the literacy programme in two stages, mainly from the point of view of the varying competence of the teachers:-

- (i) A five-month course in which the adult should be initiated to reading and writing and simple arithmetic. This should be a simple course which can be handled by the students and volunteers.
- (ii) A second five-month course should be more advanced and it should aim at improving the skills acquired earlier and at guiding the adults to use them for their own purposes.

This second course should enable the adult to acquire sufficient skills and general knowledge to profit by continuing classes leading to further education or by reading simple literature in which he is interested.

0: Literacy Programmes and Extension and Other Services

36. A ten-month course involving  $1\frac{1}{2}$  hours work on five days a week would provide adequate time for the adult to get fair skills in reading and writing. Literacy courses should be accompanied by other educational influences which would aim at giving information of interest and of value to the adult and thereby create appetite to learn on his own. It should also help him to build up attitude which comes in the wake of modernisation and help to further it. The teachers would need to be told through specially prepared handbooks, guide books, journals, and other aids what the adult needs to learn and how he can be helped to do so.

37. The teachers' work must be supplemented by a variety of other agencies e.g.

- (i) Radio programmes specially prepared for the varying needs of the neo-literates;
- (ii) Film shows;
- (iii) Lectures and talks on problems of interest;
- (iv) Recreational programmes of educational value;
- (v) Extension services of the various social and economic development departments, e.g. Agriculture, Cottage Industries, Health, Cooperative, Community Development;

- (vi) Demonstrations by Departments of Agriculture, Industries, Health, and others;
- (vii) Extension Service by the Universities.

Adult literacy programmes which are not accompanied by these and other similar efforts directed towards the end will be poor. The function of these activities is to create atmosphere and build up interests which would enable the literacy to become functional.

38. The consumption of adult literacy programmes, which with their success must disappear, lies in inspiring the adults to take advantage of continuing education, which is proposed to be provided in many ways. His interest must be kept alive through systematic follow-up efforts. Provision of libraries, radio programmes and intensive extension services are some of the answers to the problem.

P: Some Urgent Needs

39. A national programme of adult literacy would require a competent administrative machinery which will be challenged by unpredictable factors and situations which no routine file-pushing can solve. The nature of the machinery required will be considered in a subsequent chapter. Some of the important functions of the administrative machinery from the point of view of literacy will be :

- (i) studies and research into sociological and psychological problems connected with adult literacy;
- (ii) planning and programming of adult education activities;

- (iii) production of material, for example -
  - (a) Books and pamphlets and other reading material suitable for use by the neo-literates;
  - (b) visual and graphic materials, films and filmstrips;
  - (c) guidebooks for teachers, volunteers, students as well as journals and periodicals to give ideas to the workers;
  - (d) tapes and gramophone records of talks and instructions;
  - (e) teaching aids: black-boards, maps, charts, etc.;
  - (f) publicity campaign, including production of periodicals.
- (iv) coordination of the activities and extension programmes of various departments, universities, other agencies and voluntary organisations;
- (v) training of teachers, including students and volunteers, supervisors and other administrative staff and evaluation staff. It would also be desirable to organise instruction for workers in the field through correspondence;
- (vi) servicing, supervision and guidance of adult literacy activities;
- (vii) special attention to the weaker sectors of the population e.g., women and tribal people as well as remote areas which cannot be serviced in the normal methods;

- (viii) organisation of follow-up activities;
- (ix) evaluation.

Q: National Board of Adult Education

40. Eradication of illiteracy is a national problem and it has to be viewed as such administratively. Basically, it is directed to realise deeper national integration, fuller appreciation of national attitudes and intelligent participation in national reconstruction by the masses of people. Thinking and general planning of adult education programmes must, therefore, be undertaken centrally. It would also be desirable and even economically satisfactory if the central agency undertakes such important tasks as:

- (i) Preparation of books, guide-books for teachers, and all other material for audio-visual aids;
- (ii) Coordination with All India Radio and Television and with other departmental and developmental agencies, including other all India organisations for social welfare;
- (iii) Research, evaluation and general survey of the progress and of follow-up activities; and
- (iv) Publicity.

41. These tasks can be undertaken effectively in cooperation with the State Governments, Departments of Government other than Education which are concerned with national development, universities and other organisations. It is, therefore, proposed that

an All India Board of Adult Education be constituted which should also concern itself with the problems of adult literacy. This Board will have to be large if it has to reflect the views of the State Governments and other agencies but it should not be too large and unwieldy. The Board should be constituted by the Ministry of Education in consultation with other Ministries dealing with social and economic development and other allied problems. It should enjoy autonomy and it should have a strong professional secretariat to undertake activities referred to above. Its autonomy should not result in its isolation; its main raison d'etre is to strive for coordination of all Governmental and non-Governmental activities and to accommodate inter-departmental objectives in planning for adult literacy and adult education.

42. It is equally necessary to have similar Boards at the State level and to effect a liaison between the State and Central Boards in order to exchange ideas and experience and to adopt common policies.

R: New Role of the School Teacher

43. The adult literacy campaign as visualised in this note is bound to make heavy demands upon the teachers. The teacher will have to be considered like any other civil servant, as non-vacation employees. The school may have holidays and vacations, but the teacher will be entitled to leave which non-vacation officers have. He should also be entitled to special pay and allowances for the work



which he does in addition to teaching in schools. The success of the campaign will depend upon putting the teacher's status and conditions of service right. The Commission is possessed of this aspect of the problem.

S: The People's School

44. The concept of the school needs a revolutionary change. It should not be a school for children undertaking limited task of running classes for five hours on school working days. The Commission is already considering fuller utilisation of the physical amenities available in the schools. What is still more important is to conceive of the school as the people's school. The walls which separate it from the community must disappear. The function of the school is to service the community as best as possible and to be a radiating centre for all cultural activities and extension services. The schools should not merely exist to teach children but to make their illiterate parents and others in the locality literate and to organise follow up activities for the neo-literates. The responsibility for organising, imparting and assessing progress of literacy in a defined locality should be placed on the school which serves it. The schools should be built and equipped to serve these new social functions. It should have at least a library. Even the smallest school should be kept supplied with carefully selected books from a bigger library centre. The Chinese concept of 'the peoples school' should be adapted to the Indian conditions.

Departments concerned with social and economic developments should also help to develop the schools to the extent that they can be utilised for extension services. They can certainly use the schools for displaying exhibits and posters, supply simple and useful reading material, arranging film shows and in several such ways. The schools should become the centres of cultural life of the community.

T: Weaker Sections of the Community

45. Special adult literacy programmes are necessary for the weaker sections of the society, particularly the women and the tribal people and other handicapped groups. These programmes should be prepared with due regard to their social status and to their habits of life. One advantage of using the school children for literacy work is that their visits will be acceptable to women; so would be visits by pensioners and retired persons. Perhaps some additional steps will also be necessary and it is for local studies to indicate the approach that would be most fruitful. One method which has been tried can be perfected with advantage. In many villages there could be found women who have had a little education at some time and who do no more than the daily grind of life. These women should be persuaded to take some intensive education courses of the type which have been successfully organised and known as 'condensed courses'. The courses should improve their education and train them for leadership among the women of the villages. They should then go back to their village and engage themselves

in organising adult literacy classes for women. Many of them would gladly do the job for a small salary of about Rs.30 or Rs.40 per month. They may be called, as they have been, the 'village sisters'. It should be possible to create a fairly large corps of such workers who can serve as centres for rural women's education. Similar measures can be considered for tribal areas.

U: Motivation

46. The will to learn needs assiduous cultivation particularly in the people who have resigned themselves to their fates and to life of the underdog. The following are some of the steps which are necessary to arouse in the illiterate adult the urge to learn:

- (i) The leadership and the media of mass communication should create and sustain a relentless propaganda to make the illiterate feel that he is not a really free citizen - that he is a C<sub>3</sub> citizen;
- (ii) The adult should be acquainted with the efforts and achievements of those countries which have developed full literacy in a brief period; for example U.S.S.R. which is now regarded as a leading world power.
- (iii) Education should convince him that it will make him a better workers and enable him to go up in his field of work;

(iv) Departmental certificates should be awarded to those who pass in adult literacy tests and public recognition given to those who graduate in these tests. Holding of local convocations and functions to honour the effort of the successful persons would provide much incentive. Publicity should be given about those who join continuing classes and get higher education. Public recognition is a factor of considerable importance.

It is already suggested that the teachers in schools should be given an additional salary of Rs.30 p.m. for the work of adult literacy. The teachers who show special competence and leadership in the field should receive national awards.

Public recognition of the services rendered by the students and volunteers for adult literacy work should be expressed in a variety of ways. The work done by the students should be entered in their certificates which should receive special consideration when they seek opportunities for work in public or private service.

Voluntary organisations should get grants as well as recognition. Those who show exceptional leadership and do valuable work should be included among those who are given national honours on the Republic Day.

#### V: Methods of Teaching

47. It is recognised that methods of teaching

adults should be different and that all those who have to teach the adults should learn the methods of teaching and treating the adults. The adult is mature, responsible, and if he is interested he can take pains. He is sensitive and he is by no means an inferior just because he remained uneducated. The teacher should be an equal - a friend and a guide.

48. Every training institution in the country should teach methods of teaching adults to all teachers under training. The teachers already trained and working in the school should be given literature giving information on the subject of teaching adults. Regular periodicals giving instructions be produced and even correspondence courses should be organised. There should also be regular seminars and discussions among the teachers for exchange of views and experience. The students and volunteers who work for adult education should be particularly helped and trained and their interest kept alive by regular supply of information.

49. The vigour with which the mass campaign is launched and the support of leaders of all kinds will indeed create the right attitude in the adults towards literacy drive. Pictures, film shows, posters, radio broadcasts can together create an atmosphere favourable for the adults to learn. It is also necessary that the first few lessons to the adult should be oral and should impress upon them the advantages of education and to acquaint them with the experiences and achievements of the other countries.

50. Organisation of classes will also require considerable thinking. The adult should no doubt find

himself as far as possible in congenial atmosphere, in the company of persons he likes, meeting at hours and places which are convenient to him and in an atmosphere which is charged with a spirit of urgency. But he should also be made to realise that he has to make some sacrifices for his own and incidentally for the national good. He must appreciate the goodwill and efforts which others are making for his betterment. When the movement was launched in Russia there were no special teaching aids or techniques available to them nor any special material. All that the country had was youngmen and women fired by a sense of purpose, paper and pencil, a place to assemble and devotion to work. Enthusiasm of the teacher and his consciousness of the service he is rendering to the nation is a factor of enormous value. No method can do better than a teacher inspired with the sincerity of purpose and doggedness of those who offer work for adult education.

51. Adult literacy programmes aim at more than mere skills in reading, writing and simple arithmetic. Teaching must be related to social and economic reconstruction and it should arouse appreciation of national problems in the solving of which he is called upon to make his contribution. It should be clearly realised that the school teachers and others who volunteer to teach the adults have their limitations. It is essential that their work should be supported and integrated with -

- (a) All India Radio broadcasts specially arranged for them;

- (b) Extension service, demonstrations and exhibitions by the departments concerned with social and economic development and by the universities; and
- (c) the intensive use of audio-visual aids.

The main responsibility of making people development conscious should be the responsibility of the departments of Governments dealing with social and economic developments, the responsibility for educating people in participation in national programmes should be that of the All India Radio and of the leadership of the country. The teacher will no doubt help, but he cannot do so alone. The use of audio-visual aids will be particularly helpful in widening the interests of the adults and helping them to appreciate modern attitudes on life and its problems.

52. One cannot over-emphasize the value of education through the spoken word - conveyed through a variety of means and media. This method is in keeping with the old Indian traditions. In the past, the country may not have provided literacy to all but it did not fail to convey to them from time to time the prevailing views and discussions relating to social and moral behaviour and the responsibility of the individual to the society. What is known as the 'Santaparampara' or the tradition of 'Santas' was a continuing endeavour for involving the masses or people in serious thinking and re-interpretation of the ancient values of life and thought in the context of the prevailing challenges. Ramdas, Tulsi, Kabir and a host of others educated the people to the realisation of their duty to humanity. Mahatma Gandhi

was the last of the 'santas' who created a revolution in the minds of illiterate masses of people and aroused them to the appreciation of deeper human values. The art of understanding of the spoken word, of acquiring knowledge through it and of communicating ideas orally is, if anything, of greater importance in the world of today when minds of the masses are moulded by the mass media of communication. A reference has already been made to some aspects of adult education which will be best imparted orally in order to arouse intelligent awareness of the social, economic and security problems of the country. The process of acquiring literacy is slow; of using literacy is slower. But education<sup>of</sup> the masses should not wait till literacy is fully mastered and used. Through the spoken word, through the mass media of communication through audio-visual aids, people should be introduced to the world of ideas which are relevant to their lives, to their happiness and to national well-being. Literacy will no doubt progress as people grow richer in ideas and acquire new interests and purposes.

53. A strong national effort to eradicate illiteracy is essential as a remedial it is directed to make up the deficiency of a century or more. Once the existing illiteracy is removed and the Directive Principle of the Constitution realised, adult education will confine itself to more enduring forms and activities. Illiteracy is a



temporary phase in the life of a developing nation, but postponement of an all-out effort to liquidate it will

- (a) deepen and perpetuate inequality and exploitation and deny social justice to the illiterate;
- (b) reduce democracy to a farce;
- (c) impede urgent modernisation tendencies and national drives, ~~for example, for increased production and population control;~~
- (d) ~~slow down national integrity;~~
- (e) fail to provide a sense of national purpose and to build up national character and prestige; and
- (f) ~~deny to the people freedom in the real sense of the term.~~

It is, therefore, imperative that illiteracy is wiped out within a period of ten years.

53(a) In the last analysis eradication of illiteracy depends upon finance and organisation. We have already suggested a general pattern of the organisation which we consider necessary for the country. Organisation, however, is a dynamic and experimental technique and it involves constant self-searching and evaluation

of its effectiveness. Organisation must have flexibility to adapt itself to the changing circumstances which, let us accept it, are changing fast. Finance can be a seriously inhibiting factor for literacy. Finance has often frightened away even the optimists when literacy is considered and Governments are particularly panicky on this score. However, the position should not be gloomy; there are sources which can be tapped. For example, if the programmes of adult education are designed to the standards laid down by UNESCO which is moving in a big way to root out illiteracy from the world, India can hope to get substantial assistance in terms of funds and experience. There are other international agencies such as the Food and Agricultural Organisation which have realised that success of their plans is linked up with the education of the people and which are prepared to provide assistance for literacy schemes. Such assistance should be welcomed. However, it is essential to cut the cost of literacy programmes to the minimum. Success of literacy will ultimately depend upon the spirit of sacrifice and of devoted service of the educated people in the country supported by a positive and efficient organising machinery.

Chapter, III

Continuing Education

1. Scope of the Problem

Education is a life long process "from the cradle to the grave". "Continuing education" refers to provision of opportunities of education to those whose education was either neglected or partial or those who wish to continue their education in one form or another outside the formal school system. It is designed to enable those who have not completed a stage of education to complete it and, if they wish, to proceed to the next; to help every educated person to have further education without formally enrolling in educational institutions; to enable a worker to acquire knowledge, ability and vocational skills in order to be a better worker and to improve his chances of earning more; to help to refresh the knowledge of the educated person and to enable him to keep pace with the new knowledge in the field of his interest; and to give opportunity to a person to learn a skill or a craft or an art of whatever subject may be which he wishes to learn.

2. The Major Issues:

(a) Remedial Measures:

A pass at the examination taken by the children at the age of 14 should be treated as the

national minimum of education for all. It is presumed that the regular school system would consider provision of part-time education, if possible on the basis of compulsion, to children up to the age of 14 who have 'dropped out' of the primary and middle schools. This measure which merits high priority will by itself be only partially adequate. There would still be:

(i) many above the age of 14, who had to leave the school without attaining the minimum standard of education; and

(ii) many more who have become literates through the adult education campaigns and who are prepared to continue their education.

It is imperative that every possible effort should be made to bring education of persons in the two categories mentioned above up to the minimum standard. The gains of adult literacy campaigns must be consolidated by part-time instruction in primary and middle schools and in special centres for adult education. It should, therefore, be made the responsibility of the governments, assisted by the local bodies, municipalities, corporations and voluntary organisations to ensure:

(a) that the schools are adequately staffed and equipped to meet these requirements;

- (b) that there is adequate supply of books and teaching material necessary for teaching purposes;
- (c) that the teachers work beyond school hours ~~for this purpose as a part of~~ their normal duties;
- (d) that adequate number of properly equipped, staffed and serviced adult education centres are established in suitable places to meet the needs;
- (e) that necessary pressures are maintained to keep up the spirit and create the climate favourable for adult education activities - through radio and other audio-visual aids, and
- (f) that this work is helped by systematic supervision and inspection.

(b) A Parallel System

Every adult, who wishes to do so, should have the opportunity through a parallel system of continuation education to acquire education and to qualify for examinations which are normally open to those formally enrolled in schools, colleges and other educational institutions. It may be that the adult will take more time to complete courses and take the examinations than is taken normally by regular students. But the adult will have advantage of maturity and of determination to do so. The parallel system need not be confined to

general education; in fact it is more desirable in the fields of vocational, technical and agricultural education. The parallel stream for continuing education can be rendered possible by the following measures :

- (a) the doors of all educational institutions should be thrown open outside normal working hours for part-time education in special classes for adults seeking education;
- (b) the staff in these institutions should be required as a part of their duty to provide instruction and guidance in these classes;
- (c) additional staff of the type required should be provided wherever necessary, for it will be necessary to offer some relief particularly to the over-worked teachers in the secondary schools;
- (d) correspondence courses should be initiated by the Boards and Universities, and if necessary, by private agencies, for training candidates for high schools, universities and other examinations;
- (e) candidates who prepare on their own should be allowed to appear at the Board and University examinations privately - and assistance should be given to them by strengthening libraries in schools

and colleges and throwing them open in the evenings to adults who wish to profit by them;

- (f) (i) assistance of radio should be organised for teaching certain difficult themes;
- (ii) tapes and gramophone records for containing talks and lessons by the best of teachers on certain important themes should be prepared and kept in the school, colleges and public libraries for use by serious students;
- (iii) there should be a section of library of well chosen educational films in certain central libraries and facilities for projecting them for the benefit of the students;
- (iv) where there is a sufficiently large scope of serious private students or students evening schools or those taking correspondence courses, brief peripatetic visits by experts should be organised to give guidance to encourage the adults.
- (v) Adult students who are required to do practicals in science, vocational or other subjects should be given opportunity for performing experiments or for workshop practice and the other practical work in the laboratories and workshops

of schools, colleges, universities, technical institutions and agricultural institutions; and

- (vi) the place of adult students in the night schools, of those learning through correspondence courses and of those preparing privately in the system of education should be recognised and they should be entitled to the best assistance which can be made available.

(c) Special Courses:

A comparatively large number of adults will not be keen on studying for the usual certificates and degrees awarded by the Boards and universities. They would certainly be interested in taking short courses of studies in subject of special significance to their field of work. This applies to all fields of general, technical, agricultural and professional education. Such courses normally constitute parts of extension work and undertaken by the various departments of universities, colleges and technical and agricultural institutions. The scope of these activities is enormous, but the initiative in the planning of these courses must come from the universities and technical institutes which will naturally consult the employers as well consider the special requirements of the people. These special courses can be a valuable instrument for



assisting the quality of production and for enabling intelligent participation of the workers in economic production. In the fields of science, technology, agriculture and other similar fields, these lectures can be made most interesting by demonstrations and experiments and distribution of suitable literature.

This approach is particularly suited for putting across to the adult population with the assistance of experts and of audio-visual means the significance of some of the urgent national problems such as population control, eradication of untouchability, national integration and production-mindedness. Imaginatively used, this form of adult education can become a source of great national strength.

The system of continuing education should include provision of facilities for instruction in subjects not related to the vocational or career interests of the adult nor to ambition for formal education. He may wish to learn for his personal enjoyment a subject such as music, painting, sculpture, a craft or printing. Institutions which can and voluntary agencies should be encouraged and assisted to undertake this type of education.

(d) Re-education:

The educated people engaged in work, whether in the profession of teaching or in other professions, tend to become stale. While knowledge

not fully used tends to get rusted, the growth of new knowledge provides challenge even to the vigilant students. Continuing education should provide opportunities to refresh knowledge and to get acquainted with the trends of its growth. The teachers, lawyers, doctors, administrators, commercial men - all need to renew knowledge in order to keep abreast with the times. The responsibility for education of this nature obviously rests with the universities and centres of higher technical and agricultural education and their extension services.

(e) Training for civic and political leadership:

The Mouni Vidyapeeth at Gargoti organises besides a variety of useful activities, courses each of the duration of a week for the Chairmen and the office bearers of the Village Panchayat Samitis. These courses, though they are brief, have proved to be of great value. The tendency of the democratic process in the country is to place more and more responsibility in the hands of the elected leadership in the rural localities. The Village Panchayats will in the future form the backbone of Indian democracy and the leadership of the panchayats will, more or less, determine the leadership of the country. Gradually and silently, the leadership is passing into the hands of persons most of whom missed schooling and

education in their childhood. Political, communal and other forces carry leadership into the hands of the uneducated. One may not be too pleased with the situation, but it has to be accepted as a fact of life. Training of our rulers acquires, therefore, very special significance and it should have a high priority in the scheme of adult education. The principle does not apply only to the leaders of the Gram Panchayats; Members of the Legislatures and the Parliament should also have opportunities of devoting a few quiet and detached moments in academic aloofness and in the company of politically uninvolved persons who may perhaps throw new light on the vexing problems of life and acquaint them with richer experience of the peoples far away. There should be regular programmes for

- (i) the office bearers of village panchayats;
- (ii) the office bearers of municipalities and corporations; and
- (iii) members of legislatures and parliament.

The courses for the panchayats leadership such as those given at the Mouni Vidyapeeth should be multiplied and constantly modified to meet the changing needs. Similar courses should be organised preferably in the universities for the leaders in municipalities and corporations. The Extension Departments of the Universities should also undertake organizing of special programmes of workshops, seminars or discussions which will be of special

interest to the members of the legislatures and parliament. It is certainly not intended that the universities should organise courses of instruction for the elected leaders of the country. It would be sufficient to organise meetings and discussions on important national issues of interest to the legislators in which the problems could be considered objectively in less strained academic atmosphere. This would also help to bridge the wide gulf which unfortunately separates the thinker in the university and the practical decision-maker of the country. A healthy meeting of the two is of mutual interest; at least the academic man will not feel the frustration that he flaps his wings in the void. From the point of view of the country such meetings and discussions are of value.

### 3. Institutions for Adult Education

(a) Evening Colleges: In recent years, several evening colleges have come into being which enable adults, who work for a living during the working hours in day time, to attend lectures and to qualify for appearing at the university examinations. (There were 194 in 1964-65. This number includes those for regular whole time students as well as adults who work during day time). With the exception of a few evening colleges, they lack academic atmosphere. Attendance is mostly nominal and not infrequently fabricated. Fees are paid not for tuition and

guidance but for purchasing eligibility to appear at the university examinations. The situation needs urgent remedy. In the existing circumstances there is no purpose served by the ~~university's insistence upon regular attendance in lectures by those who~~ wish to appear at the university examinations. Some universities already allow women and certain categories of persons to appear at the examinations without attending lectures. There would be some advantage in extending this rule to others also. If this is done, the attendance shops will close down, but the institutions which continue will have to conform to acceptable standards.

(b) Correspondence Courses: (i) Delhi

University instituted Correspondence Courses in the year 1963 as an ~~experimental measure in a limited~~ way for certain departments viz., English, Hindi, Economics, Political Science, Commerce, History and Mathematics. The results are reported to be encouraging and there is a growing demand that the courses should be extended to other fields including agriculture and technology. It is good that the scheme was tested carefully in controlled conditions and the experience gained would be of great value in expanding its scope. There is rich experience in this field in other countries of the

world which can be of great interest to us. While cautious and careful planning is necessary for expansion of correspondence courses, the need for it is urgent. In a vast country like ours and with our limited resources, the correspondence courses are a practical and useful way for reaching education to the many who for one reason or another have not been able to get education in universities and specialised colleges. It is proposed that more universities which have the necessary expertise and means should organise correspondence courses.

(ii) The Secondary Education Board of Madhya Pradesh has recently organised correspondence courses to enable persons outside schools to take examinations of the Board. The scheme is in its infancy; but it is undoubtedly a move in the right direction and merits all encouragement.

(iii) The Universities and Boards should not confine themselves merely to courses which lead to their degree or diploma examinations. They should address themselves to a wider purpose of providing courses of interest and value to those who may not be interested in acquiring diplomas and degrees, but who are keen on learning something useful from

the point of view of their occupation or hobby. The agriculturists, the engineers, the businessmen may require short and self-contained courses dealing with special topics which have no bearing on preparation for examinations; but are nonetheless important.

(iv) While the Universities and Boards should enlarge the scope of their activities as best as possible, it is necessary to realise that there are limits to which they can provide correspondence courses. There, however, are no limits to the demands of the people. People would need courses which the university or the Board may not be able to provide and these courses may not be less valuable on that account. For example, there would be the need for courses in vegetable gardening, brick-laying, electric wiring, welding as well as several 'do-it-yourself' courses such as making furniture and simple electric gadgets. A well-devised course creates demand for itself and can help in building up of attitudes and skills required for improving production. It is proposed that there should be an all India Institute of Correspondence Courses which should survey needs of the people, consider courses of instruction which would help national economy and organise correspondence courses in them. There should also be well-planned publicity to encourage as many persons as possible to take the correspondence courses.

(c) Evening Institutions for Part-time Education: There is still need of evening institutions or part-time classes for adults. This is particularly so for courses for vocational or technical training and those requiring practical skill in the use of machines. It is already

suggested that the existing institutions including vocational, technical and agricultural should institute evening classes for working adults and enable them to do practical work in laboratories and workshops,

(d) Special Institutes for Neo-literates: There should be special institutions for further education of neo-literates. It is visualised that the existing schools will expand their frontiers and provide the newly literate opportunity to prepare for more advanced courses. It would still be necessary, particularly in the rural areas and for women, to establish special institutions as well as a large variety of courses suited to the needs and aspirations of those whose meagre schooling just acquainted them with the tools of learning. In this context, the experimental projects of Jamia Millia, Delhi, have special significance. Jamia Millia started special evening classes for the adolescents and adults in 1958. The classes were held for 2 to 2½ hours for five or six days in a week and in addition to the three Rs the courses included topics of adult interest in social studies, current affairs, general science and subject of special concern to different groups. It was claimed that in two years' time those who graduated in this course reached a higher standard of attainment than primary school children do in four years. The experiment also tested new type of textbooks for the adults. The results of this effort has been encouraging. It is also observed that wherever evening secondary schools have been started for adults in the urban areas the response has been



encouraging. It is suggested that wherever possible special evening or part-time primary and secondary schools for adults should be established and that the courses and books should be specially designed to meet the needs of the adults.

(e) Education of Adult Women: Special efforts are necessary for starting institutions for further education of the women. In this field valuable pioneering work has been done under the leadership of Shrimati Durgabai Deshmukh. The scheme which offers 'condensed courses' is blessed by the National Committee for Women's Education. It is intended for a large number of girls who get very little education, if at all, in their childhood and who find later considerable difficulties in maintaining themselves. The 'condensed courses' provide them intensive courses in reading and writing, good general education which is comparable with the middle school standard in the general school system. The 'condensed courses' lead to further education of girls who can later become teachers or nurses or get absorbed in some other occupation. This has been a sound and a practical approach which has benefited a large number of women some of whom otherwise would have remained destitutes for a life time. The system of 'condensed courses' should be expanded as best as possible. These courses should be given in the evening in schools and other institutions. It is suggested that a large number of special institutions which provide 'condensed courses'

should be established and the girls who are willing to work as teachers, nurses and in other ways should be given suitable stipends. It should be the special responsibility of Municipal Committees and Panchayat Samitis to establish such institutions which should also be aided by Government liberally. Creation of a large number of stipends for women in the courses should be fully justified.

(f) Vidyapeeths: The Vidyapeeth of Mysore is an excellent example of the nature of the work which needs to be done in the rural areas. The Vidyapeeth attempts to apply the basic concepts of the folk high schools of Denmark to the Indian conditions. The Vidyapeeth is a residential institution and while it gives general education, it lays stress on practical training in the activities of economic significance to the rural population. Education is production-oriented; and lays emphasis on agriculture and village crafts and industries. Vidyapeeth is also the centre of cultural and recreational life of the rural society. The village youth is required to take five months' training in the Vidyapeeth and during his stay in the institution he has to make contributions in the form of work. The main raison d'etre of the Vidyapeeth is to train the leadership of the village society. Some time back similar institutions under the name of Janata Colleges came into being and disappeared after a brief existence. The experience

of the Vidyapeeth at Mysore indicates that the scheme of the Janata College foundered not because the concept was wrong. There can be no doubt the rural society needs such institutions in large numbers. They will succeed, if they are in the hands of competent and devoted leadership. The Commission should insist on the establishment of such Vidyapeeths in the rural world and they should be made strong centres of a variety of forms of adult education for the rural community.

(g) We have referred to the important function of adult education which is to raise the standard of work done in various programmes by providing education to those who hold important offices in them. The most important area in which serious effort is most urgently needed is training of teachers who are working in the field. They must be acquainted with the new concepts which are growing in the different fields of knowledge with which they are concerned as well as with the new methods of imparting instruction. Of all persons, the teacher needs most continuous education and the responsibility for providing this lies with the universities and training institutions in the country. Special correspondence courses for the teachers and seminars and summer schools are methods which can benefit the teachers immensely.

CHAPTER IV

EDUCATION OF WORKERS

1. Education of the workers, particularly those engaged in economic production, merits high priority in selective adult education programme.

Definition and classification of worker

2. The term 'worker' has different meanings in different contexts. According to the 1961 Census, the term 'worker' is defined as follows:

(a) In the case of seasonal work like cultivation, livestock, dairying, household industry, etc. if a person has had some regular work of more than one hour a day throughout the greater part of the working season he was to be regarded as a 'worker'. In the case of regular employment in any trade, profession, service, business or commerce the basis for work would be satisfied if the person was employed during any of the fifteen days preceding the day on which he was enumerated. A person who was working but was absent from his work during the fifteen days preceding the day of enumeration due to illness or other causes was a worker. A person who was offered work but had not actually joined was treated as a non-worker.

(b) A person under training as apprentice with or without stipend or wages was regarded as a 'worker'. An adult woman who was engaged in household duties but doing no other productive work to

augment the family resources was treated as a 'non-worker'. Persons like beggars, pensioners, agricultural or non-agricultural royalty, rent or dividend receivers, who earned an income but did not participate in any productive work were not treated as ~~workers~~ unless they also worked in cultivation, industry, trade, profession, business or commerce. A public or social service worker who was actively engaged in public service activity or a political worker who was actively engaged in furthering the political activity of his party was regarded as a 'worker'.

3. The main categories of workers considered by the Census Report are given below:-

- (1) As cultivator; both owner and tenant cultivators.
- (2) As agricultural labourer: a person who works on another person's land without exercising any supervision or direction in cultivation.
- (3) Workers in mining, quarrying livestock, forestry, fishing, plantations, hunting, orchards and allied activities.
- (4) At household industry: either in their own household or in that of others.
- (5) In manufacturing other than household industry including production, processing, servicing, repairing, etc.

- (6) In construction: including buildings, bridges, railways, telegraphs and telephones; waterways, reservoir, etc.
- (7) In trade and commerce.
- (8) In transport, storage and communication.
- (9) In other services e.g. public utility services, like electricity, gas, water supply; public services - government and quasi-government; professional services; personal services; services by trade and labour associations; recreation services, etc. The above definition and categorisation of workers may be accepted.

Present position of working education

4. The two statements at Table I and Table II would give some idea of the magnitude of the problem. Table I gives classification of the different categories of workers according to age groups in rural and urban areas, and Table II gives classification in rural and urban areas in accordance with the levels of education.

TABLE I

Workers and non-workers, rural and urban  
classified by broad age groups (Total Population)

(Figures in Thousands)

Category	Age-Groups				Age not stat- ed	Total
	0-14	15-34	35-59	60+		
1	2	3	4	5	6	7
<u>Category of Workers</u>						
I Rural	7,318	46,521	36,416	7,614	20	97,889
Urban	78	732	723	199	N	1,732
Total	7,396	47,253	37,139	7,813	20	99,621
II Rural	3,129	15,946	10,082	1,441	5	30,603
Urban	62	461	344	51	1	919
Total	3,191	16,407	10,426	1,492	6	31,522
III Rural	995	2,073	1,310	178	1	4,557
Urban	45	335	253	31	N	664
Total	1,040	2,408	1,563	209	1	5,221
IV Rural	1,336	4,667	3,294	644	2	9,943
Urban	147	1,058	749	134	N	2,088
Total	1,483	5,725	4,043	778	2	12,031
V Rural	105	1,390	848	91	1	2,435
Urban	136	3,160	2,079	165	N	5,540
Total	241	4,550	2,927	256	1	7,975
VI Rural	42	629	383	40	1	1,095
Urban	25	524	375	40	N	964
Total	67	1,153	758	80	1	2,059
VII Rural	84	1,545	1,439	276	1	3,345
Urban	70	2,064	1,872	303	N	4,309
Total	154	3,609	3,311	579	1	7,654
VIII Rural	10	493	367	24	N	894
Urban	13	1,185	883	43	1	2,125
Total	23	1,678	1,250	67	1	3,019
IX Rural	653	5,980	4,241	607	4	11,485
Urban	222	4,298	3,216	350	1	8,087
Total	875	10,278	7,457	957	5	19,572
Rural	13,671	79,244	58,387	10,915	35	162,246
Urban	798	13,816	10,496	1,316	4	26,430
Total Workers	14,470	93,060	68,877	12,231	39	188,676
Non-Rural	135,633	33,487	18,456	10,058	121	197,755
wor-urban	29,980	14,093	5,998	2,423	17	52,506
kers Total	165,613	47,580	24,449	12,481	138	250,261
Popu-Rural	149,304	112,731	76,836	20,973	156	360,000
la-urban	30,779	27,908	16,490	3,739	21	78,937
tion total	180,083	140,639	93,326	24,712	177	438,937

N: Negligible. Source: Census of India, 1961, Vol. I, Part II-(B)(i)

Table II

Industrial Classification of Workers and non-workers by educational levels in Rural and Urban Areas

Industrial Category		Total	Illiterate	Literate without educational level	Primary Junior Basic	Matriculation & above
Cultivators	Rural	97,889	76,421	15,767	5,263	438
	Urban	1,732	1,118	366	200	48
Agricultural	Rural	30,603	27,791	2,240	564	8
	Urban	919	792	93	33	1
In Mining, Quarrying, Live-stock, Forestry, Fishing, Hunting, Plantations, Orchards & Allied activities.	Rural	4,557	3,686	642	183	46
	Urban	665	448	136	48	35
Household Industry	Rural	9,943	7,545	1,798	581	19
	Urban	2,088	1,240	592	239	17
Manufacturing other than household industry	Rural	2,435	1,226	802	335	72
	Urban	5,540	2,014	1,786	1,218	546
Construction	Rural	1,095	701	254	99	41
	Urban	964	507	236	115	114
Trade & Commerce	Rural	3,345	1,339	1,333	592	81
	Urban	4,308	1,138	1,537	1,070	569
Transport, Storage & Communications	Rural	894	378	283	157	76
	Urban	2,125	755	551	403	423
Other Services	Rural	11,485	7,235	2,056	1,317	877
	Urban	8,087	3,137	1,818	1,332	1,950
Non-workers	Rural	1,97,755	165,236	22,672	8,996	851
	Urban	52,506	30,712	11,470	8,112	2,249
Total Workers & non-workers	Rural	3,60,000	291,558	47,848	18,087	2,057
	Urban	26,428	11,149	7,115	4,658	3,703

Source: Census of India Vol. I, Part II-B(i), pp.278-279



5. In the urban areas out of every thousand workers, 585 are illiterate and of those who are classed as literates 218 have not attained any recognised educational level. The position is much worse in the rural areas where 836 out of every thousand are illiterate and among the literates as many as 115 have not attained any educational level.

6. A recent report on 'Literacy among the Industrial Workers' which embodies the result of some selective surveys made give the following account of literacy among the workers in five different industries.

No. of workers (as on the 31st March, 1964).

(Figures in lakhs)

	No. of workers	No. of Illiterates.
Tea plantations	7.02	5.99
Coal Mining	4.79	4.18
Jute Textiles	2.88	2.40
Cotton Textiles	11.00	6.50
Iron & Steel	2.46	1.24
Total	28.15	20.31

7. Since independence several important measures have been initiated by Government as well as some enlightened employers. Different approaches have been tried to provide suitable education to workers in several fields.

(a) The major programme of workers education is being carried out by the Central Board of Workers Education, a body set up by the Ministry of Labour and Employment consisting of representatives of National Unions and Federations of Labour, employers and Central Government. The Board is responsible for the general policy of the entire scheme. It encourages workers education, set standards for the programmes and stimulate trade unions and educational institutions to undertake programmes on the approved pattern. The Central Board has at present 26 regional centres and 36 sub-regional centres in the country. The Board aims at giving industrial workers basic training in trade union principles and techniques, industrial relations and citizenship.

(b) The Ministry of Labour and Employment also operates a number of educational and training schemes for workers. The Directorate General of Employment and Training of this Ministry organizes part-time classes for industrial workers with a view to improving their technical knowledge.

(c) In 1960 the Ministry of Education established a Workers Institute in Indore as a pilot project

to develop programmes for education of industrial workers. It runs classes for workers in music, Hindi, English and drawing and provides facilities for class room work recreation, library work and educational and cultural activities.

(d) The Calcutta Dock Labour Board has initiated an adult education scheme for illiterate and semi-literate workers of the Board. Any registered dock worker is admitted to the Centre. The student workers are taught English/Urdu.

(e) The Indian Adult Education Association is running schools for the education of workers at four places, namely Delhi, Bombay, Calcutta and Hardwar. Besides the schools the Association publishes a Hindi monthly, called 'Kamgar 'Shiksha' and it serves the cause of workers education. There is also a scheme of correspondence courses and at present about 50 students are taking this course.

(f) Similarly non-governmental organisations such as Bombay City Social Education Committee, Literacy House, Lucknow and International Federation of Free Trade Unions also provide some kind of workers education.

8. With regard to the education of workers and commercial and other establishments, there are very few facilities available at present. A few commercial concerns and Government Departments arrange for them specialised in-service training courses on ad hoc basis only.

9. With regard to the workers in rural areas, a few experiments have been made by Government through various Ministries/Departments but the scope of such programmes has been rather limited. Some of the important programmes in rural areas which cater to the needs of farmers, artisans and craftsmen to some extent are the following:-

(a) The training camps for progressive farmers, Gram Sahayaks, rural artisans and youth workers organized by the Ministry of Community Development and Cooperation in collaboration with the Planning/Development Departments of the State Governments.

(b) Cluster type training centres and rural artisan centres organized by industries extension workers of the development blocks to cater to the rural artisans.

(c) Panchayat Raj training centres sponsored by the Ministry of Community Development and Cooperation to offer training courses to leaders and Secretaries of Gram Panchayats in the art of administration of Panchayats. At present there are 103 Panchayat Raj centres.

10. The Ministry of Food and Agriculture carries out a number of schemes for inculcating a high level of competence in the farmers, administrative workers and administrators. These are operated through agricultural schools, tractor training centres and workshop wings as well as farmers training wings attached to the extension training

centres. The Ministry of Food and Agriculture also runs training courses for Gram Sevikas (women village level workers) working under community development programmes. At present there are 45 such training centres. These centres organize a one-year training course in women and children training programme and other extension training work.

11. The Ministry of Information and Broadcasting operate a few programmes for the education of the workers in rural areas. These comprise the rural broadcasts, radio rural forums, etc.

12. The Council of Scientific and Industrial Research initiated in 1953 a scheme for the establishment of a chain of rural scientific centres known as Vigyan Mandirs. There are about 38 such centres which have been set up in selected rural areas. They aim to educate the rural population in subjects of science and make them familiar with scientific principles involved in their day-to-day life.

13. The Directorate of training of the Khadi and Village Industries Commission has introduced a training programme for a large number of personnel for supervisory, technical and skilled workers. These are conducted at 31 institutions (4 vidyalayas and 27 registered institutions). The training is given in industries such as processing of cereals and pulses, oil expressing, tanning and leather work and other cottage industries.

14. Among the institutions for the training of adults in rural areas, mention may be made of two interesting experiments:

(a) Vidyapeeth

(b) Janta College

The Vidyapeeths - 'peoples colleges' - were started by the Mysore State Adult Education Council as residential institutions on the model of Danish Folk Schools to provide vocational, liberal and cultural education to rural people. The main objective is to re-orientate the life of the village youth by providing cultural and social education; to provide opportunity for further education to rural youth who lacks schooling facilities; and to offer training which broadens their outlook and experience and make them active citizens of the village community. The Janta College experiment was first set up in Delhi. These were set up in other areas with the object of educating village leaders so that they may develop their faculties, lead a better life, understand their role in democratic society and offer leadership to their villages.

Assessment of the programmes undertaken:

15. A brief survey given above will reveal that the efforts made so far hardly affect the fringe of the problem. Only a small section of the population of workers is provided with facilities of some type of workers education. Facilities are

available mostly for organized workers in industrial units, whereas adequate facilities for education do not exist for unorganized industrial labour, workers in commercial and business establishments and agriculturists. Secondly, the programme has not been developed with a view to bringing about an improvement in the level of living in the workers. The programme appears to be lop-sided and not designed to meet the total needs of the workers. For example while the schemes of education launched by the Central Board of Workers Education are almost exclusively oriented to imparting knowledge of the working and functions of the trade unions, those of the Education Ministry adopted for the workers institute at Indore confined themselves to general and cultural education, the significant omission being vocational on-the-job training of the workers and literacy education.

16. The education of workers in the rural areas has not received adequate attention. Most of the programmes have limited aims and inadequate from the point of view of creating impact on agricultural production. The result is that traditional methods still persist for want of scientific knowledge and knowledge of modern techniques.

17. There is a lack of coordination at different levels. There is no effort to streamline activities of various agencies engaged in workers

education. This results in overlapping of activities which is inevitable in the absence of proper coordination. There is need for an institutional machinery to maintain a sustained programme designed to provide educational services for an allround development of both the rural and urban workers.

#### Objectives and scope of Workers Education

18. In order to make workers education effective it is necessary to keep the clear-cut objectives in view. The objectives should be (a) to help the workers to increase their efficiency by improving their skill; (b) to help them to adjust to the changing circumstances and (c) to make them conversant with their specific rights and responsibilities so that they could lead a better life.

19. The programme of workers education must, therefore, awaken the worker to the social context in which he lives and should be able to discern and assist the social processes which affect him and which demands his intelligent participation. Workers education should combine the imparting of skills and aspects of general education aimed at developing the personality of the workers. In a very large number of cases, the latter has to begin with literacy. The programme of workers education must, therefore, include the following:-



- (a) General or liberal education
- (b) Cultural education
- (c) Vocational/technical education
- (d) Trade union education.

20. In view of the large percentage of illiterate among the workers the need for including literacy education in the workers education programme assumes special importance. This problem has been discussed in detail in the chapter on Eradication of Illiteracy.

Measures to be adopted

21. Systematic efforts need to be made to establish and promote institutions which may meet the requirements in respect to an educational programme for the all-sided development of workers of all types. Many such institutions will be needed to plan and execute differentiated programmes geared to the requirements of specialized groups. Broadly these institutions may be divided into two categories: urban and rural.

22. The workers universities for urban workers and peoples universities for rural population in Yugoslavia, France, Netherlands and other countries provide valuable experience in regard to workers education. These institutions provide a variety of courses and educational programmes to suit the needs and requirements of the varied categories of workers. Further, opportunities are available for systematic growth. Unskilled

workers, while in actual employment, take course work and become semi-skilled. They return back to the institution after some experience and take additional course work to become skilled workmen. After a few years of further experience they take further course work and develop special high types of skills. Capable workmen thus have a chance to reach the top however low may be the position at which they started their career.

23. Obviously our country will take a few years to establish regular institutions of the type referred to above. The nucleus may however be founded as early as possible. A few pilot projects in the field of workers education should prove very valuable.

24. The institutions established as pilot projects should organize comprehensive educational programmes for actual and prospective workers. The courses may comprise systematic instruction in areas mentioned below:

(a) Literacy wherever necessary and general education which should include elementary science, mathematics, social studies and problems of contemporary life. A programme of workers education can be built only on the edifice of literacy and general education.

(b) Vocational training to give knowledge and skill which will improve the efficiency of the worker in his occupation and lead him to work requiring better skills. Provision must be made for teaching skills in several trades appropriate

for a developing economy.

(c) Knowledge of the functions and responsibilities of trade unions and their organisations.

(d) Cultural education and other recreational means for utilizing hours of leisure with what is enjoyable and profitable.

25. It is necessary that all programmes of workers education also include elements which will encourage independent participation in the various programmes of national reconstruction. The principle suggested would imply formulation of a variety of programmes suited to the dominant interests of major groups and categories and the facilities locally available.

26. The responsibility for education of workers in factories and industrial concerns should rest squarely on the Ministry of Labour and Employment. It should be ensured that workers, particularly those below the age of 34 are given the type of education envisaged above.

27. It is obvious that the Department of Labour and Employment will not on its own be able to meet the requirements of workers education. It must have continuing and active cooperation of other Ministries concerned, for example, Ministries of Education, Industries, Health, <sup>and</sup> Cooperation. It must also have cooperation of the universities and their departments of technology, science, economics, sociology and psychology and assistance of psychometrics, sociometrics and evaluation units. Active participation in the scheme by the employers, and voluntary agencies is imperative. It is, therefore, necessary

that the Ministry of Labour should establish a Council of Workers Education which should include representatives of (i) Ministries of Education, Industries and other Government Departments concerned; (ii) Employers' organisations; (iii) Workers' organisations; (iv) Statutory organisations with the Coal Mines, Tea Board, Dock Labour Board etc., (v) Voluntary organisations working in the field of Adult Education. The function of the Council should be to advise on planning for education of the workers, to prepare programmes suited to various requirements of the workers, to carry out surveys and evaluation projects, to prepare material and other aids required for the education of the workers, and to organise studies and researches through universities and other specialised bodies.

28. There should be similar Councils established in each State and there should be close liaison between the State and the Central Councils. The main function of the State Council should be to assist in implementation of the national policies; exploit local organisation and talents in the field and to prepare local plans.

29. Cooperation of the employers is essential. In this context attention is drawn to the valuable recommendation of the 34th All India Educational Conference held at Jabalpur in December 1960 that the Factories Act should be amended in order to make it obligatory on the factory owners to make illiterate workers literate within a period of five years. The Conference also recommended that promotion and confirmation of workers in factories should be made subject to their passing social education standards laid down by the State

Governments. In our opinion this is not enough. The factories should provide continuing education to the worker so that he may have opportunity to improve his knowledge, skills and quality of life. If the employers are unable to undertake this responsibility the Government should take it upon itself and tax industries specifically to raise funds for the purpose.

30. Education of workers in the rural areas particularly those engaged in agriculture is a problem full of difficulty. The agricultural workers do not form organised groups and except in certain circumstances such as workers in cooperative farms they have to be approached as individuals. The most difficult task in this field is to group workers for the purpose of instruction.

31. Following are some of the measures which can be of help:

(i) The scheme of self-study groups to which a reference has been made in the chapter on Eradication of Illiteracy. The basic idea is that the Village Level Workers and other agencies in the area should help establishment of self-study groups of agriculturists who should consider problems of common interest - viz. improving productivity as well as the standard of their life. The group should be assisted by schools, Extension services of the development departments, universities and other agencies to get knowledge and experience which they require as well as literacy.

(ii) Agricultural farms and farms attached to schools and colleges should organise classes and courses of a variety of types for education of the adults.

(iii) A reference has already been made to the extension services by the Agriculture, Community Development and other Departments and by the Universities and Colleges.

(iv) State Governments should set up institutions for providing short educational courses to farmers on the lines of those provided at the Vidyapeeths in Mysore.

(v) All India Radio is already broadcasting valuable programmes for rural workers. The values of these programmes are being constantly evaluated and programmes readjusted in the light of experience.

(vi) For those who are able to read and write the most appropriate means would be through 'programmed instruction. This technique is ideally suited to self-learning on the part of those who are keen. There, however, is no immediate possibility of adopting this means in the absence of programmed material. It is, however, necessary to set up a machinery for preparing material on the basis of programmed learning and conducting researches connected with it with the help of the universities and other departments. We cannot too strongly support the creation of a centre of research and preparation of material on this basis and we feel that thoughtful steps taken now bear fruit in the future.

(vii) The universities can help by providing correspondence courses on some very special topics for the rural society for the benefit of those who have acquired sufficient ability to read and write.

(viii) Production of simple reading material, charts, diagrams and audio-visual aids like films and filmstrips are very necessary for reaching education

to the rural workers.

32. It is impossible even to indicate in general terms the means and methods of educating the workers in the rural areas. The problem requires constant thinking and experimentation. It is essential, therefore, to have a central body which will be constantly thinking on the problems of the education of the rural workers, suggesting a variety of forms of approaches and experiments, assessing and evaluating achievements, coordinating work of various agencies, and recommending various plans for education of the rural workers and for preparation of material necessary for their education. We suggest formation of a Council of Education for the Rural Workers. It should be established by the Ministry of Agriculture and it should have on it representatives of the Ministries of Education, Food, Community Development, Industries and other Departments concerned. It should also have representatives of the Universities, voluntary organisations and of the rural workers. Similar Councils should be established at the State level to help implementation of the national policies in the local context.

Chapter V

Libraries, Museums, Art Galleries,  
and Adult Education

Libraries

1. A good library system which places a library within the reach of all is the backbone of adult education. Whether it is literacy or some form of continuing education or extension service by a Government Department or by a University a good library is a must.

Present position:

2. A recent survey carried out by a Working Group of the Planning Commission has revealed that the position since 1954 has not improved. The public libraries in India have only one book for every 100 persons as against one book for every person in the U.S.A. and  $1\frac{1}{2}$  books for every person in U.K. Out of every 1000 persons in India only one is registered with public libraries for the borrowing of books as against 250 persons in U.S.A. and 370 persons in U.K. Again, every 100 persons in India borrow 1.6 books in a year whereas 422 books are borrowed in U.S.A. and 824 books in U.K. In terms of the money spent on public libraries in India the per capita expenditure is 03.2 paise as against Rs. 12.47 in U.S.A. and Rs. 6 in U.K.

In 1954 in the whole country there were only 3,200 libraries.

3. The Advisory Committee on Libraries set up by Government of India in 1957 recommended, among other important measures, a national system of libraries for the country by establishment of libraries at the following levels:-



- (a) A National Central Library at Delhi.
- (b) Three Regional National Libraries in Bombay, Calcutta and Madras.
- (c) A State Central Library in each State.
- (d) District libraries in each district.
- (e) Block libraries in each Development Block.
- (f) Panchayat Library in each Panchayat.

4. Libraries and Adult Education:

(a) The recommendations of the Advisory Committee need full implementation and special orientation to meet a variety of needs of people.

(b) In addition to what the Advisory Committee has recommended, the libraries in schools should be integrated in the more comprehensive system of libraries. It has been proposed that the schools should be conceived of as the people's schools and that they should shoulder new responsibilities such as teaching the parents and illiterate adults, running part-time schools, providing continuing education, becoming to some extent centres of extension services and of cultural and recreational activities of the community. The schools will just be unable to accept new responsibilities unless they are provided with efficient libraries.

(c) This suggestion would imply that all schools, including the primary, should have libraries. There is no school too small to be denied a library. The primary school libraries will have to be small and selective. It is unnecessary merely to pile up ill-assorted books in the schools; what the schools will need is small selective libraries furnished with full regard to the specific purposes which it is required to serve and some arrangement

of renewal and fresh supplies of material of special interest.

(d) The libraries will require special type of material to serve the ends of adult education. They would require books, which are particularly suited to the needs of the neo-literate adults who is riddled with life problems which he must solve with the help of books and other reading material. Where possible, the libraries should have tape records, films, gramophone records, and other audio-visual aids for those who attend part-time and continuing classes, special literature which would lead the adult step by step to standard books and reading material connected with occupational and other interests of the people. It has already been suggested that the adult education administration will be confronted with the problem of creating and producing books and other educational material specially needed for the adult. The libraries, should have a place for all the valuable material thus produced.

(e) The libraries should not merely be store houses of books. They should be dynamic and they should step out to educate the adult to use them profitably. The libraries should be made attractive and a systematic attempt should be made to draw people to use the library. The libraries should organise study circles, reading circles and book clubs and even revive the ancient Indian tradition which still rules in rural areas of holding gatherings to hear a book read or a poem recited, a story told or a play acted. Of course, the traditional reading is of the Ramayana, Mahabharata, Purnas and other religious

literature which draws good audience. New economic and social interests will no doubt attract audiences to hear what is of value to modernisation of life.

(f) This leads to the important issue of having librarians who will make the library of real service and happiness to the community. It will be possible to have well-qualified and professionally trained librarians for the Central, District, City and other big libraries. It is necessary that the librarians should get experience and training in the objectives and methods of different types of adult education and that they should be able to appreciate the role of libraries in the education of the people. The smaller libraries in the schools will not justify whole-time trained librarians and the responsibility of library service will fall on the teachers. It is, therefore, necessary that the teachers, at any rate, a select few should be given practical training in librarianship in training institutions for teachers or in special courses organised for the purpose. It is also necessary that specialist supervisors should be available to organise library deposits and replacements and to guide the school teachers in charge of the libraries. The supervisors should continually review the working of the libraries in a given area and should endeavour to make the library system effective.

(g) The archaic administrative procedures for procurement and supply of books to the libraries defeat their very purpose. Sometimes grants for purchase of books are released late and the libraries anxious to spend what

they get hurriedly purchase whatever trash is available in the local market. There is hardly a proper machinery of selecting books and testing their suitability for adults. The State of Gujarat has introduced an innovation by organising a Cooperative Purchasing Society which settles the terms of purchase of books for the member libraries. The bulk purchase reduces costs and enables arrangements for proper supply of books for the libraries. For the purchase of books from abroad, which will still be necessary, it would be advisable to have a national procurement-centre attached to the National Library, Calcutta.

5. Unesco, in collaboration with the Government of India, established Delhi Public Library in 1954 which is a model for Asia. This has proved a great success, particularly for the promotion of adult education. The library provides services to all and lends books for home reading free of charge. It maintains lending departments for adults, children departments, social education departments and a reference and information section. It has several branches and a number of deposit sections. It is recommended that more libraries of this type be set up in other urban areas.

6. Realising the importance of public library development, the Planning Commission set up recently a Working Group to prepare a detailed scheme of library development. The working Group has drawn up a scheme which envisaged the development of the libraries in three phases. According to the recommendations of the Working Group, the Fourth Plan should provide for the

establishment of all the 16 State Central Libraries, all the 335 District Libraries, 3 Model Libraries and also for the improvement of their buildings, stock, staff and services. It should also provide for the establishment of as many as 2500 new block libraries bringing their total number to 3884. Provision is also to be made to improve the services and maintain a minimum standard all along the line. Similar progressive development during the next two Plans, Fifth and Sixth has also been suggested.

We appreciate the efforts made by the Planning Commission to promote the development of libraries during the fourth Plan period. Out of the 74 crores of rupees provided for adult education Rs.29 crores have been earmarked for public libraries, especially in the rural areas. The bulk of this amount is meant for District Central Libraries, Block Libraries and Village Libraries, while a part of it is meant for urban libraries. It is, however, hoped that in apportioning funds for the different programmes of education, the position will be reviewed in the light of the requirements of the different sectors of the adult education activity.

7. The experience of the working of the Delhi Public Library has shown that efficient administration of the libraries requires freedom, which Government Departments cannot provide, and association of the more important sections of the public opinion. There is a strong case for autonomous boards at the State level with Committees in the districts, and important cities with a population of one lakh or more. The Central State Library, the District and City Libraries, as well as other libraries, should be knit into an integrated system administered by the State

Board of Library and assisted in this function by an adequate and competent staff. At the Centre, there should be a National Advisory Council with the Union Minister of Education as the Chairman which should enable exchange of ideas and experience in the country and advise on all aspects of planning for libraries in the country.

8. The libraries in the State of Madras are extremely well organized in accordance with the Madras Library Act of 1948. Later Andhra Pradesh when it came into being also adopted the Library Act. The Act provides for the creation of a State Library Committee which coordinates all library service in the State and the local Library authority which concerns itself with library at the district level. The local library authority is entitled to maintain a library fund which consists of collections through a library cess of six\* pies in a rupee in the form of surcharge on the house tax and grants from Government which according to the Act must at least be equal to what is raised through the cess. The Madras Library Act has proved to be a very useful instrument for establishment of a network of libraries in the State. The Act alone does not meet the real needs of the library service in the country. It is felt that the levy of the cess in Madras and Andhra has not augmented funds in any real way for the requirements of the State Libraries. Madras spends 6 paise per head and Andhra 4.5 paise per head while Bengal with no Library Act spends 9.3 paise. The Act does, however, provide a framework for the library organization in the State and it is suggested that other States in the country

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\* page 13, Report of Library Advisory Committee.

should adopt similar legislation for creating a useful library service for the people.

Museums, and Art Galleries:

9. There are at present 174 museums in the country of which 119 are archaeological and cultural, 43 are educational and 12 industrial and commercial. The value of the museum as a medium of education for the adults is considerable. The country does not merely need more and a much larger variety of types of museums, but of service which will enable fuller use of the opportunities which exist. There should be guided tours of the museums, distribution of literature relating to the significance of the exhibits and extension services whereby through films, filmstrips, posters and talks the people can have some idea of the treasures in the museums - and their historical, cultural and educational importance. There should also be exhibition of replicas of important articles in the museums which should visit places which are not within the easy reach of museums.

10. Art galleries and exhibitions of paintings, and other works of art and craft are just coming into being in the country; even the National Gallery of Modern Art in Delhi is of recent origin. The programmes of adult education endeavour to cultivate in the minds of the people some appreciation of the works of arts. The right atmosphere needs to be created for this purpose by employment of a variety of media such as mobile art exhibitions, brief courses in art appreciation, film shows, production of cheap subsidised books and prints containing reproduction of masterpieces of art. Encouragement should also be given to folk art and craft.

CHAPTER VI

THE ROLE OF UNIVERSITIES  
IN ADULT EDUCATION

Change of  
attitude &  
acceptance  
of new res-  
ponsibility

1. The image of the university as a closed academic community of scholars creating and disseminating knowledge and perpetuating its own type is a thing of the past. The universities depend upon the public funds and they are concerned more than ever before that the benefits of the new knowledge should be communicated to the community for its enrichment and betterment.

Work done  
by the  
Universi-  
ties in  
India.

2. Indian universities have shown in some measure a change in attitude. Some universities have moved in the matter and the following are some of the steps taken:

- (a) Establishment of evening colleges for the benefit of those who work for a living. (Universities of Utkal and the Punjab).
- (b) Organisation of lectures, seminars, tests and other programmes for women who are not enrolled in colleges and universities and who prepare for the university examinations through their own effort. (Delhi University's "Non-Collegiate Women Students Delegacy")
- (c) Training of teachers: inservice training and condensed courses, such as those organised by the universities of Poona, Rajasthan, Delhi and Madras.
- (d) Lectures and special courses for agricultural workers (organised by the agricultural universities).
- (e) Extension service by agricultural universities and teacher training colleges.
- (f) Courses in business and industrial management. (Delhi University for the executives in industry).
- (g) Advanced courses for practising engineers (Roorkee University).
- (h) Extension lectures by universities for the benefit of general public (for example By the Universities of Poona, Rabindra Bharati, Rajasthan, Madras).



- (i) Correspondence Courses which have been instituted by the Delhi University.

More work in the future (In India).

3. The University of Rajasthan has given the lead by establishing a department of Adult Education and adopting several programmes of adult education. A recent Conference (1965) held at Bhopal at the instance of the University of Rajasthan and the All India Adult Education Association discussed the role of the Universities in Adult Education. The Conference has also established an organising committee to assist the implementation of the recommendations of the Bhopal Conference. The Universities in India are showing awareness of their responsibility towards adult education.

Analysis of the functions of the University

4. One important function of the university is to provide social, economic, educational and cultural growth of the community which it serves. This function is undertaken in many ways and one effective way is through a variety of adult education programmes specially designed to communicate to the people its progressive attitudes and liberalising influence as well as knowledge and experience which are pertinent to its well being and to quality of its life. The following are some important areas of community's life in which the university's influence can lead to the good of the community.

(a) Economic Growth:

- (i) The application of new scientific findings, sophisticated techniques and rationalised economic procedures to problems of industrial and agricultural development with a view to augmenting production.
- (ii) Re-education of the key personnel in the different professions and making it review its methods and techniques in the context of the growth of knowledge and new experience.

(b) Social Security.

- (i) Nothing short of a revolution is necessary in the habits of life pertaining to health, sanitation and physical fitness which are plagued by tradition, superstition and ignorance; this revolution can come through practical education, enlightenment and appeal to good taste.
- (ii) Real check on the population growth can come through practical appreciation of the damage done to the country and through scientific knowledge which university should impart.
- (iii) Education of the leaders of the civic and political life. (Discussed in the paper on Continuing Education).
- (iv) Building up of national solidarity requires knowledge of the national problems in the international context and understanding of national attitudes. The people should appreciate challenges to the social and national life and be prepared to meet them.
- (v) Eradication of illiteracy in the country is inconceivable without active participation of the university students. (Problem discussed in the paper on Eradication of Illiteracy). The students who do the work need to be trained in the methods of adult education work; the specialist teachers and administrators for adult education need to be trained; surveys and studies on various problems have to be undertaken, and a variety of researches conducted.

(c) Education and Cultural Growth:

- (i) The mental horizon of the people has to be widened and new interests awakened which lie beyond the narrow world of give and take and which sweeten and ennoble life. They should become aware of the finest achievements of the human spirit down the ages and of the eternal quest for truth and the beautiful. The extension programmes of the university can provide the most effective liberal education for broadening the outlook and refining the public tastes.
- (ii) Production of variety of literature and some types of educational material for the education of the adults such as illustrative charts and posters, slides, exhibits can be undertaken by the university.

- (iii) Education through recreation, sports, athletics, drama, musical programmes, art exhibitions, reading and recitation of interesting literature and poems, musical programmes, can be best organised by the university.

Methods  
of Work

5. The universities have to try a variety of ways to educate the community. Some of the methods which have been successful are:

- (a) Evening classes for adults who are employed during the working hours and who wish to prepare for university examinations or pursue some special courses which may be for personal enrichment or professional benefit.
- (b) Correspondence Courses for the same purpose as those for the evening classes.
- (c) Extension programmes including lectures, field work, demonstrations, cultural activities such as plays, musical entertainment, athletic and sports activities.
- (d) Social Service Camps and adopting villages for intensive programmes for eradication of illiteracy, maintaining schools, sanitary services, agricultural education and training in cottage industries and working of the cooperatives.
- (e) Organising literacy service for the community.

These are only illustrative of the ways in which the University can render service to the adults in the community and to keep their education alive. Each University should weigh its own opportunities and find out the best programmes which it can effectively initiate.

Machinery  
and Means

6. The university should have an effective machinery for launching carefully planned adult education programmes and evaluating the achievements. The following are some important

measures which should be taken:

- (i) Establishment of a department of Adult Education in order to
  - (a) train specialists and teachers in the field of adult education;
  - (b) undertake and guide research in all problems connected with adult education in cooperation with other relevant departments such as education, sociology and psychology.
  - (c) organise programmes of adult education in and outside the university with the assistance of other departments and agencies concerned.
  - (d) It is also proposed that adult education should be given the status of a special discipline and the students should be encouraged to study it as one of the optional subjects.
- (ii) Establishment of a Council of Adult Education with representatives of other Departments involved to plan and execute adult education programmes. The Vice-Chancellor should be the Chairman of the Committee. Adult Education activities should involve all departments; each should have something of value to convey to the people.
- (iii) Special equipment and funds will be necessary for Adult Education work done by the University. It is true that most of the work will be done on a voluntary basis still the university would require
  - (a) Special libraries including film and tape libraries;
  - (b) Audio-visual aids;
  - (c) Suitable transport; and
  - (d) Camping equipment.

Extension service entails considerable expenditure which needs to be assured.

CHAPTER VII

ORGANIZATION AND ADMINISTRATION OF ADULT EDUCATION

In the previous chapters we have made quite a number of important recommendations for developing adult education in the country. If these have to be effectively implemented, it is absolutely essential to set up a suitable and adequate administrative machinery. In the present chapter we will discuss some of the measures which have to be taken in this direction.

It has been pointed out that the development of adult education in the country has been affected to a considerable extent owing to the defective organisation and administrative set up. Some of the important defects are: (a) absence of proper planning at the various stages of programmes; (b) lack of coordination between different departments and also among the various organisations engaged in social education work.

In order to overcome these defects the Report on Social Education of the Committee on Plan Projects has recommended the establishment of a Central Board of Social Education to advise on planning and execution of programmes on social education, to coordinate them and to lay down standards at different levels. At the National Seminar on Adult Education recently held in Poona, the question of organization and administration was discussed at considerable length and it was recommended that a national body known as the National Board of Adult Literacy and Education

should be set up with varied functions. While we generally agree with these views, we would recommend the setting up of an autonomous and statutory National Board of Adult Education with an independent educationist as its Chairman. This Board should be set into being by the Ministry of Education but it should have representation of other Ministries concerned and of voluntary agencies. The functions of the proposed Board should be the following:-

- (i) Planning of Adult Education programmes at all levels;
- (ii) Preparation of material necessary for implementation of adult education programmes and provision of expert services.
- (iii) Fixing up national targets in consultation with the Central and State Governments.
- (iv) To promote measures necessary to evaluate progress and ensure realisation of the targets.

There should be similar small boards or commissions at the State level to direct the activities of literacy movement and to coordinate the work of the many agencies involved in adult education. At the district level there should be committees consisting of the local departmental heads, educationists and others with the Collector as the Chairman. The Committee should implement the State policy at the district level, lay down targets for the district, survey the manpower for organising and teaching adults. Where there are Zila Parishads this Committee should be a wing of the Parishad with the Chairman of the Parishad as its Chairman.

The implementation of the proposals made by us, particularly, the eradication of illiteracy through a mass campaign, would require the following measures:-

- (a) Proper planning;
- (b) Securing adequate funds;
- (c) Mobilization of the manpower;
- (d) Securing the services of voluntary agencies;
- (e) Creating public opinion and securing public participation;
- (f) Providing the supporting services, such as follow-up work of the neo-literates, public libraries and reading material.
- (g) Production of material.

While the Board recommended above might be able to undertake some of these functions, it would be necessary to allocate the responsibilities for the various activities to the three principle agencies engaged in adult education work, namely (a) Government - Central as well as States; (b) the educational institutions, particularly universities; (c) voluntary organizations.

Role of Central Government:

At the national level all aspects of adult education should be the responsibility of the Central Government in the Ministry of Education, both for purposes of direct implementation of the schemes undertaken by them and also for general coordination. They should also promote study and research on various problems of adult education, undertake pilot projects, evaluation, production of literature and other material

for adult education such as guide books and visual aids. The National Fundamental Education Centre set up by the Ministry of Education in 1956 should be fully utilized for carrying out research and evaluation and training of the key personnel besides its acting as a clearing house of ideas and information pertaining to social education.

In so far as literacy programme for industrial workers is concerned, the Ministry of Labour and Employment should have the major responsibility. This responsibility may be discharged through the organisations for various industries such as Coal Miners Welfare Fund, Tea Board, Mica Welfare Fund, Dock Workers Board, etc. These organisations may set up committees at the central level and also in the regions where most of the work lies. The funds may be provided through Welfare funds, partly by allocations from the budget of the Ministry of Labour and Employment and partly from contributions from industry in various parts. The organisations should set up targets for removal of illiteracy among workers. As recommended by the Report on Literacy Among Industrial Workers, a Central Advisory Board for Literacy Among Industrial Workers should be formed in order to advise, to lay down policy, coordinate and evaluate the achievements made from time to time.

#### Role of the State Government

The States should be responsible for the actual implementation of the programmes undertaken by them. Each State should set up a well-organized



machinery for execution and supervision of the adult education programme. The Education Departments of the States should be made responsible to organize the literacy movement in the States and carry out all such other activities relating to the development of adult education. The State Government should endeavour to secure the cooperation of non-official organisations and voluntary bodies which are active in the field of literacy and adult education. They should also undertake the responsibility of production and distribution of literature required both for literacy programmes and also for the neo-literates besides the maintenance of public libraries and other ancillary services. The supervision work which is important should also be undertaken by the Education Departments of the States with cooperation of the social education organizers and the heads of the educational institutions in the local areas.

#### Role of educational institutions

The role of the University has already been discussed in the earlier chapter. Their active cooperation with regard to training of persons, research and production of literature, is of significant importance for promoting adult education.

In the chapter on literacy we have discussed the role of the other educational institutions, particularly the schools in the rural and urban areas. Each school should serve as a community centre and make every effort to conduct literacy programme and carry out other educational activities.

The role of voluntary organizations

The needs of the adult education are so vast that even if the Government and the educational institutions render all the facilities there would be still an important role left for voluntary organisations. As pointed out in the Report of the Social Education Committee of the Planning Commission, social education, in the very nature of things, is informal. Adult education depends for its success on the cooperation of the people and their enthusiasm. People who have close contact with the masses and who understand their needs and problems can be more effective in the adult education work. Voluntary organisations in the country have done good work in the field and produced good results. In view of this it is recommended that the voluntary agencies be encouraged to take an increasing role in the adult education work. In fact one function of the National and State Boards should be to sponsor and establish voluntary agencies to undertake the work of adult education and to give them the assistance they need. They should be assisted financially and given necessary technical guidance. Some of the important functions to be undertaken by the voluntary organisations are: (1) they should bring together enthusiastic workers in the cause of literacy and provide scope for their participation; (2) they should organise literacy classes for various groups; (3) whenever possible, they should help in the preparation of teaching and publicity

material; (4) they should help a great deal in giving publicity to various programmes of literacy; (5) wherever possible they should undertake research into the problems of Adult Education with the financial support of the Government.

#### Role of Village Panchayats

Adult literacy programme in rural areas cannot succeed without the active interest of the village Panchayats and the block level Panchayat Samiti. Besides the office bearers of the village Panchayat, there may be others in the village who may be keen on adult literacy and who would be more useful. Their participation should be facilitated by constituting ad hoc committees within the village specially for adult literacy. While the overall responsibility of the programme must necessarily rest with the Education Departments, Panchayat Samitis should, however, be the principal implementing agency of the programme at the village level. Adult education work in the villages should be carried out primarily by the voluntary agencies. Every effort should, therefore, be made to develop voluntary agencies, such as youth clubs, Mahila Mandals, etc. at the village level. The programmes of adult education should be worked out through the functionaries who are already working at this level; namely, the Secretary of the Village Panchayat, the Secretary of the Cooperative Society and primary school teacher who should be specially trained for this purpose.

Every village Panchayat should be required to constitute a committee on Social Education. They should also have local workers who have shown an interest in social education.

APPENDIX - I

Personnel of four Working Groups set up by the Task Force on Adult Education and their terms of reference:

I. To Consider the Problems connected with Literacy Education

Members:

1. Shri A.R. Deshpande,  
Adviser (Social Education), Ministry of  
Education
2. Dr. T.L. Koshy,  
Director,  
National Fundamental Education Centre,  
New Delhi.
3. Shri Mushtaq Ahmed,  
Director, Literacy House, Lucknow \*
4. Shri H.P. Saxena,  
Assistant Director,  
National Fundamental Education Centre,  
New Delhi.
5. Mrs. Durgabai Deshmukh,  
New Delhi ..... Convener

II. To Consider the role of Universities and Institutions of higher education

Members:

1. Dr. K.G. Saiyidain, Member,  
Education Commission.
2. Dr. Hans Simons,  
Ford Foundation, New Delhi (left India on 31.3.65)
3. Shri Uma Shanker, Director,  
Adult Education Department,  
Rajasthan University, Jaipur.
4. Shri Bashiruddin, Allahabad.
5. Shri Kaul, Extension Department,  
Delhi University, Delhi.
6. Shri Sohan Singh,  
Asia Foundation, Delhi ..... Convener

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\* As he left Literacy House in December, 1965  
he was replaced by Shri K.N. Srivastava,  
Director, Literacy House.

III. To Consider Problems of Education of the Workers in Rural and Urban Areas

Members:

1. Shri Abdul Qadir, Director-General,  
Employment and Training, New Delhi.
2. Shri L. S. Chandrakant,  
Joint Educational Adviser,  
Ministry of Education, New Delhi.
3. Shri Chenstal Rao,  
Secretary,  
Federation of Indian Chambers of Commerce  
and Industry, New Delhi.
4. Shri M. C. Nanavatty,  
Director (Social Education),  
Ministry of Community Development, New Delhi.
5. Shri S. C. Dutta,  
Secretary,  
Indian Adult Education Association, New Delhi.
6. Shri Annasaheb Shaserbudhe,  
Chairman, Rural Industries Planning,  
Planning Commission, New Delhi.
7. Shri N. Bhadriah,  
President, Mysore State Adult Education  
Council, Mysore.
8. Dr. R. K. Singh,  
Director, Rural Institute, Bichpuri (Agra).
9. Dr. T. A. Koshy,  
Director, National Fundamental Education  
Centre, New Delhi ... Convener

IV. To Consider the role of Cultural Institutions in the field of Adult Education

Members:

1. Shrimati Kamladevi Chattopadhyay,  
Chairman,  
All India Handicrafts Board, New Delhi
2. Dr. M. S. Randhawa,  
Special Secretary,  
Ministry of Food & Agriculture, New Delhi
3. Dr. Mulkh Raj Anand,  
New Delhi
4. Shri J. C. Mathur,  
Joint Secretary,  
Ministry of Food & Agriculture, New Delhi

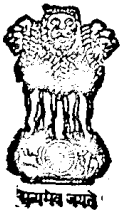
5. Dr. Grace Morley,  
National Museum, New Delhi
6. Shri D.R. Kalia,  
Director, Delhi Public Library  
Delhi ..... Convener

The Groups were requested to meet as early as possible and to prepare their first report for consideration by the Task Force at its second meeting to be which was/held on December 18th and 19th, 1964. The first report should

- (i) identify problems;
- (ii) indicate procedure it adopts to study the problems and, if necessary, prepare drafts of questionnaire or discussion papers which it may wish to send out in order to ascertain public opinion;
- (iii) suggest, if necessary, the need of holding seminars or conferences to select informed opinions;
- (iv) propose such statistics as they will need and such reports or materials as they may require or project studies which they may wish to organise; and
- (v) point out to such assistance as they would wish to have from the Secretariat of the Commission.

**Supplementary Volume No.VII-E**

**REPORT OF  
THE TASK FORCE ON  
SCIENCE EDUCATION**



**EDUCATION COMMISSION**  
**University Grants Commission Building**  
**Bahadur Shah Zafar Marg**  
**NEW DELHI**  
**1966**



REPORT OF THE TASK FORCE  
ON  
SCIENCE EDUCATION  
AND  
RESEARCH

EDUCATION COMMISSION  
UNIVERSITY GRANTS COMMISSION  
BAHADUR SHAH ZAFAR MARG  
NEW DELHI

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SCIENTIFIC RESEARCH

## P R E F A C E

The Task Force on Science Education and Research was constituted to consider the specific problems pertaining to science and mathematics education at the three levels of school education, at undergraduate and postgraduate levels as well as problems pertaining to scientific research in the universities. The Task Force held five meetings in all on 19th July '65, 9th September '65, 29th November '65, 29th December '65 and 14th January '66 discussing various aspects of the above problems before coming to certain broad conclusions. The Task Force had the honour of meeting Prof. P.M.S. Blackett, F.R.S., President of the Royal Society, London and Dr. Frederick Seitz, President of the National Academy of Sciences, U.S.A. at the 4th and 5th meetings of the Task Force.

The Task Force received many suggestions from individual teachers and scientists—as well as organisations like the All India Science Teachers Association. Particularly useful was the Report of the Unesco Planning Mission on 'Science and Mathematics Education in Indian Schools 1964' published by the National Council of Educational Research and Training of the Ministry of Education, Government of India. The Reports of the U.G.C. Review Committees, a few publications of the National Science Foundation, USA on research and development and some papers prepared by members of the Unesco Team of the N.C.E.R.T. have served as useful documents in the preparation of the Chapter on Science Education and Research. Besides, Prof. S.A. Shumovsky, Director, Methodological Division and Professor of Physics, Moscow University and Prof. S. Dedijs of the Lund University, Sweden gave the Task Force the benefit of their wide experience and nature advice.

Our deep and grateful thanks are due to all these individuals and organisations in having helped us to comprehend the complex problems of science education and research and coming to certain conclusions regarding the future development of these vital sectors of education.

New Delhi  
7-4-66

Dr. D.S. Kothari  
Chairman

## SCIENCE EDUCATION AND RESEARCH

### (Section I)

#### SCIENCE EDUCATION AT SCHOOL

##### Introduction

1. A vital role of science, in fact of all education, in India should be to fight ignorance, poverty and disease, and function as a powerful instrument to bring about a social transformation so that millions could live longer and happier lives. The average span of life in the 'under-developed' part of the world is only about half of what it is in most of the 'industrialised' countries.

2. The key to improvement of the standard of living in a country is, no doubt, science and technology and industrialisation. But, it is important to recognise that in this matter there can be no half-way house. Once we start moving along the road of science and industrialisation, we disturb the old equilibrium, reached and maintained over many centuries. Disturbance of the old equilibrium brings about a host of new problems, of which the most important is a rapid rise in population as a consequence largely of improved sanitation and control of epidemics. We must move towards a new equilibrium, based on a full utilisation of science and technology; and it should be achieved as quickly as possible. But, if we march with faltering steps, and if our commitments and convictions are half-hearted and lack faith, then, the new situation may

turn out to be worse than the earlier one. Tinkering with science and technology can often make things worse than what they were before.

3. In the past there have been great and flourishing civilisations, but the lot of the common man was almost invariably one of miserable existence. Leisure for a few so necessary for the advancement of culture and civilisation was at the inevitable cost of an almost intolerably hard and humdrum life for the vast majority of the population. In Indian society the so-called "untouchables and depressed" classes formed not a negligible part of the community. Again, at the height of the Athenian civilisation, it was said that to abolish slavery would be to abolish Athens itself. Aristotle asserted that slave labour would remain the foundation of culture so long as human ingenuity could not devise machines for doing manual work. It has taken more than two thousand years to achieve this end; and now man, if he wills, has the means to build a civilisation where all can live in peace, plenty and happiness.

4. In this context it is perhaps important to recognise the distinction between science and technology. In earlier times science and technology were separate activities. Technology was based largely on empirical experience, on trial and error, rather than on science. The electrical industry was probably the first to become science-based; next came the chemical

industry, and now in industrialised countries agriculture is also becoming a branch of applied science. This close interlocking and interdependence between science and technology is a characteristic of the contemporary world, and it is largely because of this that in recent years growth rates in GNP of five per cent and higher have been realised by several countries.

5. A number of different indices indicate that over the last two hundred years or so, scientific knowledge and things directly related to science have been growing at an average rate of 5-7 per cent a year. This corresponds to a doubling time of 10-15 years. The number of scientists has been increasing at about the same rate. (Curiously enough, the number of scientists at any time is roughly one-third the number of papers published upto that time).

6. A doubling period of 15 years means that about 90 per cent of the scientists who ever lived are with us today. It is not at all clear why the doubling time of science should be around 10-15 years. Of course, this exponential rate of growth cannot continue indefinitely. If the present rate of increase in the number of scientists were to continue for another hundred years or so, the number of scientists would exceed the total world population, an obvious impossibility. Sooner or later, therefore, the growth rate of science would come down, and perhaps level off eventually with the growth rate of population. The

first signs of this stage of "science saturation" are already evident in some of the scientifically advanced countries.

7. A consequence of the exponentially expanding science is that the time gap between basic discovery and its application is continually diminishing. So rapid is the pace of scientific progress that a scientific paper is often out of date by the time it is in print; a graduate is almost obsolescent on the day of his graduation. What we have said above underscores the extreme importance as well as the difficulties of providing effective science education.

Science Education: Present Status.

8. The main defects of the present system of Science Education at the school and College Levels are:

1. Paucity of properly qualified teachers.
2. Apparently weighty (bulky) but outdated syllabuses to be covered hastily without reference to demonstrations and experiments.
3. Non-availability of adequate apparatus, equipment, audio-visual aids, textbooks, teachers' guides etc.
4. Protracted procedures of procurement of books, journals, back volumes, apparatus and chemicals.
5. Inadequate facilities for repair of damaged equipments, standardization, calibration of sensitive instruments and paucity of contingent funds for recurring expenditure.



6. Lack of decentralisation of authority in day-to-day administration.

In order to rectify the above defects it is necessary

- (a) to create the necessary physical conditions aimed at aiding the teacher to give his best in the impartation of science to students at all levels; and
- (b) to create the mental climate for the teacher to enable him to enthusiastically put across his ideas and to fulfil his role most efficiently.

9. Whilst with a fully geared machinery on the central and state levels the first can be remedied, the second will need great deal of tact and understanding in making the teacher realise that he plays the key role in impartation of science at every level. Therefore it is most important that while framing new curricula and writing new textbooks, the average teacher must be kept in focus so that in any attempt to radically change or usher in new methods he is not left behind.

Science and Mathematics Education at School

10. We have stated earlier elsewhere that literacy, numeracy and work experience should constitute the basic elements of general education. Science and Mathematics should be taught to all pupils at school as a part of general education. Science at the school level should be not only for those who expect to be career scientists at a later date but also for those who may branch off into other areas of scholarship, or terminate their education at the

school stage. In the teaching of science copious use of simple aids and simple equipment should be made and their instructional potential fully exploited. Students should be encouraged to build (or improvise) simple apparatus and equipment (and scientific toys) in the school workshop. Every school must be provided with a well-equipped workshop. The close connection between science and industry should be stressed from the beginning. Demonstration experiments and laboratory examinations should reflect the industrial (using their term in its wide sense) interests of the local community. This would make science teaching more realistic to the pupils, and also more interesting and useful. There should be provision of special courses in science and mathematics at the secondary level (beyond class VIII) for students of more than average ability and who elect to take these subjects. To begin with such elective courses could be provided only in selected schools which have adequate staff and laboratory facilities. At the secondary stage the teaching of science can be built round 'home technology' or the maintenance and study of gadgets commonly in use at home; agricultural implements and industrial tools; and the students can be orientated to experiment science by selecting topics from nature or human inventions. Apart from science provided for all, provision should be made for special advanced level courses for gifted students, particularly at the secondary level. It would be worthwhile to have a few secondary schools attached to some of our universities, either set up for the purpose or by adoption of a good local school. Two special residential schools with emphasis on Mathematics should be established in association with Centres of Advanced Study in Mathematics. In the Soviet Union there are special secondary schools (Computer-Operators' Training) where all the subjects are studied according to the secondary school curriculum and syllabi with the exception of mathematics and physics. The syllabi in mathematics and physics are more advanced than those in ordinary schools. This will enable an ambitious school programme to be tried under the direct supervision and guidance of the university staff.

have a few secondary schools attached to some of our universities, either set up for the purpose or by adoption of a good local school. This will enable an ambitious school programme to be tried under the direct supervision and guidance of the university staff.

Rural Schools and Urban Schools:

11. In the secondary schools, particularly in the rural areas, linking of education to environments (and agriculture) can be done through integrated courses in biology as a whole and the impact of physical sciences on biology. Students should get adequate knowledge of biological life such as micro-organisms of the soils, the flora and fauna of their surroundings and be in a position to identify pests and diseases of the locality. In the rural areas it would also seem necessary, in view of the possible entry of Indian agriculture into a mechanised era, to prepare ourselves in the next 5 or 10 years to impart training in state-owned model farms, seed farms and also in the elements of mechanised farming and maintenance of tractors and other agricultural implements. This will go a long way in encouraging discerning agriculturists to participate in a programme of mechanised farming. It will also benefit small holders who wish to do cooperative farming by giving them technical know-how in specialised fields like mechanised soil cultivation, spraying techniques, mechanised harvesting, soil conservation, seed-bed

preparation and seedling transplantation. Similarly, in schools in industrialized areas the curricula may lay stress on machinery and apparatus and the know-how of manufacturing processes which will be in keeping with the industrialization of the urban areas. In a nut shell, the curricula should have a bias towards technical and industrial aspects of experimental science and its impact on industrialization. The levels to be attained in the rural and urban schools will be the same, and avenues to higher education will be available for students from both schools without discrimination.

Teacher's guides in science subjects should be prepared drawing illustrations and examples from the rural or urban situations, as the case may be, thereby linking instruction with environments.

Aims of Teaching Science:

12. At the primary and middle levels, the aims of teaching science should be to develop proper understanding of the main ideas - facts, concepts, principles and processes - of science that exist and operate in the physical and biological environment of a child. Both deductive and inductive approaches should be utilised to unravel these ideas, though more emphasis may be laid on the deductive approach or the use of scientific method. Accordingly the objectives should be:

1. To acquire knowledge of the environment, biological as well as physical, including forces of nature and simple natural phenomena.

2. To cultivate and develop problem-solving skill, critical observation, recognition, collection and organisation of facts and phenomena and to draw valid conclusions in the light of available data.
3. To develop and cultivate manipulative skills by working with hands, handling and setting up of simple apparatus and application of knowledge to situations in life.
4. To develop a hygienic sense and interest in cultivating simple and interesting hobbies such as gardening, model making, collection of biological, zoological and botanical specimens available in the area, maintaining of weather charts, studying the night sky and taking more than a general interest in astronomy, topographical geography and population and food problems etc.
5. To cultivate and develop a taste for reading books and articles of scientific interest, to inculcate the spirit of enquiry and discovery, and to develop capacity for accuracy and precision in thought, speech and writing.

#### Primary Level

13. The units of measurement, symbols of common elements and compounds, and nature study should be included in the Primary School curriculum.

13A. At the primary level the focus should be on a child and his environment - the social, physical and the natural. Emphasis in science instruction in classes I and II should be on cleanliness, formation of healthy habits and development of power of observation of children. The emphasis in classes III and IV V should continue to be laid on these and should include personal hygiene and sanitation of the environment. The child may also be introduced to formal areas of science such as the plants and animals in his surroundings, the air he breathes, the water he drinks, the weather that effects his daily life, the earth he lives on, the simple machines that are being used in his environment, the body of which he should take care and the heavenly bodies he looks on at night.

Every primary school should have a science corner or a room to keep specimens, models and charts with necessary storage facilities.

#### Middle Level

14. At the middle level, the emphasis may shift to knowledge together with the ability to think logically, to draw conclusions and to make decisions at a higher level.

Science should be taught as physics, chemistry, biology, geology and astronomy. Allocation of these subjects may be as follows:

Class VI Physics, Geology, Biology

Class VII Physics, Chemistry, Biology

Class VIII Physics, Biology, Chemistry, Astronomy.

Lumping all this under an amorphous subject of 'general science' is wholly unsatisfactory. Such a treatment tends to make science appear formless and without structure, and runs counter to the methodology of science. The coherence of science is on a plane which is not that of 'general science' as is done or could be done, at the school stage.

15. Other combinations of subjects may also be tried out to select the most suitable combination, depending on the level of the classes and the local conditions.

16. Human Physiology and Hygiene should form a part of Zoology to which it naturally belongs.

17. To impart science instruction effectively a minimum of one laboratory-cum-lecture room should be provided in every middle school as has been suggested by the Unesco Planning Mission in its report.

18. The introduction of astronomy is specially commended as it plays an important part in imparting good science education and is a vehicle for rationalisation. From the middle stage onwards the Indian almanac can be studied by observation of the night sky.

#### Secondary Level:

19. At the secondary level stress should continue to be laid on the above-mentioned aims. Besides these, science as a discipline of the mind and a preparation for higher education deserves special emphasis.

19A. Secondary School curriculum in Mathematics and Science should be completely revised and the new curriculum introduced in at least 20 per cent of schools by the end of the Fourth Plan. The report of the Unesco Team (NCERT - 1964) could serve as a basis.

20. Mathematics, Physics, Chemistry, Biology and Earth Sciences should be taught at the secondary level as compulsory subjects for all students. Having gone through the preliminary courses in these subjects at the middle level the courses should be extended to include wider and deeper content as well as methods. The changing character of the sciences should be the major factor in curriculum development.

#### Mathematics:

21. One of the outstanding characteristics of scientific culture is quantification and therefore mathematics assumes a prominent position in modern education. Mathematics is a vigorous intellectual enterprise in which abstraction, generalisation, logic and axiomatic method and consistency play an important part. Apart from its momentous role in the growth of the physical sciences, it is now playing an increasingly important part in the development of the biological sciences (for example, the

connection between information theory and the genetic code). The advent of automation and cybernetics in this century which marks the beginning of the new scientific-industrial revolution makes it all the more imperative to devote special attention to education in mathematics.

22. It is most desirable that the course in arithmetic and algebra be an 'integrated one' and is so organised that unnecessary repetition in teaching fundamental operations with numbers is avoided and the emphasis is placed on the laws and principles of mathematics and logical thinking. There need be no divergence between acquisition of skills in computation and insight into the nature of mathematics.

23. 'Set' language may be used in defining the basic terms in geometry and operations with numbers. It is only through the use of 'set' language that a proper integration of arithmetic, algebra and geometry is possible. The use of School Mathematics Study Group (USA) notations for line, segment, ray and so on, which provide for more precision in language, may be adopted.

24. The modernization of mathematics teaching is a vital element of any programme of reform of school education. But the new curricula and the new approach can be introduced into our schools only gradually. The pace in this matter will be determined by what can be done regarding the training of new mathematics teachers and the re-training (through refresher and correspondence courses) of teachers already in schools.



The new approach requires a higher level of competence in mathematics and endless endurance of the teachers. This is equally valid for other subjects as well.

25. Several students have a "block" or "resistance" against mathematics due mostly to bad teaching, but this exists and has to be taken note of.

Physics:

26. The teaching of physics should be developed in a logical fashion leading to formation of concepts that develop the unity of science, recognising the fact that physics is a single developing subject of study. Here too, as in chemistry, laboratory work should play an important role as a means of exploring the field, before formulae, definitions and laws are introduced. During the last few decades the conceptual framework of physics has undergone a drastic change, and this should find some place even in high school physics.

Chemistry:

27. Emphasis on memorisation of facts, formulae, processes and compounds, should give place to the unifying concepts in chemistry. The theory of composition and structure of matter and the periodic law being the scientific basis of modern chemistry, teaching of chemistry should be done on the basis of concrete data on chemical elements and their compounds. The nature of the chemical bond should be stressed prominently. The applications of chemistry in industry and daily life, and its growing importance in a developing economy should be stressed right from the school stage.

Biology:

28. Advance in understanding of living things are dependent on advances on related sciences. The wide gap between the science of biology as it exists in the research laboratories, and the one presented to secondary school students, requires the development of new programmes and materials. The present content of the course is traditional in nature and emphasises morphology. The concept of biology as a method of inquiry by means of accurate and confirmable observations, quantitative and mathematically analysed and controlled experimentation should be emphasised.

Earth Sciences:

29. Effort should be made to introduce earth sciences in the secondary schools. Geology and geography should be taught as an integrated subject and there are many areas in chemistry, physics and biology where these subjects could be introduced; for example, in physical sciences, composition and erosion of rocks, crystallization, ores, density, flow of molten rock, elasticity and in biology, nature and formation of soil, effect of plant on newly eroded soils and soil conservation.

Laboratory Work:

30. The weakest link in the present system of teaching science is laboratory work. Students go to laboratory and verify the results as described by the teacher. The practical book is usually available which gives all information about an experiment and what a student has to do merely is to copy out details on his practical

note book, fill in the blanks and calculate the results with the help of the given formula. The approach is confirmatory and not investigatory.

31. In respect of the above, emphasis should now shift to location of a problem, development of hypotheses and designing of procedures and experiments relating to theory. "Demonstration experiments" performed by the teacher (or by selected students under the supervision of the teacher) should form an important and integral part of science teaching. Also, there should be a place in the curricula for experiments to be performed by terms or groups of students (e.g. collection of biological samples).

#### Workshop

32. In view of the need to develop manipulative skills in the students it is necessary to provide the minimum facilities for practical work. It is therefore necessary that every school must have a workshop having sufficient number of hand tools and simple implements for wood work, metal work etc. Workshop should be accessible to students even after working hours so that students having the attitude and urge can go and work whenever they want.

33. Teachers: Orientation and training in the new curriculum should be carried out, apart from training colleges, through correspondence courses, refresher courses and summer institutes.

33A. A serious bottleneck in teaching science and in modernising it is the acute shortage of science teachers. This can be partly overcome by expansion of facilities and increasing enrolment in existing institutions and by instituting correspondence and part-time courses, such as summer and winter institutes, week-end courses on a country-wide basis.

34. A great advantage of the correspondence system is that greater the number of students, greater can be the efficiency of the system. This is unlike the classroom system, where larger numbers generally mean reduced efficiency. Also, in the correspondence system admissions can be made at any time of the year. Further, combinations of courses and subjects can be provided under this system which may normally be not possible under formal systems of instruction. Through the system of correspondence courses it should be possible to bring a first-rate instrument of quality education, within the reach of our youth in remote corners of the country. A student joining correspondence courses can adjust his progress according to the time available to meet his abilities and his background and his motivation. It also provides an arrangement for continuing education or inservice training after one has left school, college or the university.

Summer Institutes:

35. Teaching of science and mathematics cannot be effective unless it aims at the understanding and appreciation of scientific processes, concepts and principles, and is animated by an awareness of the rapidly extending boundaries of scientific knowledge. Equipment and books alone, however good they may be, will not avail much, if the teacher does not have adequate mastery of the subject. In order, therefore,

to

-17-

to acquaint and familiarise the teachers with recent developments as regards both content and methods of teaching science and mathematics education, existing facilities in the universities, colleges and training colleges, presently not utilised during vacations should be made use of. During the last few years, institutes were organised for science and mathematics teachers from secondary schools and colleges separately, at various centres. These institutes should become a permanent feature of the science and mathematics education programme and must be expanded substantially so that every teacher gets an opportunity to attend the course once in 5 years or so.

36. The objectives of the summer institutes for secondary school teachers are:-

- (a) to establish channels of communication between schools and universities;
- (b) to improve the subject-matter competence of participating teachers by acquainting them with recent developments in their subjects;
- (c) to enable teachers to develop a better understanding of the basic concepts in their fields of specialisation;
- (d) to enable teachers to conduct experiments, wherever possible, with simple and improvised apparatus, and to encourage further experimentation along suggested lines leading to a consideration of theoretical ideas growing from experiments;

- (e) to strengthen the capacity of the teachers for motivating able students to develop an aptitude for research;
- (f) to stimulate interest in teachers by bringing them into contact with eminent men in the field of their study; and
- (g) to enable teachers to exchange views with their colleagues in the profession and thus promote a greater understanding and appreciation of each other's teaching problems.

37. The objectives of summer institutes for college teachers are:

- (a) to provide supplementary training to the college teachers in Science and Mathematics and to strengthen the teachers' mastery of the subjects they teach;
- (b) to refresh the mind with new idea and to make them familiar with latest advances in respective fields of different subjects
- (c) to gain a better understanding of some of the basic and modern concepts in Science and Mathematics;
- (d) to discuss recent developments in the different subjects;
- (e) to provide the time, means and equipment for discussion amongst the participant-teachers with similar background, interest and problems so as to create greater mutual understanding and appreciation of each other's teaching problems;
- (f) to stimulate the interest of the participants by bringing them into contact with prominent scientists in the fields of their study; and
- (g) to present contemporary knowledge in the subjects as well as contemporary viewpoints of knowledge established earlier.

38. In view of a proposal to improve science and mathematics education at all levels of school educa-

tion, it is essential to organise such institutes for the benefit of primary and middle school teachers. Since the number of primary and middle school teachers to be so trained are large, it would be desirable to conduct these courses at the district level. One of the good training colleges in every district could be selected for the purpose and equipped adequately with laboratory apparatus and workshop facilities. Services of science teachers from local colleges could also be availed of in running the institutes. Some of the training colleges could run 5 or 6 courses of 2-3 months duration, round the year. This should, of course, be done in the light of the needs of the States for primary and middle school teachers.

Maximum utilisation of facilities:

39. Fullest utilisation of existing facilities and their expansion should be resorted to rather than setting up new institutions. This will not only reduce the cost of new buildings but also reduce flight of staff from existing institutions towards new ones, thereby causing a problem to both. Whatever may be the factors behind quantitative expansion, which inevitable in a developing economy, this should not be at the expense of quality. It should be borne in mind that quality, however high it may be in individual cases, is ineffective without adequate quantity, particularly in the Indian context, and quantity without quality

Identification and development of the gifted students:

40. A central scheme for identifying talented youth, and their proper placement, should be organised. In any meaningful system of education, pursuit of excellence over as diverse a field as possible should have pride of place. It should be the aim of education to include in every pupil a sense of, and respect for excellence. Everyone should be encouraged to strive towards excellence of which he or she may be capable, but this acquires a special meaning for the 'gifted students'. The gifted few are a nation's most precious asset, and everything possible should be done to identify them and to provide them with facilities that will help them to develop and unfold to the full their native abilities and special talents.

41. Educational experiences in the class room are often tailored to match the wits of the average student, and the brighter students are likely to develop a sense of frustration, and neglect. Some measures have therefore to be devised to cater to the needs of high ability students, even in a limited way.

42. Even though the National Council of Educational Research and Training has initiated a programme in this regard, presently it is confined only to students at the higher secondary, B.U.C. classes. The range of selection at present is thus restricted to a narrow group of the student population in the age



group of 16-17. It is necessary to broaden the  
research among the children over a wider range and  
include the student population at the middle stage  
also.

43. It is sufficient that the gifted cannot be identified by the usual yardstick of performance at the traditional examinations. They are far too creative to be confined within the perimeter of classroom instruction textbooks and examinations. It is no easy thing as to how identify the gifted, except perhaps, in mathematics and to some extent in science. This is a field that needs sustained and energetic research: the pay-off will be immense. It is most important that there is an element of flexibility in the educational system to cater to the special and varying needs of gifted individuals. For the gifted students, at the school stage itself, facilities must be provided for special courses with varying intensity and flexibility. It is not desirable to fix groups or combinations of subjects rigidly and it should be possible for the students to choose courses in a flexible way to suit their special needs and interests.

Assessment of Students:

44. The present results of secondary schools examinations reveal a colossal rate of failure to the extent of 50 per cent or even more. Apart from

the huge waste of national resources in a system which tolerates such high rates of failures, it is seriously harmful from the point of view of the individuals concerned. It leaves an indelible stamp of failure on the minds of students at an impressionable age, even though most of them are likely to do well in other walks of life later on. In view of this, it may be worthwhile to introduce a procedure of evaluation based on internal assessment as well as an overall performance of the students in the class. The Head of the institution may issue a certificate on completion of the secondary education. It is not necessary for all students to appear for the final external examination which could be availed of by those aspiring for higher education. The examination system should be modified to test the ability of the students and the extent of students' achievements, and recognition should be given to the students' understanding, acquisition of the work skill, logical thinking, originality and creativity and adaptation of known techniques to new situations.

#### Scientific Equipment for Schools:

49. In view of the emphasis on science education investment in laboratories will have to be stepped up considerably. Production and improvisation of equipment on economical basis should be attempted

through mobilisation of all existing units in the country and setting up new ones in the private and or public sector. Necessary technical and advisory services to manufacturing units particularly medium and small scale should be rendered by agencies like National Council of Educational Research and Training, National Laboratories, Engineering Colleges and University Departments. In view of the poor quality of indigenous stores at present, greater attention should be devoted to the aspects of standardisation, calibration, and certification by competent organisations like Indian Standards Institution, National Physical Laboratory, Central Scientific Instrument Organisation.

46. Production of scientific and mechanical toys and kits of educational value should be taken up. Import substitution presently being developed on a large scale should be made use of in the manufacture of equipment for schools and colleges. Production of projectors, film strips and other audio-visual aids, some of which could be developed locally should be given high priority. Besides, design competitions could be started on a state basis and all-India basis thus giving an opportunity for creative minds among teachers as well as students to contribute in this behalf.

46A. School Boards and universities should see that science education and research are closely linked to technical applications and national needs.

Distribution of Equipment:

47. The distribution channels have to be streamlined and energised to reach equipment to education institutions in time. The problem is particularly acute in the case of schools. It would therefore be desirable to set up a separate agency in each State under the State Government to purchase them from the manufacturers, public or private or from the Centre and to constitute suitable machinery for distribution on a district and taluka basis. The Directorate of Education in every State should be adequately strengthened with necessary technical and administrative staff.

48. In order to expedite purchase and distribution of scientific equipment and tools, the State Departments of Education should formulate their proposals with full details for the new academic year about a year in advance. This will enable educational institutions to obtain equipment well before the close of the financial year thereby avoiding the lapse of funds.

Curriculum Planning and Improvement:

49. Textbook writing has not so far been done on any planned basis even though a spate of books floods the market every year. Little care and attention, of any, has been devoted to this aspect by authors themselves who are more often than not carried away by monetary

considerations. This has resulted in a profuse supply of low quality, sub-standard and badly produced books both from the academic as well as production standards. An essential bridge must be made between the curriculum and the teachers through correct interpretation and constant evaluation of the curricula. The production of quality textbooks indicating the level of training desired to be obtained at each terminal level should be taken up.

50. In the light of the new reforms now contemplated in science education, production of quality textbooks, teacher's guides and student's manuals deserve high priority. The services of experts and teachers and only serving but even retired should be utilised to the fullest possible extent in this effort. There is immense scope not only for official agencies but also non-official ones to organise this work on a planned basis in line with recent trends in science education.

51. In this context the establishment of a separate organisation for the development of science education and research at the school and university stage is worth consideration, but a beginning could be made by appointing jointly by the NCERT and the U.G.C. a body charged with the responsibility of developing an adequate programme of science education at the school stage on the lines discussed elsewhere. This

body will work in close cooperation with the Council of Scientific and Industrial Research and professional societies like National Institute of Sciences, Indian Physical Society, National Botanical Survey and the All India Science Teachers Association. Financial assistance to universities and other institutions in respect of development of curriculum and teaching materials should be given generously. Adaptation of materials developed abroad should be taken up wherever necessary.

Educational aids:

52. There are a large variety of audio and visual aids of high instructional value, ranging from the blackboard to television sets. At present, there are schools which do not have the basic facilities of good blackboards and chalks. Provision of blackboards and chalks to every school should, in our view, should be taken up as a matter of high priority without delay.

53. Use of educational films should be promoted in a big way and there should be a producing unit and a clearing house at the central level.

54. Educational broadcast and television:

54. Educational broadcast and television should be increasingly popularised and integrated with classroom instruction. The All India Radio should be requested allot sufficient number of hours to broadcasts directed

to educational institutions on various topics not only by top ranking scientists and educationists but also by good and efficient teachers. "Good talks" should be printed and copies circulated to educational institutions at a cheap rate. Wall charts, diagrams, models and demonstration materials particularly in chemistry and biology should be prepared on a national scale and distributed to schools.

55. In India we could at least make a start with long playing gramophone records which could be loaned to instructions. Similarly, film strips can be made giving formulae, equations, histograms, graphs, drawing home a point made out in the record. A booklet can be made on the subject matter of the record and sent with the record. Later, television can be used for this purpose.

#### Role of Cinema in Education :

55A. In addition to the use of radio television and other audio-visual aids, science education can be and should be promoted through the media of cinema. Information and Broadcast Ministry is doing pioneering work in producing documentaries. A similar programme with special reference to science education should be initiated without delay. Special shows for children and students should be arranged in cinema theaters wherever they exist. Also mobile units with projectors and screens should go round the country displaying them at schools and colleges. There should be a producing unit and a clearing house at the Central level.

#### Institutional cooperation:

56. Different institutions in this country even in a locality exist and function in water-tight compartments without mutual contact and cooperation. In urban areas having a number of institutions, it will be worthwhile to establish intimate groups on subject basis and to pool the resources of

staff, laboratories and workshops  
together for maximum utilisation. Such  
centres of cooperation should grow in  
larger numbers in this country.

57. One of the good schools in a locality  
should assume the role of a leader, pace-  
setter for a group of schools in the vicinity.  
This "leader" school should be adequately  
equipped and staffed to cater to the needs  
of the "follower" institutions so that Radio  
and visual aids, reference books, costly  
equipment etc. could be lent to them by  
the "leader" school.

Library:

58. Every school should have a library  
comprising books of general interest to  
supplement what is taught in the class and  
this should grant from year to year. The  
library should also have a small collection  
of standard works (beyond the school level)  
by outstanding scholars of world fame. The  
list of standard works should be reviewed  
from time to time to keep it up to date. Such  
books may not be used by the average students,  
but are likely to provide stimulus and inspiration  
to bright students. Production of supplementary



reading materials including science journals and periodicals on a state, zonal and national policy and guidelines for action in this regard may be laid down by the Centre, local initiative and interests should be given sufficient scope so as to allow maximum participation by teachers, educationists, scientists and students.

Science Museums and Hobby Houses:

59. In order to improve science teaching in schools and colleges, it is necessary to arouse the scientific interest and curiosity of students by setting up science museums and hobby houses in major towns and cities. Batches of students from neighbouring areas can visit these centres to their advantage. Museums must display as well as demonstrate how to use scientific equipment and apparatus produced in the country as well as those imported from abroad. Also, greater attention should be bestowed on collection of local biological and geological specimens instead of the prevalent practice of undue stress on imported items. Inter-zonal and intra-zonal exchange of specimens among institutions and universities will enrich both the lender and the recipient. University departments and colleges should hold science exhibitions and fairs on a regional basis to attract large number of students and teachers. Hobby centres established in rural colleges with assistance from University Grants Commission should be enlarged on an increasing scale and they could be visited by senior students of secondary schools from adjoining areas. Such centres may also give short term training courses and workshop practice to staff from schools and colleges-

SECTION II

SCIENCE EDUCATION IN UNIVERSITIES AND COLLEGES

1. Science accelerates economic growth, but it also contributes powerfully to culture and liberation of the human mind - it is enlarging to the spirit. Unfortunately, it fails largely to achieve these ends because of the generally poor quality of science education (at all levels) in the country. Enrolment in science is not unsatisfactory. Improvement of quality is the supreme need.

1A. The proportion of total enrolment in science and science-based courses, such as, agriculture, engineering and technology as well as commercial and management studies should be significantly increased. It should be insisted generally that those who go in for agricultural or engineering education should have at least a year's practical (production) experience either before they go in for their courses or during the period of their training.

2. The education of future scientists is attendant with the twin problems of quantity versus quality. The present situation with regard to the enrolment at the university level in science courses (pure and applied) is that it varies considerably from university as well as from State to State.

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 \*UNIVERSITY ENROLMENT IN INDIA - STATE-WISE AND FACULTY-WISE  
 1964-1965

State	Arts		Science		Commerce		Education		Engg.-Tech.	
		%		%		%		%		%
Andhra	18,181	23.1	37,003	47.1	5,526	7.0	1,487	1.9	6,169	7.8
Assam	32,667	67.9	9,464	19.6	2,367	4.9	391	0.8	967	2.0
Bihar	61,253	53.8	31,670	27.8	5,774	5.1	1,042	0.9	6,632	5.8
Gujarat	30,966	37.0	24,289	29.0	12,329	14.7	1,148	1.4	6,019	7.2
Jammu & Kashmir	5,176	39.7	5,237	40.2	235	1.8	420	3.2	971	7.5
Kerala	28,632	34.3	40,978	49.1	3,590	4.3	2,450	2.9	4,008	4.8
Madhya Pradesh	36,696	41.1	23,225	26.0	10,853	12.1	2,326	2.6	6,062	6.8
Madras	23,002	26.1	41,673	47.2	5,697	6.4	1,828	2.1	6,580	7.5
Maharashtra	59,363	35.7	51,682	31.1	29,519	17.7	3,725	2.2	5,781	3.5
Mysore	16,703	23.3	29,855	41.7	6,058	8.5	1,371	1.9	8,340	11.6
Orissa	11,826	43.5	8,625	31.7	786	2.9	611	2.2	1,856	6.8
Punjab	39,900	50.0	17,749	22.2	1,587	2.0	4,069	5.1	7,884	9.9
Rajasthan	16,614	40.9	9,898	24.4	6,656	16.5	1,427	3.5	1,434	3.5
Uttar Pradesh	1,51,335	45.3	1,01,219	30.3	24,332	7.3	4,710	1.4	7,350	2.3
West Bengal	88,309	49.2	42,906	23.9	30,017	16.8	2,284	1.3	6,843	3.8
Delhi	20,363	67.6	3,229	10.6	2,489	8.2	241	0.8	1,008	3.3
Total	6,41,186	42.0	4,78,702	31.3	1,47,789	9.7	29,928	1.9	78,114	3.1

\*Including enrolment in Intermediate Boards.

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 \*UNIVERSITY ENROLMENT IN INDIA - STATE-WISE AND FACULTY-WISE  
 1964-65

State	Medicine		Agriculture		Vet. Science		Law		Others		Total
		%		%		%		%		%	
Andhra	6,915	8.8	15,181	1.5	625	0.8	1,291	1.6	312	0.4	78,691
Assam	1,117	2.4	391	0.8	246	0.5	527	1.1	-	-	48,197
Bihar	2,941	2.6	1,089	0.9	650	0.6	2,846	2.5	6	-	1,13,903
Gujarat	3,686	4.4	1,241	1.5	100	0.1	3,319	3.9	690	0.8	83,787
Jammu & Kashmir	650	5.0	334	2.6	-	-	-	-	-	-	13,023
Kerala	2,734	3.3	284	0.4	252	0.3	524	0.6	-	-	83,452
Madhya Pradesh	4,202	4.7	1,856	2.1	492	0.6	3,152	3.5	420	0.5	89,264
Madras	6,013	6.8	988	1.1	705	0.8	1,161	1.3	631	0.7	88,278
Maharashtra	6,844	4.1	3,909	2.4	361	0.2	5,050	3.0	100	0.1	1,66,334
Myso re	6,040	8.4	967	1.3	437	0.6	1,905	2.7	-	-	71,676
Orissa	1,841	6.8	970	3.6	259	1.0	428	1.5	-	-	27,202
Punjab	4,832	6.1	2,023	2.5	386	0.5	983	1.2	423	0.5	79,830
Rajasthan	1,911	4.7	1,372	3.4	180	0.4	1,101	2.7	-	-	40,591
Uttar Pradesh	5,596	1.7	27,029	8.1	864	0.3	5,230	1.5	6,247	1.8	3,34,122
West Bengal	4,199	2.3	594	0.3	153	0.1	3,778	2.1	363	0.2	1,79,446
Delhi	2,161	7.1	-	-	-	-	705	2.3	35	0.1	30,431
Total	61,742	4.0	41,228	2.9	5,711	0.4	32,000	2.1	9,227	0.6	15,28,227

\*Including enrolment in Intermediate Boards.

The percentage of pupils enrolled in science subjects, engineering, agricultural and medical courses (including the pre-university class), leaving aside those universities which are purely professional in character, varies from as low as 10% to about 65% of the total enrolment. There is an equally significant variation in the percentage of enrolment in science courses expressed per unit of the total population as may be seen from the following chart. It is highest in the Southern States. The lowest is in the State of Rajasthan. It is about 500 per million of the population whereas the highest figure of 2,200 per million is in Kerala. This regional imbalance in science education, and more so in technology, is a matter of serious concern. It has a direct effect on the pace of industrial development. Deliberate efforts should be made to raise the enrolment in science in the States in which it is at present substantially below the all-India average.

2A. Admissions to science courses should be selective. Under-graduate enrolment should be kept at the present level; but post-graduate enrolment should be increased about five times by 1965.

3. It is important that the schools as well as universities clearly define their aims and purpose in offering science education at various levels. There should be a continuous evaluation of the results obtained. Apart from each institution evaluating its achievements in relation to its aims and efforts, the universities, as also the schools, should together discuss and assess the results.

4. The shortcomings which may be observed in entrants to university courses should be analysed in -----

relation to (a) the level of ability of students, (b) the teachers' knowledge of science, (c) the techniques of science teaching and (d) equipment and material resources of schools. This analysis should be done, wherever possible, jointly by the teachers of the university and schools concerned. Practical suggestions should be made to rectify such shortcomings.

5. The view of universities regarding the contents and standard of science courses provided at the higher secondary level should be clearly stated and the minimum requirement in Mathematics needed for entry to university courses in (a) Physical and (b) Biological Sciences should be laid down.

The University entrants should be tested, wherever it can be properly organised, with regard to their relative achievements in:

- (a) knowledge of theoretical work,
- (b) ability to do practical work,
- (c) capacity to solve unfamiliar problems by adaptation, innovation, improvisation etc.,
- (d) knowledge of wider backgrounds of the world of science in terms of 'information' and 'philosophical' understanding,
- (e) their interest in Science - as a factor likely to motivate effort during the degree course and to ensure its continuance in it after graduation.

College level:

6. The objectives of higher education should be (1) training in logical thinking and reasoning; (2) preparing the students for higher studies; (3) equipping the students for the teaching profession; and (4) providing basic training necessary for higher studies in other branches of the subject as well as

7. According to international standards, the level of training obtained at the present B.Sc. in India is not comparable, speaking generally, to the standards attained for the same degree in "advanced countries". Often it is the Master's degree in India which compares favourably with the level attained at the end of the first degree in advanced countries. It is important that effective steps be taken to bring about intensive reorientation and revision of educational objectives as well as methods and contents of courses. For example, (1) a marked reduction in the amount of formal instruction and a corresponding or larger increase in independent study; (2) meaningful assessment of the students' performance at frequent intervals throughout the year; (3) more flexibility in courses taken (offered) and more freedom of choice by the students; (4) a change in the character of teaching to deprecate cramming and memorizing, stimulate curiosity, problem solving ability to develop originality; and (5) by arranging visits of eminent scientists in the country as well as from abroad, who will aid in giving special lectures, seminars and symposia aimed at increasing the quantum of knowledge to be imparted at that level. The purpose should be not merely imparting instruction but providing inspiration.

8. A rethinking of the philosophy and programmes in science education is our urgent need in the wake of

the amazing acceleration of developments in the sciences.

9. The report of the British Association for the Advancement of Science (1961) entitled: "The complete scientist" is the result of an enquiry instituted into the problem of achieving breadth in the education of scientists and technologists. It contains three main suggestions: (1) the syllabus of the subjects of specialisation be reformed (b) the first degree course be lengthened (from 3 to 4 years) and (c) a greater proportion of students be encouraged to proceed to the second degree than is done at present. There is a strong body of academic opinion in the U.K. that the study of subjects at the level of specialisation be postponed to the second degree stage, and that instructional courses rather than research be encouraged at that stage. If this is done, more time will be available for the undergraduate student of science so that he can (a) concentrate on fundamentals and (b) undertake a study of other disciplines, such as, humanities, arts. The first will provide a firm base for specialisation at the postgraduate stage and the second will enable the university to keep to its aims while fulfilling its functions, that is to make him an "educated" man. A syllabus such as this will enable him, after later specialisation, to be a creative scientist and an imaginative administrator as well.



10. Recently there have been quite a few changes in the syllabus of science subjects but most of them have been more or less related to the number of periods, laboratory hours, etc. It is now being felt that an urgent need exists for the development of a new approach to the teaching of science especially at the undergraduate level. Our science courses are often being revised but it is generally not noticed on account of the rapid advancement of science, one is tempted merely to add the new knowledge while still holding too much that in virtue of new discoveries has become largely 'tradition' and even obsolete.

11. Undergraduate and post-graduate curricula need to be drastically revised. Amongst other documents, full use should be made of the UGC Review Reports and Unesco Studies (e.g. A survey of the teaching of the Physics at Universities, report prepared under the auspices of the International Union of Pure and Applied Physics, Unesco Report (1966)).

12. The Chain of subjects permissible at the B.Sc. level should be far more open than is generally the case at present. It should be possible, for example, to combine physics or chemistry with biology, and mathematics with philosophy, and so on.

13. In teaching Botany or Zoology at the first degree level, it is important to appreciate that these subjects have benefited immensely from the recent

advances in physical sciences and technology and have access to techniques and instruments which were not available a few decades ago. It should be recognised that the vital phenomenon of living organisms are expressions of physical and chemical processes and the biologists must therefore have a good knowledge of physical and chemical techniques. The question is at what stage must this knowledge be introduced. The physics and chemistry learnt at the school stage is hardly adequate and therefore it is necessary to study these subjects at the B.Sc. level by making a suitable choice of subjects.

14. The other major defect is the poor mathematical background of biologists in this country. Teaching and research in biology nowadays requires a good amount of biometrical knowledge. A new course of instruction in mathematics and statistics for biologists should, therefore, be devised.

15. The uniqueness of the geological sciences lies in the requirement that earth materials, processes and historical events be observed in their natural associations - in the field. A most frequent criticism of geological education in our universities relates to lack of adequate field training. It is necessary to recognise some minimum time should be devoted to field training in an intensive way. The field training should emphasise modern methods and in an area providing experience with the greatest possible variety of geological materials and phenomenon. The field training

should be continuous over a period of two months in a year rather than as short excursions to places of geological interest. Short field trips should be a part of the regular on-campus program of work.

16. The other criticism relates to the museum collections, which are seriously inadequate. The acquisition of rare and unusual specimens for museum purposes, however desirable, is not as important as having representative Indian specimens; several departments have very good sets of specimens purchased from America or Germany but little comparable in quality from India. The university can easily build such museum collections through an effective program of exchange of duplicate specimens between themselves. Teaching collections are much more important than museums, and should be built by students, staff and research scholars. Such collections should be properly labelled and displayed to attract the attention of all interested in geology. Fossil collections must be especially large and varied. Maps are second only to minerals, rocks and fossil specimens. The most important geological data are generally communicated by means of maps and cross sections. Topographic and geologic maps of typical areas in India are not generally available in most departments. Students must be provided training and experience in reading a variety of maps as well as map making. To do this, requires extensive usable collection of maps. Models are essential visual aids in many essential aspects of teaching geological sciences. The types of models such as those of basic lattice groups

of crystal structure, atomic models, crystal models, three dimensional models, simple topographic and landscape models and plaster models of fossils and animal restorations should be available in every department.

17. In order to raise the standard of teaching, lectures should be coupled with demonstration of all possible types and instruction should centre round the laboratory so that theory is not divorced from practical. There should be well equipped workshops in every college having science courses and the students must be given an opportunity to work with hands and develop manipulative skill. The students should spend some portion of their laboratory time in the workshop to learn using the workshop tools and get well acquainted with such essential aspects as, elements of glassblowing, coil winding, use of lathes, photographic techniques and making of projection slides, soldering, electrical circuitry and wiring and learn to repair the mechanical and electrical equipment generally used by them in their laboratories. Physics laboratories should be fitted with adequate implements and the students should be given a kit of hand tools. The experiments designed at the undergraduate level should fall into three categories:

- (1) construction of simple apparatus starting with materials;
- (2) use of semi-finished materials for fabricating equipment needed for experiments and assembling of finished parts of equipment for purposes of conducting experiments;

(3) use of sophisticated, finalised equipment readily available.

18. Yet another radical, economical and advantageous decision would relate to the abolition of annual practical examinations in science subjects. In fact these examinations do not in any way reflect the ability or skill of the students to experimentation but involve considerable expenditure and emphasis on chance success. If the students' performance in the laboratory has been assessed carefully throughout the academic year, there should be no necessity to have this annual ritual of practical examinations.

19. There is an all too prevalent policy assigning the youngest, least experienced staff members to teach undergraduate classes. Some of them have neither the scientific stature and experience nor the poise to effectively win young men and women to a way of scientific life. Effective education at the B.Sc. level demands the best teaching available. This must be done by an inspiring teacher who is respected by the students as a scientist. It is very necessary that senior professors and researchers teach in junior classes so as "to bring together the untried fertility of young minds with the unsearchable riches of creation".

Post-graduate level:

20. Special and coordinated effort should be made to raise the quality of M.Sc. education and also expand the facilities for training in increasing numbers of persons with master's degree in different disciplines. There is an urgent need to introduce an element

of flexibility and innovation in the organisation of our M.Sc. courses. Border-line and inter-disciplinary subjects are fast becoming areas of major study and research. What we need is to provide, in addition to our present "one subject" M.Sc. course, combination courses consisting of, say, one major subject and one or two subsidiary or contextual subjects. For instance, combination courses in physics and mathematics, chemistry and mathematics or physics, physics and life sciences, would be of real value and interest. What is important is to break the present rigidity and deadening uniformity.

21. There should be a provision for special short-term courses for B.Sc.'s and M.Sc.'s in border-line and applied subjects. Similarly the engineering and technological students could be provided with short-term courses in pure or applied science subjects. This should be distinct from research work. Similar courses may also be provided in inter-disciplinary and border-line subjects which are increasing at present. It is also extremely important to devise short-term training courses in Applied Sciences. Such short-term training courses should not be of more than one year's duration and should be available at least in two levels (a) for those with the B.Sc. or (b) those with the M.Sc. degrees in any of the science subjects. As illustration of the type of courses that may be designed

for this purpose, a few are listed below.

	<u>For B.Sc.</u>	<u>For M.Sc.</u>
Electro-chemistry	1. Instrumentation (General)	1. Computer Technology
	2. Electronics	2. Analytical Techniques
	3. Pathological techniques	3. Solid State Devices & Semi-Conductors
	4. Isotope techniques	4. Advanced Electronics
	5. Metallurgy	5. High Energy Physics
	6. Biochemical techniques/	6. Electron Microscopy
	7. Genetics	7. Telecommunication
	8. Plant Breeding	8. Thermodynamics and Thermo-Chemistry
	9. Forest and Forest Products	9. Biophysics
	10. Bacteriology	10. Radiation Biology
	11. Antibiotics	11. Nutrition
	12. Insect & Pest Control	12. Public Health and Environmental Sanitation
	13. Agricultural Chemicals	13. Prospecting
	14. Fisheries	14. Petrochemistry
	15. Refrigeration -	15. High Polymers
	16. Plastics	16. Dyestuff Technology
	17. Mineral prospecting, drilling engineering	17. Geophysical prospecting
	18. Geochemical techniques.	

22. Courses of this type illustrated above should be instituted in almost every university campus which has both science, agriculture, engineering and/or medical faculties and should be organised as inter-departmental courses by utilising the facilities available in each of the departments. The National laboratories would be equally suitable places for providing such training courses. The persons trained in these short-term courses would be more than readily acceptable in industry, agriculture and medicine and would in turn release a large number of people who are trained in Engineering or Medicine and who are at present going in for jobs where they are not really required. The under-utilization of the professionally trained persons would be offset if provision is made for science graduates to go in for

these short-term courses in Applied Sciences.

23. The M.Sc. programme should provide sufficient opportunity to meet the individual needs and aptitudes of the students as otherwise the basic fact of recognising postgraduate education as an individual accomplishment will not be fulfilled. The objectives of a postgraduate course should be to train students for advanced study leading to specialization and research as well as to prepare teachers for the schools and colleges. While preparing the postgraduate courses, certain assumptions regarding the training available to the students at the undergraduate stage should be made and the curricula should be so framed that a student can either get introduced to a variety of modern topics or can receive intensive training in one or two special fields. Specialization should be attempted only in cases where facilities exist, otherwise most universities should aim at providing a general broad-based course having much in common both in content as well as the level of training obtained so that the student is equipped adequately for undertaking undergraduate teaching and also for entering into such other professions as require an advanced knowledge of the subject. Such a course should require any person desiring to take postgraduate teaching to go in for further training and research work.

24. The syllabii for the M.Sc. degree which at present varies in sets of standards from university to university should be brought to a reasonable level



of uniformity in the extent of training given. Combination courses, in addition to single subject courses, should be introduced at the M.Sc. stage. It will be an advantage to appoint, in some university science departments persons with engineering qualifications. It may perhaps be desirable to train the students more by general courses with very minimum of specialization at the M.Sc. level. Greater specialization in different disciplines should be left largely to the Ph.D. level. A balance needs to be struck with regard to the emphasis on descriptive and experimental aspects of teaching science subjects particularly in biological sciences where a functional approach should be given due importance. A clear understanding of the fundamentals is of greater importance than memorisation of unnecessary details which the students forget as soon as they pass their examinations.

25. The outstanding curricula problem particularly at the postgraduate stage is the maintenance of equilibrium between specialization, professional preparation, preparation for life and citizenship. In this respect the attitudes of the specialized faculty is important both in imparting general education as well as in providing special specialization and concentration.

#### Research and Training in Experimentation:

25A. In this context it should be mentioned that a balance between theoretical and experimental aspects has not been maintained in the Indian universities. The bias has always been and still is towards theoretical aspects.

(i) To illustrate: in physics, theoretical physics, elementary particles have received undue importance in the universities with the result that more and more theoreticians interested in mathematical calculations are produced in contrast to the very small number of experimentalists. The postgraduate students, even in the Delhi University during the course of training in solid state physics, do not come in contact with experimentalists at any stage. If the training in this very important field in present day physics is to be put on proper lines, such contact between theoretical and experimental workers should be established without delay.

(ii) The Physics of solid state has developed very rapidly in recent years from the standpoint of both theory and applications; Research, using new experimental methods is in progress in other countries on the analysis of crystalline structures and real solids and on mechanical optical and magnetic properties. Experimental

methods have developed considerably since the time when the only resources available were X-ray analysis and electron diffraction. Today neutron diffraction can be employed and X-ray diffraction has been made much more effective both by improved techniques and by advances in theory of diffraction. In addition, several new problems are tackled through the use of electronic computers.

(iii) Various scientific applications arise from the study of the physical properties of solids: First, the search for new materials as for e.g. semi-conductors, magnetic substances, and electro-luminescent substances. Second, the development of physical analytical methods which do not damage the substance analysed and lastly, the study of reactions in the solid state. The quantum theory of the conductivity of crystals is of great value in all these studies.

(iv) In the training in solid state physics, therefore, experimentation and testing are as important as the theory. If a student is given an understanding only of the theory and has no access to experimentation, his training is incomplete. This lacuna needs to be made good by bringing him in contact with the experimental workers. Together, they will strengthen and help mutual progress; in isolation, each will remain weak and perhaps out of date.

(v) Such a situation is not peculiar to the subject of solid state physics alone. This is also true in case of other sciences as well. The intra-disciplinary dismemberment and the volume of knowledge accumulated so far in the major sciences has no doubt brought about over-specialization. But this very over-specialization has provoked an inverse or a rather complementary process, that of inter-disciplinary synthesis, bringing into existence new disciplines which are influenced by more than one science. In fact, the diverging lines of the subjects of scientific research are connected by cross-links which restore unity to the whole.

(vi) It is therefore of paramount importance that some of the major physics departments in the country should develop courses in experimental physics like solid state, electronics, tele-communications etc. and will include on their staff a few persons with engineering qualifications.

(vii) Subjects like geochemistry, geophysics and economic geology play a very important role in the economic development of the country. Geophysics can be widely used in geological

mapping, for searching and prospecting of mineral deposits, in hydrogeology, engineering geology.

(viii) At present the exploitation of mineral deposits and the extraction of the commercial metals, alloys and compounds is not commensurate with national requirements, not to mention the potentialities of export trade. The country possesses enormous deposits of ferrous, non-ferrous, rare and precious metals as well as non-metallic minerals like mica, diamonds etc. Exploitation of these natural resources in full needs specialised geophysicists either in specific geophysical methods like electrical, magnetic, gravity, seismic etc. or specific subjects, for instance, general geophysics, oceanography and meteorology, oil and gas exploration, engineering geophysics etc. The geology departments and the university engineering departments in the universities should work together in such areas of vital interest.

(ix) The existing syllabi provide very little scope for an adequate training in applied geophysics. All kinds and varieties of this science are included in the syllabi. A large part of the whole time is given for study of so-called general geophysics which is not used in practical surveying and prospecting of minerals. It is desirable and necessary to change the syllabus in this respect. Even though problems of the inner state of the earth, structure of its crust, characteristics of the earth as a planet occupy a very prominent part of geophysical subjects and even though they have immense scientific interest, studies of such problems are not going to improve the national prosperity of this country at all. On the contrary, each new minerals deposit discovered by means of applied geophysics will help to develop and enrich the economy.

(x) As far as mathematics is concerned, the emphasis must now shift to areas like computational mathematics, which is of extreme importance not only from the practical but also from the theoretical viewpoint. Special attention should therefore be devoted to develop this branch in the major mathematics departments in the country, not merely as a subject of research but what is more important as a subject of compulsory study at postgraduate level. At the same time it is necessary to equip these departments with modern computers so that they will be computing centres as well. This has been discussed elsewhere.

(xi) The low level of mathematical education at undergraduate level makes it difficult to give the mathematics graduates due instructions in more advanced subjects for M.Sc. in keeping with

the requirements of modern times. This difficulty can be remedied by having, in the major mathematics departments or at least, in the centres of advanced study in mathematics to start with, special colleges for undergraduate studies. The college being supervised by the staff and specialists of the major department/centre will be in a position to prepare a better grade of students for the future postgraduate studies. What is applicable to mathematics is equally relevant for other subjects as well.

(xii) Closely allied to this is the development of studies in automatic control and cybernetics in Indian universities. Problems connected with automatic control theory, servo-mechanisms and cybernetics are at the stage of infancy in Indian universities. It is distressing to note that inspite of the increasing tempo of industrialisation of the country, there do not exist in the country special departments or Chairs in automatic control, so much so that till now our engineers have very little knowledge of automation, if any at all. Whatever teaching is done is through lectures divorced from modern instruments but based on knowledge derived from literature, in the result, the knowledge imparted to the engineers is lopsided and insufficient. If the knowledge of our engineers in the field of automation does not increase sooner than later, it will not be possible for them to step up the process of industrialisation. The country does not seem to recognise the importance of this vital field but by the time the realization comes it will be too late to improve it. In this matter particularly "to be forewarned is to be forearmed" and the present is the best time to introduce the course at selected centres, equipping them with modern instruments and devices.

(xiii) Together with the need of automation will come the need for scientists who work in this field, because only then India can increase its own production of modern instrumentation and automation instruments. To prepare good scientists in the field needs more time than to prepare engineers. There is no dearth of competent young men with great potentialities but they need proper training, help and instruction.

(xiv) It is therefore necessary to organise in the main universities good laboratories in the field of automation control and mechanism for postgraduate teaching and research. Special departments for preparing specialists in the field of industrial automation should also be attempted without loss of time. With this end in view a standard programme for courses of automatic control for engineers in chemistry, metallurgy, tele-communications

should be drawn.

(xv) In the field of biology too, the applied aspects should receive increasing attention. Taking into account the great importance of micro-organisms in human life, their role in medicine, veterinary, cattle-breeding, plant-growing, food industry and in many other fields of economic importance, and keeping in mind the considerable achievements of microbiology, it is necessary to pay more attention to its further development.

(xvi) For such a huge country as India it is necessary to have a special institute of microbiology where main problems of general microbiology and biology as well as problems of applied (non-medical) significance could be solved.

(xvii) Besides, this special institute of microbiology it is necessary to set up separate microbiological laboratories or departments under certain universities and institutes where there is a basis for it.

(xviii) A special chair in microbiology may be located in the Indian Universities and such courses should be included in the syllabi of Biology. Students obtain some information on microbes, quite often insufficient, from the courses of Botany or Phytopathology.

(xix) We consider it reasonable and timely to start the training of microbiologists in the following way:

- (a) to organise special chairs or courses of microbiology in the universities or at least in some of them;
- (b) to exchange ideas and experience of Indian microbiologists with those of specialists from other countries; and
- (c) to train specialists by means of joint working out of subjects by foreign and Indian scientists.

(xx) Many renowned scientists have visited to Indian universities particularly the Centres of Advanced Study under the Unesco Programme. They have offered many valuable suggestions for further improvement of the Centres of Advanced Study on the lines suggested above.

26. While it may be desirable that postgraduate courses are provided mostly by universities and other institutions engaged in research, in an expanding situation where more numbers are required to be trained to meet the demands, it may be worthwhile that coordinated teaching of postgraduate classes by a complex of colleges located in the same area is also attempted by pooling the available resources by way of men and material. Wherever possible the teaching potential remaining idle in purely research laboratories should be utilised for the purposes of post-graduate instruction in universities and colleges.

26A. A plan should be prepared by the UGC in consultation with the universities. The average capital investment per M.Sc. place (new) should be of the order of Rs.25,000-50,000; the recurring cost would be of the order of Rs.2,500-5,000. For upgrading of existing places about Rs.10,000 per place be provided over 10 years.

26B. A major reform which is urgently needed in the staffing pattern of our science and mathematics departments in the universities is to make it more broad based. For instance, some, if not all, departments of physics will benefit immeasurably if they had on their staff one or two pure mathematicians (interested to take up the study of mathematical physics) and one or two engineers. It would be a distinct advantage if some parts of electricity course or of electronics were taught by electrical engineers rather than by physicists. The inter-mixing of physicists and engineers will give the much needed stimulus to the development of experimental physics in our universities. It will also improve the functioning competency of the departmental workshops and help in the maintenance and fabrication of equipment for research and training. The same conditions, *mutatis mutandis*, apply to other departments, and also to the faculties of engineering and medicine.

26C. Every effort should be made to encourage mobility of post-graduate students and research workers between universities as well as universities and other research institutions. It should be possible for a selected group of postgraduate students and research workers, say, about 10% of the postgraduates to spend one or two terms of their regular training in other university institutions as a part of the requirements for their postgraduate degree

Such students should be provided with adequate scholarships and the grants to cover other incidental expenses. These facilities should be developed extensively in addition to the existing programmes in the centres of advanced study. The existing programme of encouraging research workers, teachers, technicians and other personnel to visit research laboratories and institutions for six to eight weeks should be considerably expanded so that every teacher would have an opportunity of utilising the grant once in three or five years. This would help not only in the exchange of ideas but also in the learning of new techniques and keeping abreast of the newer developments in their disciplines. Such programmes which encourage academic mobility should be adequately supported with necessary finances.

Training for the Ph.D. and other research degrees

27. While it could be said that the standards for the Ph.D. theses in most of the well known universities of India generally compare quite favourably with those of foreign universities, it should however be

recognised that the training for research lacks breadth as well as depth. In accordance with the British pattern generally followed by most universities in India, our Ph.D. students are not required to attend lectures or take any examinations as a preliminary preparation before submitting their theses. All attention from the very beginning is focussed mainly on the subject topic of the proposed thesis which itself is very often narrow or too restricted. No attempt is made to provide the student with a comprehensive and broad background even on the wider aspects of the problem. Quite often the approach itself is imitative of a plan of work designed, perhaps very appropriately, about ten or twenty years ago on solving a problem of a similar nature. Such a researcher would naturally tend to be narrow in his outlook and sometimes turn out to be no better than a technician. Indeed, the person would not only be ineffective as a teacher but his research potential would itself be restricted because of his unawareness of significant contributions in his own field much less in closely related fields. This situation should be considered more serious particularly when viewed in light of the prevailing feeling that obtaining a Ph.D. degree is the climax and the end of all research whereas in most countries a real research career starts mainly after an investigator has obtained his Ph.D. degree. The process of obtaining a Ph.D. degree is therefore essentially one of training in research



methodology, comprehension of scientific literature, ability to make critical analysis, to draw suitable inferences and to present the findings in a clear, logical and scientific way, and to be able to criticize as well as accept criticism. This training should form the firm foundation for all future research work to be undertaken by the scientist.

28. A collection of the research topics in various science subjects which have been accepted for the award of Ph.D. degree in most universities is a curious mixed bag and if one were to pick at random, one is most likely to meet with a topic which both by its very enunciation and scope would be considered to be behind times at least ten to twenty years. This is partly due to the fact that in most universities the problems are given to and not selected by the student on the basis of his ability and facilities available for work. The guide generally determines the nature and scope of the problem to be solved by the student. This does not, however, mean that some of the topics undertaken by students at least in some universities are not those that belong to the scientific forefront. But, by and large, most of the topics taken up for investigation do not reflect a modern content or approach.

29. In view of the fact that the preparation of students obtaining the Master's degree is not considered adequate enough to enable a student to straightaway embark on a research investigation

required of a Ph.D. standard, it would appear desirable that candidates going in for the Ph.D. course should spend at least one year in advanced training in the subject requiring him to attend some lectures and tutorials of an advanced nature. It is essential that the candidates participate in seminars, present papers periodically and also take part in the teaching programme of the department to the extent possible. The first year of the Ph.D. course should prepare the student for a research career in any specialized branch and provide for ancillary training in allied subjects. The candidate should become conversant with the modern aspect of the subject and his ability to undertake research, acquiring a research aptitude and capacity to do original research work should be tested both by written and viva voce examination at the end of the first year. In case a student does not satisfy the requirements at the end of the first year, he could be given another chance to prove his ability to embark upon a research career. Training in interdisciplinary areas, such as Biochemistry, Biophysics and Statistics should be insisted upon wherever necessary.

30. Concerning the evaluation of the doctorate theses itself, a great variety of procedures prevail, some of which even seemingly mean to ensure the award of a degree irrespective of the competence to obtain such degree. While it is essential that the

guide who has supervised the work throughout should be one of the members of the Board of Examiners, it should be made obligatory that no degree should be awarded unless the reports of all the examiners unanimously favour the award of the degree. It is not desirable that examiners should be all external from Indian or foreign Universities. As far as possible, evaluation should be done by Indian experts in the subject. This is a matter of national pride and prestige. A viva voce examination or a defence of the thesis should be considered as an essential part of the system before the degree is recommended awarded.

30A. A foreign language other than English should be a requirement for the Ph.D.

Translation of scientific literature from modern world languages:

30B. A considerable lot of scientific literature is published in Russian language in the Soviet Union at a rapid pace, but unfortunately the knowledge is not available to this country until the English translations are made and obtained via U.S.A. Delay in this matter can considerably be reduced by organising scientific translation, documentation and dissemination Cells or Departments in a few selected universities to serve the needs of the country. Every Centre of Advanced Study should take up the responsibility of translating in its own field the Russian literature into English as soon as they are received in the country. This will be possible only if every Centre has a permanent Instructor in Russian with a team of supporting staff who will not only do the translation work but will also conduct classes in Russian to aspiring students and research workers. Such Translation Cells in other languages like German, Japanese and French should also be set up in selected Universities.

31. Other points which need consideration with regard to the training of Ph.D. students in the university and college departments relate to the following:-

- (1) Limit the number of students to be guided by a teacher at any given time;
- (2) Eligibility of guides and the laboratories for the type of Ph.D. training proposed to be given;
- (3) Time-limit within which the thesis is expected to be submitted by the student and also the time-limit within which a final decision is to be taken by the university; and
- (4) Acquaintance with the modern developments in the subject and related subjects. The test of competence should be broad-based and should involve understanding of the fundamentals. It should not become a mere training in a narrow line.

32. It should be expected that a student would have a period ranging from two to three years in order to be able to solve a research problem which would merit the award of a Ph.D. degree. It might also be desirable to institute a higher degree than the Ph.D. in such universities where it does not exist already. This degree, namely, Doctor of Science representing the highest award should be mainly on the basis of research work of recognised merit published in international scientific journals and should be scrutinised by a team of scientists both from within India and outside. It would be desirable to have an interval of at least five years between the award of Ph.D. and D.Sc. degrees.

33. Discussions of teaching methods are centred on the school and the university in general enjoys a prestige which appears to protect it from criticism with regard to its teaching methods. The universities implicitly or explicitly hold the opinion that their methodology is protected not only by institutional prestige but also by the esoteric nature of the content of the university studies.

34. The quality of university teaching should be constantly examined in relation to its content, procedures and outcomes. At all levels of undergraduate and M.Sc. teaching, emphasis should now shift from formal lectures to one of conducting seminars and discussion groups. Original references

and very important articles in journals must be referred to and the students induced to do library work and submit periodically essays on select topics. At the postgraduate level every student should be required to learn at least one foreign language particularly Russian, which is increasing in importance in scientific publications at present. The study of Russian and other world modern languages should be encouraged (even at the school level).

Supply of Teachers:

35. Education which is committed to the pursuit of new knowledge in science and mathematics will naturally produce demands for more and more qualified teachers. The problem is further complicated by the rapid change in the structure of scientific knowledge and the resulting obsolescence in certain percentage of the existing teachers and also the developing competition for qualified men between several institutions. In general, quality worsens through shortage of qualified teachers, accentuated by the flight of teachers from colleges to university departments or into administration or industry. In this competition, the weaker institutions viz., the colleges usually suffer most. This competition for teachers and the attitude of the teachers themselves to prefer university positions will result in a hierarchy of quality of faculty parallel to the hierarchy of the student quality as well as institutional prestige. This is essentially associated with the conflict between teaching and research. The universities will attract not only good teachers

but also good students because of more funds being available for research and development. This results in a process of widening of the gap between the research frontier, mainly in the universities, and the training of undergraduate students mainly in the colleges. Such an education in a developing country has serious consequences. Therefore the twin problem of quality and quantity is of vital importance and utmost care should be taken to see that both advance at an equally fast pace and neither of them is left behind to the detriment of the other.

35A. In order to meet the situation adequately, the total funds (with adequate foreign exchange) for science education and research should be at least doubled (at constant prices) every five years for several years; and even more important the available resources (men and money) should be deployed skillfully and selectively; Waste in science and research is no less possible and no less damaging than in other sectors. For efficient utilization of resources we need to create a proper machinery; and operating agencies should be assigned clear and specific missions/roles.

#### Equipment

36. One of the factors of vital importance for an effective science programme at the college and university levels relates to timely and adequate supply of standard equipment needed for teaching and research work. This is of great importance since more and more reliance will have to be put on indigenously produced equipment and instruments. Measures will have to be found for efficient use of existing equipment and import only such sophisticated equipment whose production within the country would be uneconomical and whose import is inescapable. The analysis of the types of equipment generally required at the

college and university levels reveals that it should be possible to meet nearly all the needs from indigenous manufacture provided such manufacture is subject to strict quality control and standardisation. The Indian Scientific Instrument industry should rise to the occasion to rapidly supply the essential equipment as well as produce essential spares to help in repair and maintenance and reclaiming of obsolete and worn out equipment. With the suggestion made to partly convert every science laboratory into a sort of workshop, the need for buying finished equipment for class work should be considerably reduced. Small departmental workshops aided by central workshops and manned with qualified mechanics and technicians should go a long way in meeting the equipment requirements of our educational institutions. Besides, design competitions could be started on a state and national basis purported to give an opportunity for creative minds among teachers as well as students to contribute new ideas in such competitions.

#### Overseas Training and Scholarships:

36A. Every year a reasonably large number of Indian scholars and scientists go to foreign countries either for advanced training or for accepting short-term teaching and research assignments in foreign universities. Apart from the foreign aid programmes at present coordinated by the Government of India, a number of educational foundations, governmental agencies and other similar organizations provide fellowships for these purposes. Quite a large number of students also proceed to foreign countries at their own expense. There is at present no single agency which regulates the training of Indian personnel in foreign countries so that such training may be obtained in areas of vital interest for the development of national economy. It would therefore be essential that all fellowships for overseas training should be planned and administered as to ensure that only those that can benefit to a maximum extent by such training are sent abroad and such trained personnel return to the country with an assured job in the field of their training. Apart from those who proceed abroad for training for advanced degrees, equally important is the training of technicians and supporting research institutions. Such training facilities are at present available in countries like Japan, France, East European countries in addition to the U.S.A., U.K. and U.S.S.R. Similarly in the matter of obtaining expert services, it is equally important to have foreign aid programmes which provide for the services of experts and technicians from Japan and other countries. The expert services should specifically be requested for purposes of fabrication, design and construction of the equipment required by the universities and other research institutions.

37. At some selected universities study and research in computer technology should be organised. Training in mathematical logic and computer techniques should form an essential part of science education. While bigger data processing machines of a sophisticated type could be located on a zonal basis for use by a group of institutions, each institution requiring ordinary type of computers should have immediate access to such equipment in the course of the next 5 or 10 years. Because of the sophistication value and increasing cost of equipment, expensive equipment should be generally used on an inter-institutional collaboration basis where facilities for servicing as well as maintenance should be available. We suggest that the U.G.C. may appoint an Expert Committee to work out a 5-10 year programme for the supply of computers to universities. The possibility of setting up a study centre for computer studies and research may also be examined.

#### Computer Technology:

37A. A special effort should be made to provide facilities for computation and training in programming and computer technology in most of the major university centres. By the end of 1970 at least 25 to 30 universities should have a reasonably good computer installed to serve their research community as well as the research personnel from the universities in their close vicinity. It is a heartening feature to note in this connection that one or two universities in the country have endeavoured to design fabricate and construct their own computers comparable in performance with the usually imported types of machines and at a comparatively lower cost. Such institutions should be vigorously encouraged to construct more such units by providing them essential foreign exchange for import of the required components which are indigenously available. In fact every major university engineering department engaged in studies in electrical communication and automation should seriously think of constructing their own computers. The funds that may be required for this purpose for providing computation facilities to the universities should be specially earmarked and it is estimated that the amount would be of the order of 2.5 to 3 crores with at least 30% of it in foreign language. Such institutions should organise special short-term courses for training of other university personnel in computer technology programming etc.

#### Centres of Advanced Study:

38. An urgent need in the field of higher education in India is the strengthening of postgraduate teaching and research and channelling the existing rather limited resources effectively for the purpose. The University Grants Commission therefore has undertaken in consultation with the universities a scheme for developing, to begin with, a limited number of university departments for advanced training and research in certain select fields.



The scheme is intended to encourage the pursuit of "excellence" and team-work in studies and research and to accelerate the realisation of 'International standards' in specific fields. It provides active support and substantial assistance to promising departments in the universities carefully selected on the basis of quality and extent of work already done by them, their reputation and contribution to research, and their potentiality for further development.

39. We strongly support this approach of concentration of resources as one most likely to yield positive results. Of course, to be successful, the Centres must be selected after a most careful examination of all the relevant factors. The process of selection must enjoy the confidence of the universities and the academic community generally. The Centres should work on an all-India basis and every facility (e.g. adequate provision of scholarships for students selected from other universities) should be provided to enable them to discharge adequately their responsibilities and functions.

40. To be viable, such "Centres of Advanced Study" have to exceed a certain 'critical' size as regards their staff. The departments concerned would therefore have a fairly large staff of professors, readers and research associates, fellows of outstanding ability and qualifications who are actively engaged in research and advanced training.

A substantial proportion of the team would be a kind of 'floating staff' coming to these centres for long or short periods on deputation from other universities/institutions and possibly from abroad. Adequately staffed and properly organised, these departments are expected to make appreciable impact, direct and indirect, in raising the standards of teaching and research in our universities. As they would be functioning on an all-India basis, they would attract teachers and scholars from all over the country and help in maintaining and strengthening the corporate intellectual life in the country. Another additional advantage accruing from the scheme would be that the personnel trained in the centres would in course of time be available for strengthening the staff of other university departments thus helping to meet to some extent the present difficult position experienced by the universities in securing qualified and competent teachers in adequate numbers.

41. The implementation of such a programme is no doubt not easy; it would need such serious thought and boldness in approach and planning. It would demand cooperation and team-spirit from the participants. In actual working many difficulties are likely to be faced, but these would have to be overcome through determined efforts.

41A. Basic goals of Indian Science to be attained over the next 10 to 20 years should be formulated by the appropriate agencies, and then included in a national plan of action. It should be a major goal to establish about 30 Centres of Advanced Study, and three to four clusters of centres to constitute "major universities"; special stress on Mathematics should be laid so that Indian Mathematics and related fields occupy a leading place in the world.

#### Administration of Science Laboratories:

41B. It is to be recognised that the constitutions and most university regulations are modelled on the pattern which obtained almost fifty or hundred years ago at a time when there was comparatively slower growth in the field of science and scientific research. As a result of such archaic regulations and procedures applicable to the government departments adopted in university administration, a large number of avoidable bodies and institutions have been woven into the fabric of the university administration. Outmoded as it is and heavily burdened with unnecessary statutes and regulations often interpreted by bureaucrats, the university machinery moves haltingly and at a slow pace. One of the main reasons for these inordinate delays and unimaginative response on the part of the universities is the lack of harmony between the office of the Registrar and the teaching departments.

41C. In recent years a number of universities have acquired the services of government officers for the administrative work of the university, in the guise of bringing about efficiency. This has resulted in a dangerous situation where the university administration has gained dominance to such a degree as to vitiate the academic atmosphere of the university. People who are trained on administrative lines resort to rules and regulations as something sacrosanct and impose them rigidly on academic activities which require a flexible and imaginative approach.

41D. In fact, because of such imposition of rigid framework of rules, regulations, procedures etc., the academic departments have tended to become heavily administrative in their function and do so much of routine work, filling in all kinds of vouchers, documents etc., that they are left with little time for study and research. Preoccupation with administration at the expense of scholarship and research is a serious matter particularly in the present state of development. Every scientist/scholar who can do research should be encouraged to devote himself to study and research rather than waste his time in administration and unprofitable details. This specially happens in science departments where a large number of indents have to be prepared and a large amount of stores has to be controlled and maintained. The need for complying with superfluous rules and regulations in the purchase of furniture, equipment, apparatus, chemicals etc., needs serious reconsideration with a view to make available to the research worker and the teacher the material required by him without any delay.

41E. It must be recognised that research makes demands of an immediate nature and which cannot be foreseen and to obtain such things through normal procedures prevailing at present would seriously hamper the work. While financial rules, filling in of vouchers and maintenance of registers etc., are, to some extent, inescapable, they could certainly be simplified and reduced to the absolute minimum. The decision of the academic men in these matters should be accepted and the university administration should try to evolve simpler and speedier procedure procedure to

suit each situation. Once a departmental budget has been assigned, the details as to how they should be utilized under different heads of requirements should be mainly left to the departments concerned with almost no financial rules or internal auditing to be gone through. Much of the administration part to conform with the university rules etc., should be done outside a science department. Unless the university rules and procedures change to suit the present pace of science development and research, much of the trained manpower in our science departments would be wasted in attending to these administrative matters.

#### Development of Library

42. Library development must be based on the premise that library service of high quality is the heart of an academic programme of high quality. With ever increasing enrolment in universities and colleges,

the demand for library service has been constantly growing. Unlike the past, the library staff have now to cater to the diverse needs of undergraduates, postgraduates and research scholars. It should be realized that modern university libraries are also required to serve a large number of academic departments and to perform new functions like indexing and abstracting.

43. The present position of expenditure on books and periodicals is not very satisfactory. It is only in four universities that expenditure on books and periodicals is more than 5% of the total expenditure as given below :-

<u>Percentage of total expenditure</u>	<u>No. of Universities</u>
Less than 1% ..	5
1 to 5% ..	34
5% and above ..	4

44. The Heads of Departments and library staff should co-operate fully in drawing up an integrated plan of library development from a long range point of view. Such a plan should take into consideration a number of factors such as the anticipated increase in science enrolment, the faculty-wise distribution of students, new subjects and fields of specialisation, special research projects and so on.

45. No new university, college or department should be set up without taking into account its library needs in term of staff, books, journals, space etc. Nothing could be more damaging to

\*Information available for 43 universities.

a growing department than to neglect its library or to give it a low priority. On the contrary, the library should be the main source of attraction on the college or university campus.

46. The utilization of library grants should be suitably phased over a plan period, in other words, there should be a suitable programme of feeding of academic departments by the library instead of over-feeding them in one year followed by starvation in the next.

47. The essential thing about the development plan of a university library is to lay down physical rather than financial targets. More important than this is a proper use of books by students and teachers. Lectures should be supplemented by tutorial instruction, and thereafter the students should turn to the library to find for themselves, with the help of reference librarians, the facts and knowledge needed. More working hours and working days, easy accessibility to books, adequate provision in terms of sufficient staff, multiple copies of textbooks to be loaned to needy students, better display of new reading material, organisation of book clubs, separate rooms for periodicals, reference books and research works are some of the measures that would help raise the standard of library service. The reading habit which is appallingly low must be toned up at any cost.

48. In addition to having 'departmental' and 'seminar' libraries stocked with a 'working collection

of books and journals' the central library, should facilitate inter-disciplinary communication as also the work of research scholars in borderline disciplines. This will also be economical in the long run.

49. With the emergence of active research in our universities, there is the need for conservation of research potential through documentation work and service. It is, therefore, necessary to appoint a team of documentalists in university libraries who can speak the language of research workers and undertake for them document - search, indexing and abstracting. A few regional centres with equipment for photographic reproduction of documents such as microfilming and photostating need to be set up.

50. It should completely break away from the traditional view held by universities that a library is a conventional but more or less useless accessory. No definite sets of standards can be used in developing a university library programme but the essentials relate to competent staff, an adequate collection of carefully selected and well organised books, well planned physical facilities and professors - teachers who teach with books.

51. A pile of books, even a pile of good books, is not a "library". Given teachers who teach with books and librarians who can and will cooperate with them in converting the library into an intellectual workshop, a handful of sensitively chosen books may work wonders in the life of students. Without such a staff, the most luxurious building or extensive book collection,

may have no effect at all. The object of library planning is not to build a collection or a library as something unrelated to class-work, laboratory and conference room. The object is rather to relate book selection, organisation of the books, conditions of access and all library activities to the daily needs and activities of the academic community, both professors and students. The book selection should be oriented toward supporting instruction and research. The teaching staff and library staff should determine the titles and copies of books to be purchased as well periodically work together to discard obsolete books from the collections. Many of these can be replaced with microfilms and micro-cards.

The library should

- (a) provide resources necessary for research in fields of special interest to the university;
- (b) aid the university teacher in keeping abreast of development in his field;
- (c) provide library facilities and services necessary for the success of all formal programmes of instruction;
- (d) open the door to the wide world of books that lie beyond the borders of one's own field of specialisation; and
- (e) to bring books and people together under conditions which encourage reading for pleasure, self-discovery, personal growth and the sharpening of intellectual curiosity.

52. The financing of library development needs to be stabilised if it is not to suffer from alternative years of plenty and lean years. But there is no formula for estimating with precision how much money a



university should invest in its libraries. It has been found that the expenditure on library in relation to total educational expenditure of the university, has gone up from 1.88% in 1951-52 to 4.04% in 1960-61, by which time the grants provided by the U.C.C. had begun to make a nation-wide impact. The Radhakrishnan Report suggested that about 6.5% of educational budget as reasonable expenditure on libraries. But this could vary from 6.5% upto 10% depending on the stage of development of each university library. This would account for about Rs.7.5 to 10 lakhs generally. It may also be suggested that as a norm, a university should spend each year about Rs.25 for each student registered and Rs. 300 per teacher. This means that our universities and colleges should spend Rs. 10 crores every year for purchase of books and journals.

SCIENTIFIC RESEARCH

1. This Section deals broadly with the function of university research in Indian education and in Indian life in general; and how much research is being done in the universities and what should be done about university research in the future.

2. These questions can begin to be answered realistically only by taking into account :

The role university research plays in the world's most "developed" countries.

India's national objectives and targets in the next and the following plans; including its available and foreseeable resources.

Its social conditions in general and the social conditions in universities in particular.

3. The Universities have always played an important role in the life and culture of the people. We may recall, for example, the great contribution to Indian civilisation made by the world-famous universities of Takshila and Nalanda. However, it is important to recognise that in an age of science and technology, universities, in 'advanced' as also in 'developing' countries, have acquired a new role and a new significance. Through the invigorating and symbiotic combination of teaching and research, knowledge and discovery, youth and age, universities make a contribution to fundamental science as no other organisation or agency can or does. In fact, the state of science in the universities provides a reasonably good barometer to the standard and health of science and technology

in a country generally. The experience of more than a century, beginning with the great German universities, has clearly demonstrated that teaching and research flourish best in combination. In isolation they both wither. The best of either is achieved in an atmosphere where both are cultivated; and in this combination of teaching and research, learning and discovery, lies the real strength of the universities.

4. A precise programme of action about university research can be formulated only on the basis of a systematic analysis should be based, as far as possible, on carefully chosen quantitative indicators and time series. We have less information about some elementary and essential aspects of university research than about almost any other major aspect of education. This lack of information about university research is both a cause and an effect of the relative neglect of university research within the framework of Indian education and within the research situation in general. We would like to stress that in the organisations to be established for the study and research on Indian education in general and on university education in particular a proper and an important place should be given to the continuous production of objective information by the most advanced methods available on university research in India and on its role and impact on Indian society. Scientific work, specially in the applied field, must be directly related to national needs. But science in its essential aspects

is universal, supra-national and supra-societal; and therefore in the formulation of a national research policy and its relation to education policy it is important to make a systematic study and comparison with developments in other countries, and more significantly in USA, Japan, USSR and also the People's Republic of China. Full use should be made of the methods, including definitions and indicators in the statistics on research, that are being developed and accepted all over the world. The existence and development of studies bearing on the scope and purpose of research and criteria for allocation of relative priorities is an essential condition for the development of Indian self-reliance and science policy.

5. To define the role of research within the general framework of national objectives it is necessary to understand to some extent the social forces involved in the development process, and its close dependence on science and technology. In USSR and USA an enormous literature on the various aspects of the scientific revolution is being written by the leaders of science, industry, agriculture and education, of research policy organizations: in other words, by the producers, promoters and users of research. More and more often these analyses are based on social science methods. Here we shall very briefly deal with only those aspects of the current inter-action of research and society which are relevant to the problems of growth of

university research.

6. In the modern world research is becoming a necessary precondition for all kinds of human endeavour.

Today in the highly developed countries research work is the fastest developing category in the social division of labour. The growth of investment in research and the development of research manpower has surpassed all expectations. In the United States, for example, the number of workers (at all levels) engaged in science, research and engineering, expressed as a percentage of the total labour force, is likely to exceed in the near future the percentage of the labour force engaged in agricultural production. The USA plan for science made in 1947 estimated that by 1957 the USA should be spending 1% of its national income on research. The actual figure for 1957 was more than double - it was 2.26%. In all the most "developed" countries of the world (USA, UK, USSR, Sweden, France, Germany) the percentage of the national income spent on research is close to or greater than 2%. It is becoming of the same order of magnitude as that for education and for health services. Both in the USA and in USSR the development and use of research is considered the key factor for the increase of productivity of labour and the development of the productive forces, that is, for economic growth generally. There is a close and direct connection between the percentage of national income spent on research and development and the number of scientists

and technologists expressed as a percentage of the total population. We cannot have one high and the other low without leading to inefficiency and wastage. To do more science we need more scientists. Investment on research and investment on education go together.

7. In the past the development of research and the use of its results often took place "by itself", as it were, without any conscious policy. Yet during the past twenty years or so in most of the developed countries a conscious research policy and planning for the development and use of research work has become almost as important as the policies for defence, foreign affairs, industry and agriculture and so on.

8. The growing importance of research work and its impact on economic and social progress of the country demand a clearly articulated research policy and its correlation with the other national policies. University research, apart from its integral connection with teaching, constitutes a vital sector of the national research effort, and this in a very real sense determines the 'health' of the whole,

9. Research and development and in fact the entire structure of modern technological society has to be supported by a well organised system of education. In the context of ultimate goals of progress, scientific research, technical development and education are inseparable. Research institutions and industry have to depend for their trained manpower on universities. The nation looks to them to bring up a new generation

of scientists and they have a vital role to play in the supply of trained manpower. For supporting the research and development in India, the universities and teaching institutions must provide a healthy and well taught under-graduate school, supplemented by strong post-graduate schools in science and technology.

10. The universities are the places where fundamental, basic or pure research without any restricting considerations of economic advantage or application would find the proper home. Training in the scientific method, research to satisfy the inner urge and intellectual curiosity are both the duties and the privileges of a teaching institution. The maintenance of proper standards, the quality of training and the supply of sufficient members by the universities are of special importance to the nation.

The characteristics of universities, apart from their teaching functions are threefold :

- (a) They act as a pool of manpower which can be drawn on to staff new ventures.
- (b) By improving their attraction, the tendency for students to go overseas for Ph.D. training will be reduced.
- (c) They could be the "Centres for advanced research studies and learning" where most creative and gifted of the scientists could enjoy complete freedom to pursue 'to-excellence' research subjects of their choice.

11. The increasing scope and diversity of research work and the complexity of its interactions with society has made practical decisions on relative priorities among the various types of research, and on the distribution of national resources between research and other sectors of the economy, extremely difficult. On the basis of literature from the developed countries, such as USA, USSR and others, one can define research as the industry producing inventions, discoveries and information based on science. More precisely, research is the creative work done by means of the scientific method to produce new knowledge about nature, about man and his society and the work done to transform this knowledge into new technology, new or better and cheaper goods and services and more efficient social policies and patterns of social action.

Practically every decision in any field of national endeavour, whether it is the improvement of the trade balance or community development, requires not only know-how but also scientific knowledge produced by research performed in the local environment. Every aspect of national development policy depends on research conducted within the country although it must, of course, be based on the achievements of and conform with, the standards of international science, National development requires a large and continuous production of scientific results: the importation of foreign specialists to produce them is politically and economically intolerable as along term arrangement. The development of a national research



potential, that is, qualified scientists, scientific institutions and equipment and a scientific culture within those circles must be created in order to carry out other national policies with any degree of effectiveness. The development of this potential must be regarded from the very first not as a luxury but as an inseparable part of the general programme of development.

12. A conscious research policy has as its aim to develop and utilise "research resources" or research potential toward the national objectives as productively as possible. For this purpose very intensive study and research is being done both in the USA, USSR and other countries to find these relevant factors which determine the productivity in research work and the social productivity of research work and to define and measure these factors. Economists, sociologists, political scientists, management experts are now attempting to identify the conditions leading to a better quality of the work of researchers. Very intense studies are being pursued to determine and measure the productivity of research on the micro economic and macro economic levels. These studies have hardly begun in our country. It is difficult to define research potential precisely. Its essential ingredients are:

- (i) the full time equivalent manpower engaged in research work.
- (ii) the capacity of universities to select and produce well trained researchers.

- (iii) the number and variety of research production units;
- (iv) their equipment, instruments, facilities,
- (v) the availability of financial resources,
- (vi) the network of documentation centres and research publications,
- (vii) national capacity to produce scientific apparatus, equipment, instruments and research "semi-finished products" and "raw materials".
- (viii) national scientific and research work terminology. The research and development work covers a very wide range of activities. It is a multi-dimensional spectrum. Its classification, as indicated below, depends upon the point of view adopted. We have:
  - (i) the innovation chain: basic, applied, development, pilot plant,
  - (ii) method: theoretical, experimental, observational, multidisciplinary,
  - (iii) field of phenomena studied: Various branches of physical, life and behavioral sciences, and their increasingly over-lapping sub-divisions,
  - (iv) investment intensity: "little science", "big science".
  - (v) Social policy function: defence, education, medical, agricultural, industrial,
  - (vi) production environment: industry, government, university, independent,
  - (vii) production unit: team, project, division, laboratory, institute, and so on,
  - (viii) administrative organisation: Commission, academy, council institute, and so on.
  - (ix) source of finance: government, industry, university, autonomous agencies, foundations.

13. The terms defined above are now increasingly expressed in terms of quantitative indicators. And it is in terms of these indicators that the international comparisons have to be made between the university research situation in India and that in other countries.

14. We can reformulate the questions at the beginning of the chapter in the following way, more suitable to quantitative treatment:

I. Compared with the world standard what share of the total Indian research potential, what sectors of the overall Indian research programme, what amounts of research work, of what quality and how effectively are being performed in Indian universities:

II. To what an extent and how effectively are they being used towards India's national objectives and targets?

III. Taking into account in factual terms the Indian national objectives, social conditions and available resources, what should be Indian university research policy in the foreseeable future in comparison to

- (a) the world standard for university research policy, and in relation to
- (b) the education policy of India and
- (c) its national research policy.

#### Research Potential

14. In India, at the present stage of development, there can hardly be a surplus of skilled scientific personnel. Various research organisations compete for the limited members turned out by universities. The dearth of scientific personnel in certain fields has affected standards of research. At the same time due to opening of too many research laboratories, the universities have been denuded of their senior teaching

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Budgetary and Personnel

and research personnel. This is a most serious development, for, it affects the main flow of scientific talent for the entire system. A partial reversal of this process seems very essential.

15. The research potential built up, since Independence is rather very insignificant in comparison with developed countries both in terms of current expenditure as well as manpower. The potential is also not oriented in a balanced way with respect to the major national goals, as well as relative size of the various sectors. Whereas in the U.S.A., U.K. and U.S.S.R. the university research expenditure amount in each case to about 10% of the total R & D expenditure, in India it is considerably less. Also research in India is concentrated in very few centres in very few states.

16. In this context it is essential to assess the impact the scientific revolution on universities in general and on university research in particular. Almost all aspects of university are being changed. These changes are deep, radical and long range. The central change in the universities is the growing importance of its research functions. University research is the focal point of coordination of the two major components of national policy in the developed countries; education and research.

17. It is an interesting and important fact that in the industrialised countries the changes in the function of university research and its impact on national life in general are on the whole very similar everywhere and independent of the size, and the political system

of the countries in question. Thus, although the universities in USA and USSR have different historical background and exist in different political system, the growing importance of their research function is taking place in both countries along essentially similar lines.

18. In the modern world research work is becoming one of the central and most important activities of man. And university is the central institution where man acquires the necessary attitudes, motives, knowledge and skills either to perform research or to utilize its results in a rational way. The development of the creative ability of man was always one of the objectives of education and of university education in particular. Now, this is becoming consciously one of the central objectives of education. If in the past one purpose of education was to produce "learned men" today it is produce "creative men" - for, now machines can learn. It can be said that today some of the functions of the learned man in the past, are being taken over by a well programmed computer. Many of the best computers today incidentally, are able to do what many learned men cannot; to learn from their "mistakes". In the scientifically advanced countries of the world we can see the first signs of the on coming cybernetic revolution. Man will not only perform less and less physical labour; he will perform less and less routine intellectual labour - routine mental tasks will be taken over by computers. Man will be more and more engaged in the effort not only to rationalise

nature, but to rationalise all aspects of his social activities through the creative acquisition of scientific knowledge about himself and society. This can be seen in the rapid development of behavioural sciences. The acquisition of a scientific attitude and the ability to question and creatively interpret the world around us, and to work on the solution of its problems, are becoming the central objectives of all education, and university education in particular. The central and conscious objective of education today is to stimulate and train young minds to discover problems, to formulate them scientifically, to learn to use the tools for their solution and to supply them with the minimum knowledge necessary for that purpose. Students must be taught to be creatively self-reliant, to search for problems, to look for knowledge in the university necessary for the understanding and solution of these problems. This means that the relation of university teacher and student is rapidly changing in the direction of that of collaboration between two creative minds. It implies inevitably that every teacher must either be researcher or be in the closest touch with research work.

The research function of universities has many important aspects. It has a powerful impact on the entire national life.

(i) production of researchers: The university is the central place for the identification of research talent. It produces all or very nearly all the researchers of the country. It gives them their basic training in research. Thus, the quality of national research depends to a very large extent on the quality of university research.

(ii) performance of research: University performs a very considerable portion of national research work, both in quantity and variety. A significant part of the national research potential is located in the universities. This does not apply only to the natural but also to the behavioural and social sciences. The reinter-pretation of the past of country, of its social inheritance and all aspects of its culture, by means of the continually improving scientific method and techniques is a major task of university research and studies.

(iii) quality of teaching: Engagement in research work is a major precondition for creative teaching and stimulation of creativity.

(iv) production of teachers: Since the universities produce all their own future teachers, and also of of secondary schools, a highly developed research atmosphere in the universities has a direct influence on their future creative character and the identification and development of creative talent at the university and also at the school level.

(v) training of leaders: All leaders and decision makers in all fields of national life are now almost exclusively university trained. One result of the scientific revolution is that all the problems of the country are studied and tackled as problems in social sciences. A major task of the universities is to impart to the country's future leaders an interest in the development of a scientific attitude in tackling the problems they are called to face in their work.

(vi) Consultative function: Through its

research performing function the university staff acts in a consultative and advisory capacity to other institutions whether engaged in research, production, decision making etc.

(vii) research policy: In most countries, university supplies the majority of advisory personnel for higher research policy bodies, including the highest.

(viii) research community: The university staff plays a key role in the development and improvement of the scientific tradition of the country and in the organisation and development of a socially aware, and active scientific community. The university staff performs this function through their contacts and communication with each other, and with scientists outside the university. Through individual contact and through student societies the teachers help to develop the scientific tradition and the norms for behaviour in the scientific community among its future members, that is, the students.

Let us now turn specifically to what the Indian university research policy should be. University research policy, as any other policy, can be said to consist of the following four, closely interacting components:

(1) Objectives: Objectives of university research, the ideas of university research function, the will and determination to achieve these objectives,



the values and norms for action derived from the Indian culture and the world and based on the knowledge about the university research situation in India and abroad.

(ii) Organisation established to pursue the objectives.

(iii) the functions and actions: These comprise not only the preparation, execution of plans, but also coordination, promotion, administration etc. of university research.

(iv) Communication system: Whose task is to produce, assemble, process and transmit all information relevant to university research policy.

19. The formulation and execution of university research policy is no routine or a temporary task. It is both a scientific problem and as a practical task. It is both a scientific problem and as a practical task requiring skill and know now. Thus, for example, as indicated previously, the long range objective of this policy is to make the present university research functions in India approach as rapidly as possible those existing in the most advanced countries. The world standard for university research outlined in the preceding pages will change in time as the scientific revolution develops. One of the central tasks of university research policy

in India is to study the unfolding scientific revolution, the trends relevant to university research and to foresee the direction of its changes so as to adjust accordingly the objectives and actions of Indian university research policy. This creative approach to the adjustment of objectives is a permanent and essential task for university research policy makers. Only thus, can the university research policy cease to be an effort to copy this or that foreign model. Consequently, and we must return again and again to this point, a primary and continuous task of the research policy organisation in India must be to study in a scientific manner the changes in the interactions of research and society in general, and university research in particular. The reports of the U.G.C. Review Committees are a first step, but no more, in this direction.

20. A realistic appraisal of the social relations within Universities, of attitudes toward research, of research politics in particular, is extremely important as it is difficult. Equally important is the attitude of University research policy makers toward these conditions, as part of the University research policy ideology. This kind of appraisal is important because it supplies the information for the improvement of the research atmosphere, the building of a healthy scientific tradition and of a creative scientific community. The improvement of these conditions can result in higher productivity without necessarily involving additional material investments. One hears both Indians and foreigners speak of the apathy toward research in Indian Universities, lack of awareness of its importance among the leaders of

Universities and University departments, lack of communication between departments and lack of organizations for stimulating these communications and contacts, antiquity of the curricula, of the experimental facilities and the content and methods of courses, gerontocracy (the rule by the old) not interested in research and lack of encouragement of the young interested in research, back biting, nepotism and all other manifestations of "University politics", of the lack of a creative atmosphere, tradition and the absence of a University Scientific community and so on.

21. In several essential respects the conditions of work in our Universities are most unsatisfactory. But, it would be wrong to assume that a poor research atmosphere, absence of a scientific community and so on are peculiar to Indian Universities. These are to be found in an almost all developing countries, and not entirely absent even in the most advanced countries. A vigorous and positive effort to eliminate the conditions and influences which inhibit the growth of science is itself a most important part of the process of development. To establish scientific traditions in a developing country needs deliberate effort and it also takes time. To quote Michael Polanyi: "Those who have visited the parts of the world where scientific life is just beginning, know the back-breaking struggle that the lack of scientific tradition imposes on the pioneers. Here research work stagnates for lack of stimulus, there it runs wild in absence of any proper directive influence. Unsound reputation grows like mushrooms; based on nothing but common place achievements, or even on mere empty boasts... However rich the fund of local genius may be, such

environments will fail to bring it to fruition,"

22. What should be the attitude of University research policy makers toward these conditions and their alleged existence? The only possible and fruitful attitude to take in this matter is that of social engineering. This means - first to establish the existence of these conditions and identify their causes by all the means available to social sciences. Second to proceed to change them. In other words the University research policy makers should not consider these alleged "Indian" conditions as unmovable walls against which one can do nothing except complaining about their existence. Instead once it is found that they do exist, these conditions have to be described in clear scientific terms, and by all kinds of policy measures they should be modified, changed and where necessary destroyed - the faster the better. Should it be established that these conditions do not exist in actuality, do not affect the productivity of research work, then this fact should be publicised, because the very widespread thought of the existence of such conditions can be very harmful to the general atmosphere so important for fruitful research and other activities.

23. Figures 'A' and 'B' show the percentage of national research expenditure and of research manpower in University Research in a number of developed countries and in India. It is apparent that India's University research absorbs a much smaller share of national research expenditure and research manpower than in the developed countries.

Research manpower and research expenditure in Universities

<u>Year</u>	<u>Number of Researchers*</u>	<u>Total expenditure @ for research (Rs. in millions)</u>
1962-63	3,162	37.9
1963-64	3,342	40.1
1964-65	4,065	48.7
1965-66	4,622	55.4

\*Includes research scholars and fellows, post-doctoral research fellows; and full-time equivalent of university and college staff engaged in research. (This is explained more fully in Appendix A).

@Includes share of UGC, State Governments, Research Councils, Foreign Aid and P.L.480 Funds.

Full time equivalent has been calculated on the assumption that, out of the total time available, the professors spend  $\frac{1}{4}$  of the time, the Readers and lectures  $\frac{1}{3}$  and  $\frac{2}{5}$  of their time respectively in research time. (25%; 33% and 40%).

Research Expenditure in Indian Universities  
and other Research Organisations

Rs. in millions

S.No.	Name of Organisation	1961-62	1962-63	1963-64
1.	Universities	36.0	37.9	40.1
2.	C. S. I. R.	75.4	89.1	103.9
3.	Atomic Energy Commission	74.0	89.3	95.4
4.	Medical	12.3	14.1	15.3
5.	Agriculture	41.3	44.9	49.6
6.	Irrigation & Power	3.7	4.3	-
7.	Industry	3.5	4.0	4.7
8.	Private Industry	5.3	9.3	11.7

24. A major weakness of Indian education and research is the relatively very small part played by the universities in the sum total of Indian research which itself is far too small then what it should be in relation to our needs and capabilities. The universities with few exceptions lack the most rudimentary facilities and tools for research. In most post-graduate departments the laboratories and workshops are grossly inadequate even to merit the basic demands of teaching. Under such conditions it is no wonder that the Universities generally fail to attract and retain persons of outstanding merit. If this situation is allowed to continue for another decade or so it will mean nothing less than ruination of Indian Science and scientific research.

The present position in India is that the university research is both "everybody's concern" as well as "nobody's concern". The maintenance grants provided by the State Governments and the development grants provided by the University Grants Commission are never adequate even to meet the demands of the training programmes undertaken by the universities. As such there is very little scope for development of intensive research. Any research undertaken therefore is of a marginal character and does not help to build up active schools of research. It is well to realize that fundamental research is a matter of immense prestige and no developing nation can ignore the fact that discoveries in science alone can add immeasurably to national pride. No amount of borrowing of ideas and purchasing of patent right for manufacture and purchasing of patent right for manufacture of sophisticated

instruments or consumer goods can adequately replace the grandeur of a great breakthrough hailed as a fundamental discovery.

25. The relative neglect of University research is partly based on the situation with respect to national research policy in India. There is in India no powerful body close to the Centre of political power which deals with national research policy. The Advisory Committee of Science to the Cabinet upto now cannot be considered to have successfully performed this function, no matter what its terms of references are. This committee is constituted of representatives of the largest research organisations in India. As such, its members cannot function efficiently and 'objectively' as advisers on national research policy, simply because they have their own institutional vested interests. In most of the developed countries the central advisory bodies on national research policy are composed of people who have no institutional vested interests to defend or to fight for. For instance in the U. S. A. the President's Advisory Committee on Science is composed mostly of university professors, and the post of its leader, the President's Science Adviser, has always been held by a university professor on deputation (Killian, Kistiakowsky, Wiesner, Horning) and not the Directors of AEC, NIH, NSF, NASA etc.

26. Whatever the causes may be, the situation is that in the national research spectrum university research has been sorely neglected, both as regards resources and other problems. This can be seen, for example, from the utilization of foreign exchange - a key element in the financial support of research in India, (Table K).



7) Foreign Exchange allocations in Universities/Research Centres.

Year	Univs.	M/E	A. E. D.	C. S. I. R.	Agriculture	Medical	Other Ministries	Total
1.	2.	3.	4.	5.	6.	7.	8.	9.
1961-62	42.00	6.78	158.48	44.40	13.60	0.80	11.30	279.36
1962-63	30.35	23.30	206.60	46.70	16.80	0.30	12.50	336.75
1963-64	25.50	24.66	358.10	67.80	6.00	0.50	13.70	496.26
1964-65	31.22	20.85	252.00	70.00	8.00	0.60	14.00	396.67
Total:	129.07	77.59	975.38	228.90	44.40	2.20	51.50	1509.04

Year	C. S. I. R./Univ.	A. E. D./Univ.
1961-62	1.06	3.77
1962-63	1.54	6.81
1963-64	2.66	14.04
1964-65	2.24	8.07
Total:	1.77	7.56

\* In lakhs of Rs.

A Central Organization should be established which will not only have the responsibility of fostering the university research but which will also be placed in a position to increase the awareness of the improvement of science among all the important decision making sectors of society, and to establish and support within the universities the academic body of problems of the growth of science within the country. It should also ensure that foreign aid programmes include systematic advice and <sup>material</sup> help in the establishment and cultivation of scientific research within the country.

27. The present Scientific Advisory Committee to the Cabinet was set up about five years ago. Its role is largely advisory and it reports to the Cabinet. The terms of reference of the Committee are very wide and include practically all aspects of policy concerning scientific research, its organisation, and conditions of service of scientists, and allied matters. The first three Chairmen were Cabinet Secretaries. Later Dr. H. J. Bhabha (Chairman of the Atomic Energy Commission) was appointed Chairman of the Committee.

Dr. Homi J. Bhabha (Chairman)

Shri Dharma Vira

Dr. S. Bhagavantam

Prof. S. Dhawan

Shri S. S. Khera

Prof. D. S. Kothari

Prof. P. Maheshwari

Dr. B. P. Pal

Dr. K. R. Ramanathan

Dr. Vikram A. Sarabhai

Prof. T. R. Seshadri

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There are number of Research Councils:

(a) The Council of Scientific & Industrial Research

The Prime Minister is the President of the Governing Body (as also of the Board of the C.S. I.R.) and the Minister of Education is the Vice-President. The Council has under it about 30 National Laboratories. The laboratories have their separate Executive Council.

(b) The Agricultural Research Council

The Minister of Food & Agriculture is the Chairman of the Council. Its functions are somewhat on the lines of the C. S. I. R.

(c) The Medical Research Council

The Minister of Health is the Chairman of the Council.

(d) Defence Research Council

The Defence Minister is the Chairman of the Council.

The Atomic Energy Commission;

Apart from its own laboratories, it supports Universities in the field of cosmic rays and nuclear science generally. The Chairman of the Atomic Energy Commission is Dr. H. J. Bhabha and the other members are Mr. J. R. D. Tata, the Cabinet Secretary and Mrs. S. S. Khara. The Commission is under the Prime Minister.

NOTE - In the U.K. the Research Councils are:

Science Research Council, Medical Research Council, Agricultural Research Council, Natural Environment Research Council, Social Sciences Council. These Councils are responsible to the Minister for

Education and Science. Most of the National Laboratories, including the National Physical Laboratory, are under the new Ministry of Technology. The Ministry of Defence has a Defence Research Policy Committee.

The Planning Commission recently established a National Planning Council to advise the Commission. It has a Science Committee under the chairmanship of Professor f.C. Mahalanobis, Member-in-charge of Science in the Planning Commission. The other members of the Committee are Mr. S.R. Sen Gupta, Director, I.I.T. Kharagpur, Dr. Sarabhai and Dr. D.S. Kothari.

In this context of the foregoing discussion we may recall the Government of India's scientific policy resolution:

Some seven years ago the late Prime Minister Nehru stated in Parliament;

"Science has developed at an ever-increasing pace since the beginning of the country, so that the gap between the advanced and backward countries has widened more and more. It is only by adopting the most vigorous measures and by putting forward our utmost effort into the development of science that we can bridge the gap. It is an inherent obligation of a great country like India, with its traditions of scholarship and original thinking and its great cultural heritage, to participate fully in the march of science which is probably mankind's

greatest enterprise today.

And the statement continues;

The Government of India have accordingly decided that the aims of their scientific policy will be;

i) to foster, promote and sustain, by all appropriate means, the cultivation of science, and scientific research in all its aspects - pure, applied, and educational;

ii) to ensure an adequate supply, within the country of research scientists of the highest quality, and to recognise their work as an important component of the strength of the nation;

iii) to encourage, and initiate, with all possible speed, programmes for the training of scientific and technical personnel, on a scale adequate to fulfil the country's needs in science and education, agriculture and industry, and defence;

iv) to ensure that the creative talent of men and women is dissemination of knowledge, and for the discovery of new knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom;

v) to encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom;

vi) and, in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

The Government of India have decided to pursue and accomplish these aims by offering good conditions of service to scientists and according them an honoured position, by associating scientists with the formulation of policies, and by taking such other measures as may be deemed necessary from time to time."

28. Scientific decisions and scientific policy play now such a vital role in the national economy that it is most important for the governmental authorities at the highest level to ensure that on major issues they can get advice which is as impartial and as objective as it possibly can be. It is important to have an advisory body which is appropriate for this purpose. Such a body may have on its heads of major agencies concerned with scientific research, but it is, if anything, even more important that it should have on it persons (younger persons should be preferred) with high standing and regard in their professions and who inspire general confidence. The number of such persons should not be less than the agency heads. They could be from the universities, research institutions (government or non-government), industry and public life. The advisory body should also have on it not only scientists and technologists but also social scientists and persons with experience of research organisation and management.

29. The scientific Advisory Committee to the Cabinet should be reorganised. The Committee should be in a position to make an objective assessment of the scientific needs of the country and advise Government on policy, including allocation of resources.

activities. The task of this body should be to review continuously the national research policy situation, and first of all the present position of university research, and to make recommendations for its improvement. One of the first tasks of the advisory body on research should be to organise a well prepared conference to review the University research policy problems. A close attention may also be given to the establishment of an inter-ministerial committee on research to include the representatives of the research community in order to coordinate all government actions on research.

30. The most scarce resource in a country is its pool of competent men. Their deployment should be such as to ensure maximum value for the country. In their utilization high priority should be given to areas of employment likely to have a maximum "multiplier effect". In this respect universities have a special significance as these contribute not only to new knowledge but also to the training of the new generation of research scientists. In fact these days when an appreciable fraction of the national income is spent on research, it is important to ensure that research is meaningful and directed to useful national goals and objectives. Let us consider the question of basic or fundamental research. Basic research, if it is to be of quality, needs to be carried out by men of the highest ability. It is thus expensive not only for physical equipment but also in terms of the deployment of the gifted individuals of the scientific community. Also the results of basic research takes a relatively long time to find practical applications. Basic research is international.

and the discoveries made in one country often find practical applications in other countries which may even be less advanced in basic research, but has got greater resources to translate research into practical technology and production. Japan provides an excellent illustration of this process. Penicillin was discovered in the U.K. but its production on a big scale is done largely in other countries. The same is true of many fundamental discoveries. In other words fundamental research is an expensive undertaking and in strictly economic terms and of national productivity it may even be regarded as superfluous. Some basic research may be and is necessary for reasons of national prestige. However, speaking generally the right to do basic research by any institution must be justified and earned, as it were. Universities must engage in basic research as that is essential to their mission of teaching, advanced study and training of research people. The only way to learn how to do research is to do it. Laboratories engaged in applied and industrial research also needs to do some basic research related to their field of work, but this must be justified in terms of the laboratories' main mission and contribution to industrial progress. Research is becoming so costly in terms of physical hardware as also manpower that we may almost state as a fundamental principle that the right to do basic research must be earned. Universities obtain this by performing their main mission which is teaching; and industrial laboratories by doing industrial research which is their main mission.

31. Another related matter is that work in pure science enjoys currently almost everywhere much greater prestige than applied research. It is important to remember this in organising the research activities of engineering and technological institutions. Unless special care is



taken pure work in such institutions will always dominate and even displace applied work. We may almost state it as a principle that pure work drives out applied. In other words there is always a tendency for research in an organisation to tend to become purer and purer unless there be strong countervailing forces. This is sometimes called the principle of "maximum purity".

32. In dealing with priorities in the field of scientific research it must be explicitly recognised that in most cases the relevant considerations lie outside and beyond science. These have to be determined on the basis of economic, social and political arguments and the overall national goals and objectives. In the case of basic research in the universities the main aim is to further science. In other words it is science for the sake of science. But in most other situations the question whether a particular field of research should be intensively developed or not will be a question involving considerations going outside science. For instance, in India today work in agriculture should receive the highest priority because this is a dominant national need.

33. The possibility of establishing a NSF-type of organisation, or on the lines of CSP in UK for promoting science study and research may be examined by the Scientific Advisory Committee. The Advisory Committee or rather a special sub-committee of it in consultation with the University Grants Commission should prepare a proper plan for Universities. The research plan should include calculations on the growth of University research potential and research programmes, the development of research functions of Indian Universities, and even recommendations made in

quantitative terms (within the possibilities offered by the present methodology) of development of the productivity in university research and of University research. Every item of the plan should be based on two comparisons :

- (i) With other sectors of research in India, performed outside universities,
- (ii) with the long range objectives of research, and comparison with the world standards of university research.

Science must be looked upon as part of a planned national policy. The formulation and control of the execution of research policy and its continuous improvement has to be one of the constant major tasks of the highest political set-up of a developing country. Such a body should make the basic decisions on all the key components of a national science policy, that is, national objectives to be reached by the existing research potential, the planning of the growth of the various elements of the research potential, such as, scientific and technological manpower, training and research institutions, equipment and buildings, scientific publications, financial support; long range research programmes; the distribution of scientific potential with respect to the prospective productive forces of the country and with respect to the principal goals to be reached through science.

34. For purposes of illustration are given below a small number from a long list of possible steps necessary for the proper development of some of the major aspects

of the research function of the university. One of the objectives in planning such a long range development can be stated to be that more and more university personnel - that is teachers and students - should perform more and more research work of a better and still better quality. Every university teacher in India should become a researcher, and every university researcher should become a teacher. Students should be oriented more and more away from passive lecture attendance and book learning toward independent creative study and research. Publication of qualitative research should become one of basic criteria for advancement of teachers in their university career and as a standard for the successful completion of studies by the student.

35. A certain proportion of the bright M.Sc. and Ph.D. (and even undergraduates in exceptional cases) in accordance with the principle that every researcher should be a teacher - should spend a portion of their time teaching undergraduates including formal courses.

35-A. A certain proportion of researchers in CSIR, AEC and other Indian research institutions outside the universities are induced by policy measures to become teachers (full-time or even part-time).

36. The major constraining factors which have to be taken here into account are:

- i) the lack of acceptance of the above principles by the leaders of departments, faculty heads, university vice-chancellors and policy makers in education and research;

- ii) lack of cohesion in the scientific community and scientific tradition, and the resulting frustrating atmosphere in the universities;
- iii) individual motivation of the university teacher and student himself;
- iv) the increase in the number of students foreseen for the next decade or two, and the consequent claims of activities other than research upon the time of teachers and upon the possibility of their personal engagement in research and in research guidance of students.
- v) material resources and facilities.

There is a small number of first class scientists in the developing countries who under the extremely difficult conditions existing prior to independence, when scientific research was scarcely encouraged, managed not only to survive scientifically but, through the strength of their character and their devotion to science also managed to build first class laboratories and institutes. The hard struggle for scientific existence they had to go through often left an imprint on their personalities which made it difficult for some of them to adjust themselves to the new generation of scientists. Such personalities, however, as a rule, held very high the standards of fruitful scientific work and they often succeeded in transmitting their views and beliefs to their pupils. Yet one often encounters other types of scientific personalities who have a more negative influence on scientific productivity.

These include those who do as little work as possible, always speak well of their superiors and those who may be called "research politicians" whose main concern is laboratory politics rather than their own research work and the irreconcilable malcontents who complain incessantly about the conditions of their laboratories, the condition of science in their country, their colleagues' incompetence but do very little themselves. Similarly there are other scientists who have fixed ideas and who have an established reputation often backed by political support and who enjoy privileges out of all proportion to their real worth as scientists.

37. The change in the attitude of the university leaders toward research through the acceptance of the above principles as their guide to action in university policy matters is an essential and basic precondition for the successful development of the research function in the university. This in itself has to be considered as a problem in social engineering, a problem of developing modern university policy ideology. This change in ideology should be stimulated through the activities of the national research policy bodies and education policy bodies. The conscious improvement of the scientific tradition and the improvement of the atmosphere favourable to research in the University must also be analysed and studied as a problem in social science engineering and then achieved through a continuous series of actions on the part of the leadership of the University.

A first step is to find out how the total working time of teachers is divided among some or all of the following activities: preparation of courses, teaching classes, leading seminars, preparation and correction of examinations; writing textbooks, monographs, studies and lecture notes; instruction of students by means of field and laboratory work; personal study, personal research, leading research, administration, participation in University affairs, and participation in public social activities. A thorough study of the actual time distribution of the working hours of university teachers at various levels, in various disciplines and in different universities is very essential for a planned increase of their research function. We understand that the University Grants Commission is organising such a study.

38. The stimulation of university teachers to undertake research can be achieved also by a whole series of policy measures. Of course, this cannot be done for all categories of teachers in all universities. One should start with the younger categories of teachers. After providing them with time the possible measures to be used for this purpose could be:

- i. salary remuneration for those who besides teaching do and publish research.
- ii. Prizes in the form of research equipment, material etc.
- iii. Increased status and role in university for those who do research.
- iv. Possibility to travel in India and abroad.
- v. Requirement of research work and publication, as the criterion for advancement from the lower to higher university positions, etc.

39. It needs to be stated that the amount of research now done in Indian Universities is so small that there is no real danger in the near future that the research function may develop to the detriment of the teaching and other functions of the university teacher. Equally we may say that there is no harm in adopting publication of quality research and scholarly works (including outstanding books for the use of undergraduate and higher classes as a major criterion for advancement in university careers. "Publish or perish" is generally taken as a very harmful and a contemptible policy criterion for a university career. But the fact is that both in the United States, and in the Soviet Union this is the basic criterion used in practice for the advancement along with the University ladder. Of course, we immediately come against the objection that under Indian circumstances the adoption of "publish or perish" may lower the quality of research work, that a lot of what will be published will be "junk". This raises the question of the general improvement of quality of Indian research. We should use policy measures in a planned and deliberate way to raise the standards of our research work and publications.

40. Roughly, it should be possible to identify university departments as (a) centres of advanced study, (b) "aspirants" which may be recognised as centres of advanced study in the next five years or so and (c) ordinary university departments mainly engaged in training of students at different levels.

The scheme for the centres of advanced study would make available reasonable amounts of funds to the departments in category (a) for taking up research work in an intensive manner. Those included in the last category and which require only limited amounts for continued research associated with their teaching activity generally receive such assistance through development grants available to them. The main problem of supporting university research in an effective way is, therefore, in relation to the departments included in the category (b).

41. The universities, apart from the funds available to them through state and central financing essentially look for support for their research activities to various organisations within India, such as the Council of Scientific & Industrial Research, Indian Councils of Agricultural/Medical Research and the Atomic Energy Department. Some support is also available from International Foundations and through foreign aid programmes, such as, PL.480 etc. The research work supported by these bodies is essentially in the form of short term research projects extending not more than three to five years. The result is that there is no continued support for undertaking research by the university departments.

42. It is not uncommon to find some university departments having as many as 12 to 15 research schemes entrusted to them. The research fellows working in such departments naturally require and also make demands on the laboratory space, scientific equipment, consumables,



library books and journals etc., available in the department. Such fellowships do not carry any provision for providing these departments with grants for capital expenditure so that they could improve their physical facilities also. The university departments which accept such research schemes or research fellowships naturally divert their available resources, normally meant for improving training facilities, for supporting these research programmes. This naturally results in neither of the two sectors viz., teaching and research being fully supported with the limited funds available to them.

43. If university research in India is not to be left behind and has to make its presence felt not only in the national scene but also in the international field, it is imperative that special support should be given for scientific research in universities. This can be done only by making a separate provision for such research to be undertaken in carefully selected areas of work.

44. Instead of a number of research planning and administrative units functioning in an unsystematic way, it has been suggested that a National Research Planning Unit should be set up and the University Grants Commission could and should be the place for such a unit. Such a unit would be charged with the task of drawing up a plan for university research development for next ten years, to cover the 4th and 5th Five Year Plans. The basic objectives of the plan should be :

(a) To plan university research as an integral

part of India's national research potential targets for 1975.

- (b) By 1975 or thereafter Indian University Research should have approximately the same relation to the total national research effort as in the developed countries.
- (c) The university research potential in physical, life and social sciences should be utilised for the development of India at least to the same degree as University research in developed countries.

45. One necessary measure for the improvement of quality is to set the standards for this quality. One simple and effective measure would be to insist, for example, that every Ph.D. thesis before it is accepted and passed as satisfactory must result in the publication of one or more papers based upon it in reputable journals, either abroad or at home. The definition of "reputable" or "high quality" journals is not as difficult as it may seem. Each one of any ten professors of physics in the country, for example, no matter what is the difference in quality among them as researchers on in their training, will most probably draw up the same list of "reputable" or "high quality" foreign journals in physics when asked to do so. The problem of achieving a good standard of Indian research publications is more complicated. This task would perhaps require the organization of central Indian reviews to be brought out yearly in every major field of research. The editorial boards of such reviews should, through policy action, be composed of the most prominent and successful researchers in the given subject; and possibly, at the early stage of this endeavour, it may

include a limited participation also of foreign researchers. Such "quality" reviews, if done carefully, may come to be regarded as indicators of the qualities of work in the various University departments and other institutions. They could play a great role in stimulating good work.

46. A number of measures should be undertaken to stimulate student research. The first measure, evidently would be to make gradually some key aspects of research work as the requirement for successful M.Sc. studies. The development of undergraduate student interest in research should be a basic matter of concern in university policy and those responsible for it. This can be done, first of all, through the change of curricula, the decrease of number of classes to be attended, the development of independent individual study, the change in the examination procedure, and collective activities of students. For this purpose the establishment of student research societies is an important and necessary step. In every university department, as a matter of university policy, one teacher, preferably a younger one, should be put in charge to help in the development of such a society, and to insure the participation of teachers in its activities. The Society should be provided with the resources and facilities essential for its functioning. Also, Researchers in the universities should be allowed and encouraged including Ph.D. students to obtain the help of bright and talented students in some phases and aspects of their research work. This

should be used also as a criterion for judging the achievement of students in their studies.

4.47 Three main causes for the obstructions to the effective use of limited scientific resources in a developing country which are interconnected and which render it difficult to evolve an efficient scientific policy relate to (a) the failure of scientists, such as they are to carry and transmit the tradition of science and their consequent failure to constitute a scientific community, (b) the lack of appreciation of and demand for research by industry, agriculture and other sectors of society and (c) the Government, a bureaucratic institution lacking in experience and tradition in dealing with science.

48. The development of team work is an essential condition for the improvement of the quality of university research. It is also a necessary condition for the development of a healthy research atmosphere and research community within the departments and within the university as a whole. Team work must be real. It is a travesty of team work and the spirit of research if the professor or the departmental head puts his name on every paper without his having contributed anything to the solution of the research problem. Unfortunately, this is not a rare thing in India. It should be a part of university research policy to eliminate ruthlessly such spurious and parasitic team work. We now come to the central problem of research planning in India. This is concerned with the proportions of university research potential at

present and in the future within the total Indian research potential. It is most important for the health and progress of science and research that university research potential should come within the next few years to about the same level relative to the total national research potential as is the case in the developed countries of the world. The expenditure on university research should reach by the end of the decade about 10 per cent of the total R and D expenditure of the country. The total university research expenditure in India is at present of the order of 3% of the total national research expenditure, which in most of the developed countries is from 8% to 15%. It should be the function of the National Science Advisory Committee to study the causes for this disparity, find ways to rectify it, and plan a better distribution of the national research potential. It is apparent that in the national research plans a higher priority should be given to the increase of the university research potential in terms of all of its basic indicators, manpower, money, foreign currency, equipment, libraries, computers, etc. than to the increase of the research potential in other sectors of the economy. This planned increase of university research potential expressed in percentages of the total can serve as the upper limit within which one can calculate the possible priorities of internal distribution of university research potential. This should become a national research policy, and a careful study should be made of the most effective ways to implement it and to overcome the constraints arising from, among other things, the jealousy and fear of "research-empire-rulers" to open their

to open their accumulated research potential and resources to outsiders through collaboration. One first measure in this direction with many benefits for Indian research may be to increase the number of students - at all level of studies - working for their university degrees in research institutions outside the universities.

49. The increase of the research potential and support in the universities by other organisations and institutions than the University Grants Commission should be encouraged as a principle of national research policy. This should include foreign sources, but above all it should lead to the development of multisource support to the university research from Indian institutions. The development of support of university research, and especially of research in institutes of technology, by private and public industrial enterprises, by the defence departments, and so on, should engage the attention of university policy bodies and of the national research policy bodies. This is one of the most important steps in furthering university research.

50. The elimination of dangers to university freedom and independence which may arise from this kind of support is essential for the fruitful development of university research. It should be a major task of the national research policy, and university policy, to prevent and to eliminate through energetic and public measures all dangers and infringements of this kind to university autonomy and freedom of action.

This kind of danger, it should be recognised, is much greater in the undeveloped conditions of a scientific tradition and scientific community than it is for example, in such developed countries as the United States, the USSR and the U.K. In those countries it is hardly conceivable and it would be a major public scandal if any agency outside the universities, because of the research and political power it wields, were to prescribe and dictate what research should be done in the universities or whether this or that project within a given field should be undertaken by them. A man or an institution attempting to dictate and dominate university research in this manner would be laughed off the public scene by the scientific community and would soon disappear from the national research policy scene. A major task of the university research policy bodies should be to make on the basis of interviews, public hearings an objective study on the prevalence of any malpractices in Indian research and to take measures to ensure that universities are free of them.

51. In the context of scientific research, we should like to stress the special importance and value of research in social sciences. Generally speaking, the less developed countries tend to neglect social science as compared to natural sciences. This is not the case in the developed countries. The coming phase of the scientific revolution can be expected to result in a rapid increase in the demand for social sciences, in a rapid development of the methodology of social

sciences and a relatively higher priority for social science support. In the less developed countries the development of social sciences should have a high priority and almost every problem of development is in the first instance a social science problem and only to a secondary degree it is a problem of resources. The development of economics, political science, public administration, management, sociology, social psychology, anthropology, education research, innovation and research is of primary and paramount importance for national development. The full development of the many sides of the social function of university research is possible only if social sciences receive a high priority. The problem of development of university social sciences research should be one of the first tasks to be undertaken by the U.G.C. and the Scientific Advisory Committee.

52. It is often stated that universities should perform almost exclusively "pure" basic research, leaving applied research and development in all branches of research, natural and social to other institutions. This belief is based on an image of university role and university research which prevailed among a minority of university teachers in the U.K. and some other countries some thirty or fifty years ago. Today, the universities - as shown by the distribution of the national research potential and programme in the developed countries (see figure) are engaged also in applied research and some of them to a



small degree even in development research.

52A. Prof. P.M.S. Blackett in his discussion with the Education Commission particularly stressed the importance of applied research to a developing country like India. This necessarily implies close and intimate cooperation between research in the universities and engineering institutions, usefully employing not only engineers but pure science investigators. The problems of industrial research, it was stressed, should be jointly tackled by staff in the universities and engineering institutions as well as those working in industry on a cooperative basis. There could and should be exchange of staff from universities to industry and vice versa. Consultancy and advisory positions and even directorships in industrial concerns can be offered to academic people.

52B. The laboratories of the CSIR and the industries should help the nation in training undergraduates and postgraduates for specific categories of technicians who will man the industries of the country. This training course should not involve a thesis for a Ph.D. Such technicians should be usually be taken not only in industry but also in the university departments for maintenance of instruments and also bringing up new designs and construction of instruments in the workshops of the universities. However the laboratories of the CSIR could take a few students for the Ph.D. in applied fields especially working with industries etc. the type of work cannot be easily be done in the universities. Both the public and private sector industries must spend sizeable amount of money in research and development so that they can retain the excellence of their products and introduce new items of manufacture. It should be mentioned that the excellence of the industries in the United States of America is mainly due to the efforts of the research and development wings of the industries which has been made possible by their ploughing in into research and development large sums of money continually. This example is worthwhile emulating. In Germany industry puts up research institutions in collaboration with some university departments and they join hands and work together on many projects. This is worthwhile implementing in India, wherever such facilities exist.

52C. A survey has not yet been made showing how in India the university research potential is distributed along basic, mission-oriented basic, applied, development research. It is essential that this survey be made as

soon as possible. One beginning in this direction should be made by analysing the surveys made in various branches of research in India universities by the UGC also by analysing the Ph.D. thesis done in universities along with classification.

52. It is an important conclusion of this Report that the systematic and scientific study of the problems of development of university research, the development of methodology for this purpose, has to become a full time professional task for a number of people in the country, either in U.G.C. or in some other institution concerned with university research policy.

54. We would like to reiterate the extreme importance of a balanced allocation of resources between the universities and other institutions of high-university type devoted largely to basic research but divorced from teaching. If research institutions outside the universities expand at too rapid a pace this would result in depleting the universities of their men, and may be also the money which should go to them. In the long run weak universities would inevitably weaken the research institutions. In this context the report by the (U.K.) Institute of Physics and the Physical Society (1963) is of considerable interest. Commenting

on it The Economist (London) has said:

"The two learned bodies are alarmed at the way good physicists are absorbed into government establishments, lured by salaries and by research facilities that they could never hope to find outside them (few organisations pay scientists as well as, for example, the Atomic Energy (Authority). Once there, they are lost for ever to the universities, to teaching and to science generally. The universities see their own teaching standards in danger because good scientists will stay to teach only if they have facilities for research and the universities are denied the right to provide those facilities because they have already been installed behind some government security fence.

Underlying this complaint is the brutal fact that many of these government establishments have turned to university type pure research because they are no longer required for their original purpose. Much of the work now done by the Atomic Energy Authority is of highly academic nature. So is the work done by Ministry of Aviation's radar research centre at Malvern. They are openly preaching on the universities' preserves, but what would one have them do, leave their equipment

idle and their skilled staff underemployed? The problem of providing for the free exchange of research staff between universities and government establishments is one that has exercised several committees of investigation and none has come up with any apparently workable solution, not least because, as the report stresses, the difference in salaries paid presents insuperable difficulties to all but the most unworldly." (The Economist, 31st August, 1963).

55. At present there are in the country a number of institutions which devote a very large part, if not their entire effort on university-type of work but functioning outside the universities and with no real contacts with them. These have grown largely at the expense of the universities and there is no doubt that their general effect has been to weaken them. Prof. H.J. Bhabha brought this out in his recent address on the occasion of the ICSU meeting at Bombay (January 1966):

"These (Dr. K.S. Krishnan and Dr. A.R. Verma) are not isolated instances, since the attempt to fill senior posts by mature scientists from outside must inevitably lead to their being taken away from the only institutions which have scientists in some measure, however, inadequate, in an underdeveloped country, namely the universities.

It cannot be disputed that the cost of building laboratories on the lines followed by the Council of Scientific and Industrial Research has been a weakening of the universities by the drawing away of some of their good people, which is their most valuable asset."

56. At the present level of our resources it will be nothing short of squandering to organise fundamental research divorced from teaching. The real strength of the universities lies in that they combine teaching and research, but this they can only do effectively if adequate facilities for research are provided to them. The time has now come when a serious effort should be made to bring within or at any rate to link intimately with the universities/institutions such as the Bose Research Institute (Calcutta), Laboratories of the Indian Association for the Cultivation of Science (Calcutta), the Tata Institute of Fundamental Research (Bombay), the Physical Research Laboratory (Ahmedabad), Birbal Sahni Institute (Lucknow), the Mathematical Research Institute (Varanasi), the Raman Institute (Bangalore). This is necessary as much in the interest of the growth of science in the country as in the interests of the individual institutions themselves. Institutions engaged in fundamental research and isolated from the universities can hardly last for more than a decade or two even under favourable conditions. Setting up of faculties/institutions for basic research separate from teaching should be avoided, if not eliminated altogether.

57. Recently the Atomic Energy Department has undertaken a programme for research in radio-astronomy, and also in the

field of molecular biology. The interests of the A.E.C. in these fields is to be welcomed, but it needs to be stressed that these fields of research should primarily be developed and supported in the universities unless there be compelling reasons to the contrary. (We are not aware of such reasons).

58. We should like to say at this stage a word about the Research Councils. As mentioned earlier there are a number of such councils: The Council of Scientific and Industrial Research, the Agricultural Research Council, the Medical Research Council, the Defence Research Council. The Prime Minister is the President of the Government body of the C.S.I.R. and the Education Minister is the Vice-President of the Council. The other councils are presided over by the Ministers concerned. This arrangement was no doubt advantageous in the beginning, but now the time has come when a revision is, perhaps, required. There are several reasons why the chairmen of such bodies should not be Ministers. A Minister is hardly likely to have the time to go into the details of professional and technical matters brought up before the governing bodies. Further, as the Minister is the final authority concerned with policy and executive decisions, it may not be desirable for him to be directly involved when these are being discussed among professional people at the meetings of the governing bodies. Added to all these is the consideration that when a Minister is the head of one governing body and not of another agency, the first one is likely to get or at any rate appear to get much greater support and patronage of the government.

59. The Scientific and Industrial revolution has given a new status and a new significance to the place and role of the universities in national economy. In fact, the level of science and technology in the universities provides a reasonable good barometer to the standard and health of science and technology in the country. In a developing country the strengthening of the universities is fundamental to everything else. There is no substitute to strong and progressive universities.

60. The US President's Science Advisory Committee in its recent Report on "Scientific Progress, the Universities and the Federal Government" (1960) prepared under the chairmanship of Prof. G.T. Seaborg, (now Chairman of the Atomic Energy Commission) states: "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; whether the quantity and quality of basic research and graduate education in the United States will be adequate or inadequate depends primarily upon the government of the United States. From this responsibility the Federal Government has no escape. Either it will find the policies - and the resources - which permit our universities to flourish and their duties to be adequately discharged - or no one will."

61. The underdeveloped countries have scientists, but have no scientific community. The latter, defined in the context of developed countries to mean as an organized group with a developed system of beliefs, with the developed system of institution for internal communication as well as a system of communication for dealing with other social groups for furthering their individual and collective work in science and technology. Education and research in science and technology should be planned as a whole; to keep science and technology separate is harmful to both.

## SECTION IV

### The Education of Engineers

1. Though we confine our attention to the institutional preparation of future engineers, we recognise that there is a considerable number of practising engineers in India who, for many good reasons, have not taken degrees but have risen by merit and experience through industry's ranks. Many of these are holding responsible positions and discharging their duties with high competence. Since progress in industrialisation will depend more and more on a deep understanding of the basic sciences, the training of engineers necessarily becomes more and more institution-based. This is as it should be. But it should be also recognised that "practicals" have always contributed greatly to industrialisation, and more so in its early stages and since outstanding potential engineers and technicians should always have an opportunity to improve their qualifications, widespread and professionally supervised facilities for part-time, correspondence, and vacation courses should be organised for those who wish to further their training.

2. Institutional facilities have greatly increased since 1947. As against 45 colleges in 1947, there were 133 in 1964. Expansion has created problems in quality, and rapid technological advances make an examination of the education of engineers more urgent each year. We shall discuss this problem under the aspects of facilities, content, teachers, wastage, costs, equipment,



post-graduate courses, and manpower needs.

3. Facilities: Considerable variation exists in the duration of courses and admission requirements, as the following table shows:

	<u>No. of institutions</u>	<u>Duration of course</u>	<u>Minimum admission qualifications</u>
(1)	68 (in 1963)	5 years	Higher Secondary (or equivalent)
(2)	25	4 years	I.Sc.
(3)	17	3 years	B.Sc.
(4)	5	3 years	I.Sc.*

4. We believe that for maintaining adequate standards a minimum of five years of engineering education after completion of the higher-secondary stage is essential. This includes the time spent to acquire 'production experience' in industry. Some institutions which lay particular accent on quality or for some special courses or other reasons ( e.g. relatively low standards of the higher-secondary course in relation to the 'national average') a period of one or two years of institutional or self-study may be required between completion of the higher secondary course and entry into the engineering institutions. We do not favour at all courses of only three years after I.Sc., as desirable standards would hardly seem possible, except with enormous strain on the student. We understand that the All India Council of Technical Education (AICTE) has urged replacement of these by other types of courses.

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\*\* A few institutions in Maharashtra and Gujarat are offering these courses.

As a general recommendation, we urge that all institutions not conforming to the standards fixed by organisations such as the AICTE/UGC should either be converted to institutions training technicians, or closed.

5. The further recruitment of higher quality B.Sc. students into selected subjects in engineering such as electronics, should be encouraged, with courses suitably adjusted to make up for their inexperience in workshop practice. Such courses should be normally of three years duration.

6. Content: There are two general observations to be made. The first is the urgent need to strengthen the teaching of the basic sciences specially for those of our engineers who are to be concerned with R and D, and participate in and even anticipate technological advances.

We are considering the training of engineers and not of quasi-engineers or "engineers-cum-scientists" and more science should not be done at the expense of the 'engineering' component of the courses. We find that, in many engineering institutions, science departments are treated as Cinderllas and the scales of pay of science teachers are considerably below those of their colleagues in the engineering departments. We recommend that steps be taken to remove these anomalies, which only impoverish both disciplines, and salary scales should be the same in science and technology faculites. Furthermore, we recommend that an appropriate number of posts for physicists (four or five) be reserved in engineering

departments, and an equivalent number of posts for engineers be reserved in science Departments. The model syllabuses drawn up by the AICTE provide adequate curricular time for strengthening science teaching. On the other hand extensive use of science (mathematics, physics etc.) should be made in teaching of engineering subjects. The recruitment of B.Sc. students into engineering courses at appropriate points, will also help in this direction.

7. Here again, it is the general view - particularly of employers, that our graduate lack practical experience and knowledge of industry. The existing practice of requiring practical experience in vacation periods is open to a number of abuses. Students do not take such training seriously, are too immature in their first years to profit from it, are insufficiently supervised, and are rarely guided into a problem-solving, project-oriented way of thinking. A number of steps can be suggested to correct these defects. Practical experience for full-time students can be delayed until the third year of the course, properly prepared in cooperation with industry and properly supervised. While we believe a strong science base is needed by engineers, we believe, if anything, even more strongly ( and this is particularly important in the context of our present needs) that production experience should be an integral part of the curriculum We recommend the wide extension at this level, as with

technicians, of sandwich type courses. An immediate beginning in this direction should be made as early as possible, and institutions which because of their location or other reasons are in a favourable position to organise 'sandwich type' courses should be given every encouragement to do so. Besides ensuring a stronger link with industry and giving a more practical bias to training, such a practice will have other advantages. It will shorten the period before which an engineer is productive: it will permit students to earn while they learn; it will draw industry and institutions closer together; it could permit some students in non-industrial areas to follow courses.

8. Several steps can also be taken within the institutions. Workshop practice can be made more production oriented, both in the prescribed courses and in vacation periods, with staff and students undertaking research and design of equipment needed in other educational institutions. Groups of students can be set production problems, taken from industry, as project work. Teachers and Departments should be encouraged to undertake consultancy for industry and should themselves work in industry in vacation periods. Frequent professional contacts in summer institutes between teachers and industry should be encouraged. Graduates should be required to have at least one year's practical experience in industry before proceeding to post-graduate work.

9. In addition we should like colleges and institutes of Technology to become much more concerned with the future needs of industry, both in the manpower sense discussed below, and in collaborating in the form of training given. In order to make this purposeful, research design projects should be made a part of the curriculum from the third year. The aim should be to introduce students to the methodology of research.

Projects could be sponsored by industry or government and students could work in groups with assistance from post-graduate students. Public exhibition and competitions for this research project work could be organised.

10. Apart from these two specific measures to improve the present content of course, adequate machinery for continuing revision of syllabuses is needed. General guidance can be given at the national level by expert committees from industry, teachers, and research workers under the All India Council of Technical Education. Rigid conformity should not be the aim of these exercises. Universities and Principals of colleges should have their own machinery, in which industry and research workers collaborate, for the determination and revision of courses, with freedom for professors and departments to develop new approaches.

11. One of the difficulties faced in curriculum making is that we are telescoping two industrial revolutions, as it were. A large part of our industry is traditional,

using processes developed many years ago. Our view is that a much more significant use could be made of technicians in this area. At the same time we are entering new fields and introducing more sophisticated processes based on newer technology and applied sciences. For these new needs - many of which must be anticipated some years in advance - courses must also be developed and manpower estimates made. Some of these fields are : (a) electronics; (b) instrument technology, including automation; (c) chemical technology; (d) in matullurgy, the processing of rare materials and special alloys; (e) aeronautics and astro-nautics; (f) nuclear power generation. Coordination at the national level is required in the location of teaching and research facilities in these new fields. Institutions should encourage the development of extra-curricular clubs and societies among students for cultivating interest in these and other traditional fields and for carrying out additional project work.

12. Teachers: In addition to the modification in curriculum and courses of study, the quality of engineering graduates can be best influenced by the quality of their teachers. We have already suggested that teachers should themselves obtain the practical experience within industry through vacation work, consultancy contracts, working with industry in the

development and revision of their courses of study and carrying out research for industry. In addition, widespread Summer Institutes for the upgrading and constant revision of the knowledge of teachers should be organised.

13. The key step, however, is to make the profession attractive to good engineers. This will be partly accomplished by the conditions of work and the possibilities for research, production and collaboration with industry. While it may not be possible to compete with the best that industry can offer, many high quality engineers may prefer to work in teaching and research, for significant periods in their careers. To ensure this salary scales must be adequate.

14. The existing shortage of teachers in engineering colleges is disappointingly large. In several institutions the staff is short by as much as 30 % of its normal requirement. To help overcome the existing shortage of competent teachers at the college level, "the Technical Teachers Training Programmes" has been introduced. During the training period, young graduates will receive guidance from experienced teachers, some teaching experience, the possibility of obtaining the Master's degree, of doing design and research, and acquiring some industrial experience. So far nine institutions have been set up under this programme. The duration of the course is three years for graduates and one year for holders of a Master's degree. The

total enrolment in 1964-65 was only 143 - it is too small for our needs. We suggest that the duration of this course be reduced to two years for graduates and one year for post-graduates. The course generally should also include study of a modern 'world language' relevant to engineering and technology. Russian in this context is specially important. In addition to this programme we recommend that the scheme of Advanced Study be extended to cover the technological field and that Centres in selected subjects be built up on an All India basis and be given the special responsibility of training, teaching and research staff for Engineering Colleges.

15. All that has been said in the chapter on Higher Education on the role of Departmental heads in building up faculties and providing opportunities for the intellectual growth and professional development of teachers, applies with equal force here. The reputation of institutions will depend to a great extent on the quality of its departments and faculties. The present practice of frequent transfers of teachers and principals in Government colleges for other than professional reasons, must be stopped if the building up of faculties in these is to be effective.



16. Equipment: No effective training in basic sciences and engineering can be given without adequate laboratory and workshop facilities. Procedural delays are at the moment handicapping the development of these. Special consideration should be given to the timely release of foreign exchange and the stock-piling of essential equipment and spare parts, whether imported or indigenously manufactured. Purchasing should be co-ordinated through one agency. A more rational location of equipment and warehousing of parts and materials in terms of work flow, should be ensured in Colleges. This study of location and work flow should form, in fact, part of the training of students.

17. Industry should be approached to loan or gift new or old equipment to institutions, or the samples of their products, both College and Polytechnic.

We add here that in our view Polytechnics should be discouraged from acquiring sophisticated equipment which is used for only a few days in the year.

18. While we have heard widespread complaints at both polytechnic and college levels of lack of equipment and spare parts, we have seen little evidence of attempts to design and manufacture these locally. At various points, we have suggested

that workshop practice at both levels could at least in part be directed towards manufacture of equipment needed by educational institutions. Specimen pieces of imported items of equipment should be dismantled and proto-type substitutes manufactured under the supervision of competent staff members. The design, working drawings and specifications may then be turned over to workshops for manufacture by staff and students as a part of practical training. Extra grants and rewards should be offered to encourage such initiative.

19. Post-Graduate Courses: The growth of facilities at this level has been considerable since 1947. The total enrolment in 1964-65 was about 2,000 with facilities offered in about 41 institutions. Of these 41 Centres, only 6 offer facilities for Post-Graduate diploma and Ph.D., with an intake capacity of 125. The total stock of post-graduates in engineering technology was around 4,000 in 1964. The Ministry of Education has plans for building these centres and the IIT's for Master's degree and post-graduate diploma courses in a wide range of subjects.

20. We have already recommended that admission requirements to post-graduate study should include at least one year's experience within industry. Apart from this we do not see any necessity for uniformity in the duration of these courses which

may vary between one or two years as required by the special field. Research at this level should be directed more and more towards the problems of industry, and larger numbers of those taking up post-graduate courses should be sponsored by industry. A special doctorate degree for professional development work within industry, equivalent to the research Ph.D. degree, should be created. In general, post-graduate work should be more in the nature of research projects than dissertations. The indiscriminate proliferation of courses should be avoided, and the location of highly specialised courses, particularly those such as aeronautics requiring expensive facilities, should be determined in consultation at the national level.

21. Wastage: We have already referred to the alarming wastage rates within the Polytechnics. The wastage rates at the degree level are equally disturbing. A number of studies have been carried out into this problem since 1959 by the Planning Commission, the Institute of Applied Manpower Research and others. A summary of these studies is included in a Supplementary Volume.\* The latest study shows an overall average rate of wastage at the degree level of around 20 p.c., rising in certain branches and years of study to as high as 44 per cent. The causes of this situation lie partly in the academic qualifications of students, and partly in financial difficulties, the absence of hostel facilities, shortage of qualified staff and their rapid turn over, lack of adequate

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\*Please see Special Paper No. \_\_\_\_\_ in Supplementary Volume No. \_\_\_\_\_.

instructional facilities and difficulties with the medium of instruction. We have elsewhere recommended steps which, rigorously applied, should materially assist in reducing this wastage in an area of heavy investment. Further steps can be taken through the better selection of students, arresting the present practice of relaxing minimum academic requirements for admission, and the provision of remedial courses in English for students with an inadequate command over this language.

22. Costs: There are great variations in the per capita total cost per student at the first degree level between different types of institutions, as is shown in the following summary table:

Type of Institution	Recurring Component	Average equipment depreciation component	Building Depreciation component	Total
I.I.T.	11,315	4,436	635	16,886
Regional Engineering College	6,000	838	130	6,968
University College and Faculties	2,010	891	112	3,013

Source: IAMR Working Paper No. 9/1964. More details by institution and by course of study are given in a Supplementary Volume.\*

23. The wide variations in cost per student between University College and the I.I.T. merit at least one or two

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\*Please see Special Paper No. \_\_\_\_\_ in Supplementary Vol. No. \_\_\_\_\_

observations. The present arrangements under which the University colleges receive funds (per student) in order of magnitude lower than the IITs is neither justifiable nor desirable. The fact is that the standard of training in the lower category needs to be raised and this will entail a heavier per student cost. We should discourage severely the proliferation of low quality Engineering colleges. Much larger grants to University colleges are required for their improvement. Also the heavy investment in IIT's can be best justified by the training quality or of research engineers in crucial areas urgently required for industrial development, and the training of teachers for other colleges.

24. We find that engineering colleges in some of the States demand a capitation fee for the award of seats and that no action has been taken to curb such practices. We strongly recommend that such requirements for admission to engineering colleges should be stopped immediately.

25. Manpower Requirements and Planning: The overall considerations regarding the manpower needs within the next two decades have been discussed in Chapter X. The Commission had before it three estimates for engineers and diploma holders. One has been produced by the Ministry of Education as the basis for calculations in relation to the Fourth Five Year Plan. A second has been developed by the Institute of Applied Manpower Research and the third by the planning unit of the Indian Statistical Institute and the Unit for Economic and Statistical Studies on Higher

Education of the London School of Economics in collaboration with the Perspective Planning Division of the Planning Commission.\* The Commission's feeling, after reviewing these studies, is that good beginning has been made in forecasting needs in technical field, but that given the variations in the estimates, the range of assumptions and the inadequacy of data, there is need for rigorous and more refined studies of the educational background of the existing labour force and for more detailed studies in each branch of industry, in terms of national, regional and state needs. This general recommendation applies for the skilled worker and technician levels as for the engineering level. When these studies are made, the opening of new training facilities and admission to courses should be linked with projected manpower requirements.

26. In the immediate future, we recommend that attention be given to the elimination of present wastage rates and to improvement in quality of the education offered through the different programmes we have suggested. These measures should be combined with the expansion of existing facilities to their optimum size and the development of part-time courses for those already in employment. All this should be done with the greatest care and with the fullest assurance that minimum standards will be maintained.

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\*Please see Special Paper No. \_\_\_\_\_ for details of these as well as detailed statistics on the intake into degree institutions by speciality for the years 1959-1966.

27. A study carried out by the Education Commission into the socio-economic background of students admitted into vocational, technical and professional institutions in 1965 brought out certain differences between the possibilities open to different socio-economic groups. Full details of this study are given in a Supplementary Volume.\* Though in many ways remarkable progress has been made in equalising the opportunities open to students from rural areas or from parents of low incomes, there are marked variations in the composition of students in the different institutions. Thus, 85 per cent of students in Institutes of Technology are from urban areas and only 14.5 from rural areas. The position is better in the Regional Engineering Colleges and the Government and private engineering colleges, as it is also for the economic origin of students. In engineering colleges, for example, 41.2 per cent students have parents earning less than Rs. 150 per month and only 11.5 with parents earning over Rs. 500 per month. At the present juncture, over per cent of students in engineering colleges are on scholarships. What is needed now is probably a greater equalisation of educational attainments in secondary schools between urban and rural areas, better aptitude and other tests for admission requirements so as not to handicap students applying from different socio-economic origins and the organisation of remedial courses for good

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\*Please see Special Paper No. \_\_\_\_\_ in Supplementary Volume No. \_\_\_\_\_.

students whose preparation in languages has been inadequate.

VI. Medium of Instruction

28. At the secondary stage and at the polytechnic stage, the regional language should be the medium of instruction. We agree with the decision of the All India Council for Technical Education that, for the present, English should continue to be the medium. The switch over to Indian languages in engineering education should be linked with a similar change in science courses at the post-graduate level in the universities. English will always remain an important library language, and a good knowledge of English as also of other world languages will continue to be required of students going in for study and research in engineering. Vigorous action, however, is required for the preparation of good textbooks on technical subjects in regional languages and for the translation of foreign books and other teaching materials. University teachers and industrialists should be associated with this work. This can be begun at the national level in the production of model textbooks for translation into regional languages. The central organisation should work with State and regional organisations for the selection of authors, preparation of material and publication. The books may be tried experimentally in a few selected institutions before their widespread adoption. In all regional languages, care should be taken to retain a common international terminology.



VII. Co-operation with Industry

29. This has been a theme through this chapter. In some countries such as the U.K., under its recent Industrial Development Act, a levy of  $2\frac{1}{2}$  per cent on the wage bill is imposed on industry for providing training facilities. While re-emphasizing the need for cooperation between industry and educational authorities in the development of training facilities, we feel it may not be necessary in the early stage to enact such legislation in India. In its place industry should be encouraged to start training schemes and a Central scheme of subsidy to industrial concerns providing training facilities may be usefully started. In public sector undertakings, a separate budget provision for this work could be made. Suitably qualified training officers should be posted to industry or groups of industries taking trainees. The training of these officers should be organised by the Ministry of Education. Representatives of industry and educational institutions should meet regularly to review training programmes.

VIII. Administration of Technical Education

30. At the degree level, it has lone been recognised that to ensure professional growth, it is essential that those responsible for individual institutions should have the lest, external control and work in an atmosphere of academic freedom. In the memorandum relative to the setting up the Regional Engineering Colleges, it was clearly recognised that "the Colleges shall have the maximum amount of autonomy, both financial and administrative, so that their

establishment and development may proceed with speed and efficiency." Similar autonomy for the Institutes of Technology was recognised in the Act of 1961. The need for such autonomy and academic freedom is re-inforced by our recommendations for the strengthening of co-operation between educational institutions and industry, for the development of new approaches in the courses offered and for the building up of high quality faculties. Heads of institutions should have adequate powers over both academic matters and the recruitment, retention and promotion of their staff. Government procedures should not be permitted to interfere with the development of academic excellence.

31. Below the degree level, a greater measure of freedom is also required for the Principals of Polytechnics in the execution of the programmes we have suggested and in the improvement of their relationships with industry and the development of suitable training facilities. At the craftsman level, a greater co-ordination is required between the different responsible departments, particularly at the State level.

32. At all levels, greater sensitivity to manpower needs and adequate planning machinery for the adjustment in time of both the strategic location of facilities and the intakes into different courses is required. This should go hand-in-hand with programmes of vocational and educational guidance that we have suggested earlier.

33. In order to give effect to these general principles

we recommend the following steps:

- (a) To ensure the pursuit of the highest standards at the degree and post-graduate levels, and to provide an adequate machinery for the national and professional concern with the future development at these levels, we recommend the setting up of a Technical Committee under the existing UGC Act, on which adequate representation should be provided for representatives of the All India Council for Technical Education, professional organisations, industry and concerned Ministries. This body should have a full-time Chairman and funds allotted to it on a block basis. The UGC should receive separate allocations for engineering, agricultural and general education.
- (b) The Committee recommended above should work in the fullest collaboration with competent organisations such as the Perspective Planning Division of the Planning Commission and the Institute of Applied Manpower Research, for the detailed elaboration and refinements of manpower projections of both short-term and long-term nature regarding the requirements for engineers and research workers.
- (c) The Institutes of Technology have already made a significant contribution to technical education, largely due to the academic freedom which they enjoy. To provide for their further development to their full potential, we recommend that these and comparable institutions be given university

status, while retaining their individual names and characteristics, and brought within the purview of the Committee proposed above. The present dichotomy in engineering education is most undesirable and detrimental to progress in this field.

- (d) At the State level, various Departments are involved in programmes of technical training at the school, polytechnic and college levels, and practices vary from State to State. In those States - such as Madras - where technical education has been made the responsibility of a Directorate of Technical Education, a new impetus and purpose has been given to this work. We recommend that, as part of the Boards of School Education, recommended elsewhere, Directorates of Technical Education be set up at the State level to co-ordinate programmes and ensure continuing contact with Manpower and Planning mechanisms and District level machinery. It should be empowered to recruit staff needed for educational institutions, thus removing a number of procedural delays which now occur through the use of State Public Service Commission channels.
- (e) Chairmen of Boards of Governors of Regional Engineering Colleges, where constituted, should be drawn from a panel of distinguished educationists.
- (f) The Principals of Colleges should have full discretion to decide matters relating to the building up of educational facilities in their institutions within the financial ceilings and policy guide lines laid down. The Principal

or his nominee should be the Chairman of all sub-committees set up for the development of courses and facilities and should have full disciplinary powers vested in him in respect of the appointment of staff.

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Supplementary Volume No. VII-N

**REPORT OF  
THE WORKING GROUP ON  
SCHOOL COMMUNITY RELATIONS**



सत्यमेव जयते

**EDUCATION COMMISSION**  
**University Grants Commission Building**  
**Bahadur Shah Zafar Marg**  
**New Delhi**  
**1966**

REPORT  
OF  
THE WORKING GROUP ON SCHOOL-COMMUNITY RELATIONS

EDUCATION COMMISSION  
GOVERNMENT OF INDIA  
UNIVERSITY GRANTS COMMISSION BUILDING  
BAHADUR SHAH ZAFAR MARG  
NEW DELHI-I



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## P r e f a c e

At the Inaugural Function of the Education Commission, the Chairman, Dr. Kothari stated that "it is one of the basic tasks of education - education at all levels - to generate in the young generation a sense of purposefulness and mission, dedication, confidence in themselves and faith in the country's future. We have to find and provide to our youth 'adequate' and 'inspiring' opportunities of participation in national reconstruction and in the achievement of national goals." In order to do some detailed thinking on these problems, a Working Group on School Community Relations was set up under the Chairmanship of Shri L.R. Desai, Vice-Chancellor Gujarat University, in November, 1964 with the following terms of reference:-

(i) The manner in which educational institutions at all levels could be taken closer to the communities in which they are situated;

(ii) The manner in which the educational institutions themselves could be developed to function as communities;

(iii) The manner in which programmes of community work could be organised in educational institutions at all levels;

(iv) The manner in which the local communities should be induced to take greater interest in the development and support of their institutions.

THE REPORT OF THE WORKING GROUP  
ON SCHOOL-COMMUNITY RELATIONS

The system of education we have inherited was originally designed with the object of familiarising the Indian people with the English language and through it, with the literature, philosophy and science of the West. While this object was laudable and has done a great deal of good to the country, it must be remembered that no earnest attempt was ever made to relate education to the life of the people. It was essentially devised for imparting knowledge and this single objective has dominated the whole scene because of the system of external examinations on which the entire future of individuals depends, emphasises mainly the capacity to remember and recall vast amounts of information which may or may not have any bearing on life. Even in this limited field, the system is not delivering the goods because it has not taken note of the explosion of knowledge that has now taken place in the world and its curricula are still cluttered with enormous dead wood that ought to have been cut out long ago. But education is not mere acquisition of knowledge; it is a three-fold process which includes acquisition of knowledge, building up of skills, and the development of interests, attitudes, and values, all of which <sup>go</sup> to character-building and thus emphasise moral and spiritual values both in individual and community life. As regards the first of these factors, it is not merely the acquisition of knowledge that is important, but the process through which knowledge is acquired is important, especially

when the rate of growth of knowledge is extremely fast. The other two processes are more important and especially the third. But they never figured prominently in our educational system. With the attainment of independence, what the country expected the educational system to produce is young men and women who, besides being well-informed and imbued with a love of knowledge, will also have those qualities which will enable them to participate joyously and successfully in the great adventure of national reconstruction and enrichment of individual life. The most crucial reform needed to transform education is to relate it intimately to the life, needs and aspirations of the people and to emphasise all its three processes and particularly the building up of skills and values. We claim no originality for this suggestion. This fundamental concept was first enunciated by Mahatma Gandhi and incorporated in the scheme of Basic Education. It is, however, unfortunate that there has been only a limited and grudging acceptance of this idea in principle and an indifferent implementation in practice; and the educational system still continues to be, as it was in the pre-independence period, largely unrelated to life. What is needed, therefore, is a firm and unequivocal re-enunciation of the power of education as a means of social change and to make an earnest effort so as to permeate all stages and sectors of the National System of Education.

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2. Of the different programmes which can be introduced in the curriculum from this point of view, we attach great significance to (1) Introduction of work-experience as an integral part of education; and (2) Developing closer relations between the schools and their communities by introducing suitable fieldwork in the curriculum (more especially in higher education) and other social and national service activities.

A. WORK-EXPERIENCE

3. Work-Experience ; Definition and Objectives: Work-experience means participation in productive work, in a farm or in a factory or in any other production unit, under real-life conditions or on the premises of the school. In our opinion, the introduction of this work-experience as an integral part of all education - both general and vocational - will be the most effective programme to revolutionise the educational system and to link it effectively with life and productivity.

4. The objective of 'work-experience' is to build up the total personality of an individual and to prepare him for effective participation in the productive - social as well as individual-activities which form the principal means of subsistence of every community. The justification for making it an integral part of all education can be explained against the background of the development of the formal system of education. Prior to the creation of this system, an individual grew up in society through participation in its

activities and 'work-experience' obtained as an apprentice formed his entire education. While this informal system of education had several advantages, its principal weakness was that it was not sufficiently forward-looking and that it tended to perpetuate the traditional forms of working. When the formal system of education was organised, its principal objective was to withdraw the individual temporarily from participation in communal activities and to train him, in a hot-house, as it were, for his future role in society. While the advantages of this form of educating the individual are obvious, its main weakness lies in the fact that it tends to alienate him from society and to create an artificial cleavage between the world of work and the world of thought. The introduction of 'work-experience' in life situations is intended to overcome these weaknesses and to combine the advantages of both the formal and informal systems of education.

5. Apart from its intrinsic and obvious value as an effective educational tool and in character-building, work-experience would, in our view, serve at least five purposes : (1) it would help to soften the separation between intellectual and manual work, and the social distinctions based on this; (2) it would prepare children psychologically and manually for technical and professional careers and make entry into employment easier; (3) it would help social and national integration; (4) it would, through planning, execution and assessment, develop in the individual, a scientific outlook, attitude of accuracy and spirit of self-confidence; and (5) it would contribute

to increasing the country's productivity by helping children to develop increasing insights into productive processes and the use of science and by generating in them the habit of hard and responsible work.

6. The Forward-Look in Work-Experience: In the present context of Indian society, the work-experience to be provided in educational institutions should be oriented to technology, industrialisation and the application of science to productive processes, including agriculture. This 'forwardlook' in work-experience is extremely significant in a traditional society which is striving to modernise itself through the adoption of science and technology and it may be desirable to draw attention to two of its special features which tend to be ignored :-

(a) In advanced, industrialised countries children grow up in a mechanical world and become familiar very early with the use of tools, hand-machines and power-sources such as electricity. There will be few under thirty in these countries who do not understand the principles of the internal combustion engine and who cannot carry out simple mechanical repairs to a bicycle, car or household appliances. Apart from this more or less daily evidence of applied science and technology, the whole environment gives continuous lessons on the use of machines and power to replace manual labour. Such immediate and general environment is absent in our country. The school is, therefore, called upon to

correct the defects of the child's environment.

(b) The second aspect is even less obvious; but it is also more subtle and of considerable importance in developing science technology. In an economy of crude, hand-made tools, either in agriculture or traditional handicrafts, wide degrees of inaccuracy can be tolerated without interfering with the functioning of the tool or process. In an industrialised economy, extreme accuracy (frequently involving tolerances expressed in thousandths of an inch) is of capital importance, and the whole mechanical world from a simple switch to an aeroplane would break down if this were not observed. A tenth of inch must mean just that; nothing more and nothing less. This respect for accuracy is a characteristic trait best learned through experiencing the effects of inaccuracy. There are, in addition, other more subtle abilities - such as judgment of space relationships, of speed and motion - which go with a technological training and which also can only be learned through work-experience oriented to science technology.

(For some detailed discussion of this form of work-experience, please see Annexures I and II)

7. It may not be immediately possible to provide this type of forward-looking work-experience to every child. But a beginning should be made wherever possible and it should be an objective of State policy to increase such facilities for work-experience in industry and agriculture as rapidly as possible and



to make them available to schools for the education of the rising generation.

8. In the transitional stage, however, the bulk of the students would have to be provided with work-experience in traditional programmes of production which the community practises at present. This second category of work-experience may not be as good as the first. But it will have to be accepted as a hard reality and on its basis, work-experience will have to be organised for the vast majority of schools and students. Even in this case, a continuous attempt should be made to bring in science and technology and to introduce the students to better ways of performing these traditional tasks. It should be realised that the effective value of work-experience is largely proportional to the extent to which a spirit of modernisation or a forward-look is built into the programmes in which the students are made to participate.

9. In the execution of work-experience, like a series of interconnected activities, care should be taken that they not only provide enough time for development by skills, but they give the students the satisfaction and confidence of completing an assignment. It is of utmost importance that work-experience is not only organised educationally but it leads to the enrichment of the creative aspects of an individual. It should also be recognised that in community activities there will be some

which do not call upon display of highly developed skills but enable the individual to work in cooperation and develop corporate skills.

10. Cooperation between Home, School and Community

in Providing Work-experience: Education is a joint responsibility of the school, community and the home; and all these agencies must cooperate in providing work-experience to students. It would, therefore, be desirable to develop certain programmes of work on the school premises as well as in the neighbourhood, and to encourage participation by students in domestic work. These programmes would form a third category of work-experience which needs to be developed and utilised fully for educational purposes.

11. Domestic Work: Participation by students in domestic work can be organised as shown below :

(a) Household Chores: This includes all domestic work like cleaning, washing and cooking and work in the kitchen-garden. Parents should be advised to assign some daily work to their children as an integral part of their upbringing; students should be encouraged to participate in such work, and schools should teach pupils to work with better tools and scientific ways of doing it. This work-experience of high educative value is neglected in the present system of education with the result that students, and particularly the first generation learners, are estranged from their families. This is a weakness which has to be remedied as early as possible.

(b) Parental occupation: Parents should be advised to give opportunities to their children to participate in the family occupation, such as work on the farm or in the workshop or in some family trade or craft, and students should be encouraged to do so.

It is true that schools have no direct control over the two forms of work-experience indicated above. But it is possible to secure the cooperation of the parents in creating and utilising work-experience of these types for the better education of their children. This will need close parent-teacher contacts and an effort by the schools to change the outlook and philosophy of the parents themselves. This task would obviously be assisted if an atmosphere favourable to work-experience is created in the society by a nation-wide adoption of this programme. The purpose would be served if the teachers were to inquire of the students the chores done at home and to encourage them to do so further.

12. Work-experience on the School Campus and in the neighbourhood : In addition, educational institutions can create opportunities for work-experience on their own campuses and in their neighbourhood as shown below :

(a) Work in Class-rooms, Schools and Colleges : Various opportunities for work exist in the class-room, on the campus of the schools and colleges,

and on the playgrounds. Cleaning the school-rooms and the school premises, levelling of the playground, preparing and maintaining a school garden, decorating the school and the class-rooms, polishing the furniture, white-washing the walls of the school and painting the doors and windows - these and similar opportunities of work exist in schools and colleges. Instead of utilising servants and labourers for this work, it is possible to get this work done through the pupils. Japan has followed this practice in her national system of education and several schools in India are already doing this.

(b) Examples of institutions working on this self-help basis are available in the U.S.A. and other countries where the entire school plant, so far as its maintenance is concerned, is worked by the students themselves reducing thereby substantially the per capita expenditure. And there is no reason why it should not be possible in our country. This type of work-experience will teach the pupils dignity of labour and will cultivate among them habits of manual work. If this is done on a nation-wide scale, it will effect some saving in expenditure, which can be utilised for providing better amenities to students.

(c) At the school level it should be possible to do various crafts as is done in basic schools and a good many progressive schools in other countries. In

addition to developing the dignity of labour and the habits of manual work, such crafts will add to the mental development of the child and if various opportunities and experiences are used for purposes of academic work, the work in the class-room will become more purposive and real. Similar craft work of a different type can be thought of for higher classes. In order that the community may realise the value and utility of that education it will be desirable to select crafts suitable to local conditions.

(b) Work in School and College Hostels : The hostels are like homes for the pupils, and all the opportunities for work-experience in the homes are also available for pupils in the hostels of the schools and colleges. At present, life in most hostels is far too costly and there are too many servants about so that the residents are brought up like scions of aristocratic families. The training institutions for basic teachers have tried to break wrong traditions and have evolved a form of community-living in which students get valuable work-experience and learn to economise. We recommend that the broad pattern of hostel life evolved by these institutions should be followed in all Government and private hostels for schools and colleges. This generalisation is of great significance. Until now, this type of work-experience has been confined to the pupils of the

basic training schools and because of this isolation, these pupils regard themselves as victims of the experiment and often develop attitudes of hate and dislike towards it. If self-help and manual work would become a part and parcel of daily life and training in all types of educational institutions - as was done in the old Ashram Schools and Academies - the concept would yield rich educational dividends.

(c) Work-experience in the Neighbourhood : The School neighbourhood will also provide opportunities for cleaning of public places like temples, mosques, townhalls, parks and gardens, decorating these places during festivals, planting and watering trees in public parks and gardens, etc. Every educational institution should be responsible for some definite work in this respect. Occasions for useful work-experience also arise when fairs or festivals are held, in busy seasons of agriculture when labour shortages are keenly felt, in times of crisis like the outbreak of an epidemic, and on special occasions when some programme of national reconstruction is taken up in the local community. It should be the responsibility of the school to provide services to the community on such occasions and to participate with it in productive work and national reconstruction. Besides providing work-experience such activities will establish better contacts between the community and the schools and will develop,

among the pupils, desirable attitudes towards their community. In this connection, the possibility of adopting one or more villages for social and community work-experience may also be explored.

13. Work-experience in General Education : Work-experience should be an integral part of all general education, although its form and objectives would have to be varied from stage to stage to suit the age and maturity of children. At the junior primary stage (classes I-IV), it may begin as simple hand-work and its objective would be to train the children in the use of their hands and thereby help the growth of their intellect as well. At the senior primary stage (classes V-VII), it may take the form of learning a craft and its objective would be to develop technical thinking and creative capacities in the pupils. Even at these early stages, however, it is possible to provide some work-experience in real-life situations, e.g. work on the farms at the time of harvesting or sewing or in a family production unit, and this should be done to the fullest extent possible. At the Secondary stage (classes VIII-X), it may be provided as training in the school-workshop; but an attempt should also be made to provide it, to the extent possible, in real-life conditions in a factory or a farm. At the higher secondary stage (classes XI-XII), work-experience should be provided only in real-life situations. At the collegiate stage, work-experience

can be provided more easily; some students may have such experience in connection with their studies (e.g. students of Economics may work in a bank or a Cooperative Society or a regulated market), while others may work for a time in a farm or a factory or other units of industrial production.

14. Work-experience in Vocational Education: In all professional, vocational and technical education also, work-experience plays a significant role. Its ideal organisation would be found in medical education where a medical college is closely related to a hospital and the student is taken through three stages before he enters life : (1) Theoretical study; (2) gradual introduction to work-experience under controlled conditions through practical work in hospital; and (3) internship for one year at the end of the course. Similar arrangements ought to exist in technical education, teacher education, agricultural education, education in the Faculty of Commerce, and other programmes of vocational education. But this does not always happen; and one of the major programmes of reform in this sector is to make adequate provision for good work-experience for all students.

15. Institutions of higher education and Universities have a special role to play in the development of work-experience as an integral part of all education. It is they who set the fashion for the entire educational world and success for the programme would be ensured by



launching it affectively and on a large scale at this stage. From this point of view -

It would be worthwhile to organise some special programmes for organising work-experience in institutions of higher secondary and University education. For instance -

(a) In the case of some selected institutions in Science and Technology, it would be most stimulating and profitable from every point of view, to assign to them some carefully chosen industrial/scientific projects. The institutions should carry the projects through all stages, upto full-scale production.

(i) Some institutions could take up the manufacture of scientific equipment and chemicals required for science education in schools and colleges;

(ii) Some institutions could take up the manufacture of furniture, teaching aids, etc. needed by school itself or those in the neighbourhood.

(b) Some institutions may think of undertaking projects such as dairy, cooperative store, bank, etc. and run the project through all its stages.

16. Economic Aspects of Work-experience : Work-experience should ordinarily result in some 'earning' for the students - either in cash or

in kind. This would set off, to some extent, the expenditure which the students have to incur on their education or on their maintenance while at study. Quite naturally, the size of this earning will increase as the student grows up, i. e. at the higher levels of education.

A significant way to provide work-experience is to encourage students to 'earn and learn' to the extent possible. There should be a deliberate and intensive effort to provide adequate opportunities for the purpose especially at the Secondary and University stages and in fact there may even be a general convention that the education of a student is not complete unless he participates in some work-experience in real-life conditions and earns some amount, however small, towards his own maintenance. This will help to promote the development of values which promote economic growth such as appreciating the value of productive work and manual labour, willingness and capacity to work hard, thrift and austerity which will facilitate capital formation, cost-mindedness, etc.

17. If the organisation of work-experience in schools and colleges is to be done effectively, three precautions will have to be taken :

(1) To do all the necessary preparatory work in detail and sufficiently in advance;

(2) to create an adequate implementing machinery; and

(3) to prepare a carefully phased programme

for implementation in view of the resources available.

18. The preliminary spadework to be done will include the preparation of essential literature for its introduction to teachers and schools. Short orientation courses will also have to be held for Principals and Headmasters and special teachers needed for the programme would have to be trained.

19. Implementation: Very difficult problems of educating public opinion, mobilisation and training of personnel, administrative organisation and financial support will arise if this large-scale programme is to be quickly and effectively implemented and its success will largely depend upon the extent to which these are solved satisfactorily.

20. At the national level, the responsibility of giving a momentum to the whole programme and ensuring that it is satisfactorily implemented in the States should be placed squarely upon the Ministry of Education. For purposes of coordination and mobilisation of effort, it may be desirable for the Ministry to set up an Advisory Committee which will have upon it the representatives of the various organisations concerned such as Ministries of Food and Agriculture, Community Development, Labour Employment, Industrialists, Universities and State Governments. A similar committee may be set up at the State level and it will be necessary to have a whole-time special officer in the Directorate of Education to look

after the implementation of the programme and to remain in charge of the funds provided for it. At the District level where the programmes are to be implemented, it will be essential to have a committee of the representatives of the various Departments concerned, educationists and a few headmasters of schools. The District Educational Inspector should be the Secretary of this committee which should be charged with the responsibility of ensuring that a careful phased programme is drawn up for the District with the object of providing work-experience of both types - productive and social - to all the students in the district and to implement it.

21. With regard to the provision of productive work-experience, three problems have to be tackled : (1) training of teachers; (2) provision of necessary facilities including supply of equipment; and (3) organisation of work-experience, under real-life conditions in farms, factories or other production units.

(a) Training of Teachers: It would be necessary to have specially trained teachers for the higher primary and secondary schools and special institutions for the purpose may have to be set up. The pioneer work done in Punjab may show the way to the development of similar programmes in other areas. While we should work steadily towards this ideal of having properly trained teachers

for every school, it may be desirable to augment the teacher supply from other sources. Many countries use as teachers for these programmes skilled draftsmen or graduates of vocational schools who are given short courses of training as teachers. The same procedure might be adopted for the middle and lower secondary schools in India. Such teachers might work in one school or be used as itinerant teachers for a group of schools.

(b) Facilities and Equipment: In rural areas, farms should be attached to schools wherever possible. Where this is not possible, arrangements should be made to obtain the assistance of the local people to provide work-experience to the students on private farms. In addition, facilities for industry-oriented experience should be provided in all the bigger schools. All secondary schools, whether urban or rural, should be provided with workshops.

The help of industrial concerns might be enlisted to design and manufacture cheap kits of tools and materials which can be used by groups of children and graded for the different school levels. Standardised designs of tools and simple equipment needs might also be given to ITI's, polytechnic, Upper Secondary Schools and conceivably Engineering Colleges for manufacture as part of their training programmes.

22. For the provision of social work-experience, it is necessary, as stated earlier, to have an organisation at the District level for labour and social service camps.

The key to the success of this programme is to select really worthwhile projects which would prove to be meaningful and challenging and which would hasten the country's onward march. The resources of the community development, agriculture, forests, public works, and other Departments of Government should be fully utilised for the purpose.

It would be most welcome to organise work-experience programmes by allowing the institutions to exercise initiative and plan with a sense of freedom.

23. It will also be necessary to prepare a phased programme of implementation. This will essentially be the responsibility of the District Committee in accordance with the general directives given by the State Committee. The simpler forms of work-experience, i.e. work on the school premises, in the neighbourhood or at home, could be introduced in all schools in a short period. But it may not be possible to provide work-experience in factories or farms or in workshops attached to educational institutions to all the students in the early years. As a transitional measure, therefore, all other categories of alternative work-experience indicated above may be adopted on as large a scale as possible. It is further suggested that, broadly speaking, a beginning may be made in 1967-'68 with not less than 1 per cent of all educational institutions at each stage of education and that this number could be raised to about 20 per cent by the end of the Fourth Plan and all the institutions should be covered by the end of the Fifth Plan.

24. Care should be taken to see that the scheme is left flexible and that it is modified and improved every year in the light of actual experience gained.

#### B. School and Community

25. Another important programme which can assist in relating education to life is to bring the schools as close to their communities as possible. Such a close relationship has several obvious benefits. It enriches the educational process by making community resources available for purposes of school instruction, it introduces the children to community life, its needs and problems, and thus prepares them to be more responsible and useful members of their communities when they grow up, it enriches the life of the community through the services which the school can offer, it enables the school to outgrow its traditional status of an institution for children and to become the 'people's school'; and it helps to improve the school through the services the community provides for it. In fact, the school, instead of remaining an institution for children, should become an institution for the people - the community.

26. The programme of linking the schools with their communities has three significant aspects. The first is that the schools themselves function as communities. From this point of view, it will

be necessary for each school to develop a common life of its own and to provide adequate and challenging opportunities for children to participate in the common life of the school and to have a due share and responsibility in running it. A large number of programmes can be organised from this point of view; the introduction of pupil-self-government; work in class-rooms, hostels and on the school-campus as indicated earlier in paragraph 11(a) and (b); organisation of programmes in which pupils help each other in studies; etc. The nature of these programmes would vary from stage to stage and also upon the character of the institution, e.g., day or residential. But there is immense scope for the development of this programme in every institution; and if fully utilised, it can be of great educational value, especially for exercising initiative, responsibility and training in leadership and organisation.

27. In the second aspect of the problem, the school (a) studies the community or (b) offers services to it. For instance --

(a) The school can study the community itself as part of its curriculum and also use the available resources of the community for the purpose; and

(b) The school plant and facilities can also be made available to adults and both teachers and students can participate in helping the adults to educate themselves.



If education is to be for life through life it must relate itself to the various problems of life around. That is, it must base its teaching around the various aspects of life. The curriculum should touch one or more aspects of life and it should thus be possible to find contacts with the life of the community for every subject that is taught in a school or a college. What is necessary is to organise some sort of field-work touching the life of the community in every subject and if, such field-work can be made the basis of teaching, the community will realise the utility and importance of education and the students will find the knowledge purposive and useful. The experts in the subject can surely find out such points of contacts for field-work which may not uniformly be the same or similar in all subjects, that is, the quantum and nature of field-work may vary from subject to subject. What is needed is the use of such points of contact with the community as the basis of teaching in order to make it richer and at the same time to give back to the community the findings of such field-work so that the community may also be benefitted by it.

Among the different ways for including community contacts through the curriculum the following may be illustrative :

(a) A dissertation in every subject based on actual field-work suitable to the subject may be made compulsory so that the students during the course of

their studies are required to collect data from the actual life of the community and build up their dissertation on the basis of that data.

(b) The curriculum may be so planned as would necessitate the collection of some data or the study of a few relevant problems to substantiate the principles of the subject under discussion.

(c) The solution of certain problems of the community may be made the responsibility of the colleges in the locality or the neighbourhood so that the community is encouraged to refer such problems to the teachers who would, through the students, collect the relevant data and suggest solution.

(d) In professional courses certain jobs of public utility can be taken up by the professional college and carried out to completion with the help of students.

(e) Demonstrations of new and scientific methods can be organised in the locality so that the community may be encouraged to use such reformed scientific methods in place of the old traditional ones.

Teachers and experts in the subjects can surely find out such ways of making the community feel the usefulness and the importance of educational institutions and create in them a confidence that their children are given some realistic education which relates to the life the children would be required to lead. Such devices will, in addition, raise the general life of the community as well.

Moreover, the school can also (a) participate, with the adults, in general programmes of community development; and what is even more important, (b) it can plan and carry out several projects of community service and welfare (as indicated in paragraph 11(c) above). This can help the children develop attitudes of civic responsibility and social service and enable the community to discover the important, intelligent and effective contribution that well-educated youth can make to community welfare. For this purpose the C. D. Block activities can be utilised in as large a measure as possible to provide opportunities for education work.

28. In this third aspect, the community should take interest in the development of the school and provide effective services to it. This programme would be considerably strengthened if the second aspect - the school serving the community both through curricular, field-work and other co-curricular activities - is properly developed. In fact, the two go together, each supporting the other. Quite an effective method would also be to organise school improvement programmes as in Madras State where the local communities have helped their schools by supplying physical facilities worth millions of rupees. Ultimately, the policy in this sector should be to associate the local communities, more intimately than at present, in the management and support of their schools. A beginning in this direction

can be immediately made by associating each school with its local community more or less on the French system - that is to say the provision of the teacher at all stages becomes a responsibility of the State and the community shares in managing and supporting all the non-teacher costs.

29. Participation in Programmes of Community

Development or National Reconstruction: In addition to these local programmes whose principal objective is to teach the dignity of manual labour and promote social integration, it is essential to make participation in meaningful programmes of community service or national reconstruction an integral part of all education from primary to the undergraduate stage, as a form of work-experience since such participation can help to create attitudes of social service and closer ties between educated persons and the masses and can build up, in the rising generation, certain values which are of fundamental significance today, viz., a sense of purposefulness and mission, dedication, confidence in themselves and faith in the country's future.

30. At the primary stage, this programme can take the form of community services which the school can provide. These would include, for instance, such activities as running wall newspapers, reading out books and newspapers for the elderly, interested but illiterate persons, teaching adults to read and

write, cleaning public places like temples, townhalls, parks and gardens, decorating these places during festivals, assisting at fairs, organising festivals, planting and watering trees in public parks and gardens. Every educational institution should be responsible for some definite programme in this respect. Besides giving work-experience, this activity will establish better contacts between the community and the schools and will develop, among the pupils, desirable attitudes of civic responsibility and social service and enable the community to discover the important, intelligent and effective contribution that well-educated youth can make to community welfare. A good deal of pioneer work in this direction has been done by the basic schools and this aspect of their work should be generalised to all schools.

31. The main difficulties would arise at the secondary stage. Here very little work has been done so far and there are also strong resistances for an introduction of programmes of school participation in national reconstruction. But it is at this impressionable stage that this programme is most worthwhile and we, therefore, recommend that immediate steps should be taken to introduce suitable programmes of community service in all secondary schools as an integral part of education at this stage.

Under this programme, as we visualise it, it will be an integral part of secondary education, provide opportunities for students to participate in programmes of national reconstruction lasting for about 10 full days a year (or 30 days at the lower secondary stage and 20 days at the higher secondary stage). No student should be deemed to have completed his secondary education unless he has gone through this programme to the satisfaction of the school authorities. Unless this is done, neither the students nor the teachers nor the school managements will have adequate incentive to emphasise it.

32. From this point of view, two programmes are contemplated: Every secondary school should be expected, like every primary school, to develop a programme of good school-community relations and to organise some suitable programmes in which the school would serve the community.

Such programmes may be in the form of projects which the students can work and which may be of service to the community. Adequate arrangements will have to be made for the carrying out of such projects to their finish and for the stay of the students during the period such projects continue. This would need great organisational skill and equipment which a few good schools would be able to plan and successfully implement. With proper guidance and encouragement, some schools will

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\*This period of compulsory participation may be done every year or in a continuous stretch to cover two years (and in exceptional cases, even three) at a time.

develop these programmes and provide this experience to their students.

33. For those that may not be able to do so, another approach is essential under which there would be an organisation for Labour and Service Camps at the District level to provide these experiences to students by active participation in these camps. Since the idea is somewhat new, we propose to describe it in some detail.

There should be an organisation at the District level for the organisation of Social Service Camps. A senior officer of the Education Department should be the Head of this organisation. It will be the responsibility of this organisation to select, as mentioned above, (a) one or more common projects on which students can work all the year round; (b) to provide the necessary community contacts; (c) to provide the residential arrangements, implements, utensils, etc. and (d) to provide also a part of the expenditure of the entire organisation of the camp. The main responsibility left to the schools, would be to draw up a programme, in consultation with this central organisation, for taking their students by turn to the camp and to work with the students and teachers at the camp in accordance with the programme assigned to them.

Greater care should be taken to select the projects for the camp. The idea should be to

take up a project which could be completed within the time given. This would make the students and teachers feel that they are doing something worthwhile, something which results in lasting benefit to the community. The cooperation of the Community Development Administration should be sought for the purpose and the projects should be connected with the Five-Year Plans for the area.

During the period of the camp, students would be expected to put in adequate manual and intellectual (but not connected with their studies) work. There should also be provision for recreational programmes in which the community may also participate.

A part of the funds for the programme could be obtained from the local Rural Works Programme which is being implemented by the Planning Commission.

All the overhead charges - which will come to a very small amount - should be met by Government. The students should be required only to bear (a) transport charges to the camp site and back, and (b) food charges during the stay at the camp. Even these could be subsidised to some extent on the basis of the work that the students would put in. A student who holds freeship or half-freeship should be given similar concession in the camp. Adjustments could also be made by requesting the students to bring some articles of foodstuffs etc. from home. On the whole, an attempt should be made to keep the cost of this camp down to the minimum for each period.

Similar camps should also be organised for girls and there need not be much difference between the types of



programmes undertaken for boys and girls. The implementation machinery we have suggested earlier can take care of this programme also if the schools cannot organise such camps.

34. If this programme becomes general at the secondary stage, there would be no difficulty in continuing it on the same lines, at the University stage also. That is to say, each institution of undergraduate education should develop its own programme of social service and participation in activities of national reconstruction, suited to its objectives and the age and competence of its students. For instance, agricultural and medical colleges can organise programmes of community service in their own fields. The N.C.C. may be voluntary and may be regarded as a form of community service. In addition, participation in labour and social welfare camps should also be regarded as an alternative form of such service. The level of participation prescribed, from the point of view of the demand on the students' time and energies, should be approximately equal in all these forms; and it should be obligatory on every student in undergraduate education to participate in this programme in any three of the choices offered above.

35. When this stage is reached, there would be no justification for full-time national service on educational grounds.

ANNEXURE I

Note on Programmes of Work-experience

In introducing programmes in this field it will be important to ensure that certain basic criteria are met. These may be summarised as follows; (a) the work chosen should be creative in nature and hence productive; (b) it should be available in a continuous and not sporadic form; (c) it should be dynamic and forward-looking; (d) it should form a significant part of the school curriculum; (e) competent staff should be available for supervising it; and (f) it should be given a place in school examination.

Programmes of work-experience will have to be devised in such a way as to suit the age and maturity of the students in the different stages and sectors of education. But at every stage and in every sector, an attempt should be made to provide work-experience so as to lead to creative and productive work and to social and group-living necessary for the development of a pupil's total personality. Both the aspects are equally important and no school should be deemed to have made adequate provision for work-experience until these aspects are made available - the former through the introduction of productive work/and out of school in and the latter through programmes of linking schools with their communities and participation by the children in meaningful activities of national reconstruction.

~~Work-experience and Productive Work~~

In its first form, work-experience means participation in productive work in school, in a workshop, on a farm or in a factory, or in any other production situation, under real-life conditions, or, in conditions closely reproducing these. As has been said, its form and objectives would have to be varied from stage to stage to suit the age and maturity of children. At the junior primary stage (classes I-IV) it may begin as simple handwork and its objective would be to train the children in the use of their hands and thereby help their intellectual and emotional growth as well. At the senior primary stage (classes V-VII), it may take the form of learning a craft and its objective would be to develop technical thinking and creative capacities in the pupils. Even at the higher primary stage, however, it is possible to provide some work-experience in real-life situations, e.g., work on the farms at the time of harvesting or sowing or in a family production unit, and this should be done to the fullest extent possible. At the secondary stage (classes VIII-X), it may be provided as training in the school workshop; but an attempt should also be made to provide it, to the extent possible, in real-life conditions in any production unit or a farm. At the higher secondary stage (classes XI-XII), work-experience should be provided, as far as possible,

students may have such experience in connection with their studies (e.g. work in a bank or at cooperative society or a regulated market), while others may work for a time on a farm or in a factory or other units of industrial production.

In providing this work-experience in production, every attempt should be made to orientate the educational programmes to technology, industrialisation and the application of science to productive processes, including agriculture. This 'forward look' in work-experience is important for at least three reasons :

(a) In advanced, industrialised countries, children grow up in a mechanical world and become familiar very early with the use of tools, and the whole environment gives daily lessons on the use of machines and power to replace manual labour. Such immediate and general environments are absent in practically all parts of India. Since, however, the country is embarked on a course of industrialisation, the school is called upon to correct these deficiencies in the child's environment.

(b) The second object of this forward-look is to develop certain values essential for the development of science and technology. In an economy using crude, handmade tools, either in agriculture or traditional handicrafts, wide degrees of inaccuracy can be tolerated without interfering with the functioning of the tool or process. In an industrialised economy, however, extreme

accuracy is of capital importance, and this respect for accuracy is a character trait best learned through experiencing the effects of inaccuracy. There are, in addition, other more subtle abilities - such as judgment of space relationships, of speed and motion - which go with a technological training which also can only be learned through experience.

(c) The third reason is the need to link education with future life situations of the student; to prepare him better for a wide range of employment possibilities; to develop self-reliance in a technological world; and to prepare him so as to make later diversification easier.

Programmes and Syllabuses : The range of possible activities which can be adopted to provide productive work-experience is enormous and choice will be determined mainly on the availability of materials and trained instructors. The list given below is purely indicative and the choice of activities would be made in the light of prevailing local conditions. Included in the list are also activities of special interest to girls or to schools in rural areas:

Lower Primary School

Paper-cutting

Cardboard cutting

Modelling in clay or plasticine

Spinning

Simple needlework

Kitchen-gardening (on plots or in pots)

Upper Primary School

Cane and bamboo work

Leather work

Pottery

Needle work

Weaving

Gardening

Model-making

Fretwork

Work on the farm

Basket-work

Class-room decoration

Book-binding

Lower Secondary School

Woodwork

Simple metal work

Basket-work

Leather work

Ceramics

Soapmaking

Preserving

Weaving

Electrical repairs

Cookery

Model-making

Making simple scientific equipment

Carpet-making

Book-binding

Linocutting

- Fabric printing
- Tailoring
- Toy-making
- Millinery
- Wood-carving
- Simple farm mechanics
- Animal care
- Crop care
- Care of the soil
- Workshop practice

#### Upper Secondary School

Many of the activities listed above would be continued but the emphasis would shift to workshop practice or actual work-experience in industrial or commercial concerns or on farms. The activities would be oriented towards productive work. Skills demanded in a woodwork, metalwork and agriculture would be of a higher and more exacting nature.

One or two points need special mention. While it is true that productive work-experience in rural areas could be largely built round agriculture, it should not be exclusively so. Programmes oriented to industry and technology should be introduced in a fair proportion of rural schools where facilities exist. The pioneer work done by retired Air-Vice-Marshal Hajinder Singh in the Punjab is a good illustration of what can be done in this direction at the primary stage. School workshops should

necessarily be provided to all rural secondary schools or, where this is not possible, suitable kits of tools and materials may be manufactured at low cost and made available. In the same way, steps should be taken to provide gardening in as many urban schools as possible and to provide experience in farmwork to at least a small proportion of urban students.

It may not be immediately possible to provide this type of forward-looking work-experience to every child. But a beginning should be made wherever it is possible and it should be a declared objective of State policy to increase such facilities for work-experience in industry and agriculture as rapidly as possible and to make them available to schools for the education of the rising generation. In the transitional stage, the bulk of the students would have to be provided with work-experience in traditional programmes of production which the community practises at present. This hard fact has to be accepted and programmes of work-experience on this basis will have to be organised for the majority of schools and students. Even in this case, however, a continuous attempt should be made to bring in science and technology and to introduce the students to better ways of performing these traditional tasks. It should be realised that the effective value of work-experience is largely proportional to the extent to which a spirit of modernisation or a forward-look is built into the programmes in which the students are made to participate.



ANNEXURE II

(Adapted from 'Polytechnical  
Education in the U. S. S. R. -

UNESCO Monograph edited by S.G. Shapovalenko)

In Grade I, they work with paper, pasteboard, cloth, clay and plasticine, and do simple work on plant-growing. In working with paper, they acquire such basic skills as learning to mark out, bend and fold paper and pasteboard, cut them with scissors or knives along marked lines, and glue and paste them. This work is well within the scope of a seven-year-old and in carrying it out, the child learns to work accurately with pencil, ruler, scissors and glue, to make simple articles for his own use (e.g., material for doing sums, bookmarkers, packets for seeds, notebooks forward--lists, Christmas cards, etc.). In working with cloth, the children learn to sew on buttons, to sew simple little objects (penwipers, handkerchief, etc.) and to look after their own clothes. The work with clay and plasticine has considerable educational value, for it develops their power of observation, creativeness and taste. In their modelling work, they develop coordination of movement, dexterity, the ability to measure by eye and the idea of space.

On the school experimental plot they learn to grow flowering plants in special beds, and both in class and at home they acquire the first practical skills in tending indoor plants.

In Grade II, the children also work with paper pasteboard, clay and plasticine and continue to learn sewing and work on the school plot, but the tasks are more complicated; the children cut out shapes from paper and pasteboard along marked lines, glue them together, and learn to use the graduated ruler and set-square for simple measurements and for checking the quality of their work, on the basis of progressive development of their desire for accuracy.

In their work with clay and plasticine, they develop as in grade I, the ability to recognise and reproduce accurately the shape of relatively simple and familiar objects; for example, they model from life (or from memory) fruits and vegetables. In their work with cloth, they do very simple and ordinary stitching and learn how to embroider very simple designs on serviettes and sew little bags and other uncomplicated objects. They also learn how to use the tape measure and ruler for simple measurements, mark out rectangular shapes for making patterns, and become accustomed to looking after their own clothes, doing simple mending, etc.

On the school plot they grow pulses, and in class and at home they continue to look after indoor plants and grow flowers in jars, flower-pots and boxes. Working on the school plot, they dig beds, rake them smooth, use a marker-cord to align the drill furrows in which they sow the seed and observe the growth of plants.

The task of developing proficiency in work with paper and pasteboard continues in Grade III. The pupils make and mend simple visual aids needed for teaching Russian, arithmetic and natural history, and learn to mark out paper - board and to frame flat cardboard articles of simple shape with paper straps. They acquire skills in elementary book-binding, making simple pads, notebooks and small file-cases, and binding pamphlets, etc. They perfect their knowledge of fabrics in Grade III, continue to learn sewing and embroidery and begin to darn stockings and socks. They learn to cut out and sew very simple articles (aprons, mittens, small bags, etc.) and acquire an elementary idea of dressmaking and tailoring and learn simple methods of mending clothes.

On the school plot they cultivate beetroots, carrots and their seeds, and plant and tend strawberries. They dress the beds themselves, sow dry, wet and germinated seed, thin out foot crops, transplant beer and cabbage seedlings, look after seed-plants, apply top-dressing and conduct simple experiments with the plants. As far as indoor plants are concerned, the children learn how to plant flower seedlings in pots, jars and boxes.

In Grade IV, work is continued, and the proficiency acquired in manipulating paper and pasteboard is consolidated. The children make file-cases and pads, repair maps, diagrams and other visual aids made of paper or pasteboard, stick diagrams, photographs and reproduction on pasteboard backings and make models of simple geometrical forms.

They go on with their sewing, embroidery and knitting, and undertake more complicated dressmaking work; they take measurements of their own, note them down, make the rough sketch, cut out the patterns, cut out the cloth on their own and for the first time sew simply constructed articles. They also learn more about looking after their clothes and simple mending, and they crochet belts and small scarves. They also learn how to use sewing machines and flat irons, and are taught to observe the basic safety rules in using them.

The object in Grade IV of technical modelling is to develop the children's technical-mindedness and of creative design. The syllabus accordingly provides for the preparation by the children of simple equipment for natural history experiments and simple methods and models of various machines.

On the school plot, they grow potatoes and maise, learn how to plant currant cuttings and to tend and look after the plants. In class and at home, they learn how to propagate indoor plants from cuttings, and this work provides a good preparation for the systematic study of botany in Grade V.

The knowledge, accomplishments and skills which they acquire in the work lessons in the junior grade (I-IV) are of major importance from the standpoint of polytechnical education, providing a thorough grounding for further manual and technical

and polytechnical instruction in Grades V-VIII. In addition, the knowledge, accomplishments and skills acquired by the younger children make it possible to initiate them progressively into socially useful work and housekeeping work at school and in the home.

#### INSTRUCTIONS IN GRADES V-VIII

The object of manual and technical instruction in these grades is to impart general technical, agricultural and domestic knowledge and skills to develop technical thinking and creative capacities in the pupils; to foster in them a communist attitude to work and to labour conditions in general; to help them give expression to their own inclinations; find their bearings in the various spheres of human activity, and make a careful choice of their future vocation.

The instruction given in these grades at the eight-year school is polytechnical in character. It includes work in the school workshops, practical and experimental work in agriculture, and domestic-science activities, three periods a week being devoted to these in every grade (V-VIII).

In the school workshops, the pupils become knowledgeable and proficient in woodwork and metalwork with the use of hand tools and certain machine tools. Most of the metalworking operations in factories and plants are carried out, of course, with the help of a variety of machines, but manual work is also used to some extent in every branch of production for the successful operation of a machine, the elimination of breakdowns.

and the assembly and adjustment of mechanisms. Hence the study and mastery of the methods of working these most commonly used materials - metals and wood - with hand tools are of great importance for the pupils' polytechnical education and technical training and the procedure employed is to get them to make various useful articles, including equipment models, mock-ups, tools and implements for use in the school workshops and on the school plots, articles for use in pioneer activities or for the pupil's personal toys, etc., and component parts manufactures to the order of factories and of collective or State Farms. These activities are chosen and carried out in a particular sequence, progressing from the simple to the more complex, so that their execution helps to consolidate and develop the skills which the pupils have already acquired in working the materials.

The eight-year-school pupils also acquire some knowledge of the mechanization of labour processes. They learn about the construction of the commonest simple machines and mechanisms and how to use them. The wide application of electric power in modern industry, agriculture, transport and everyday life makes it essential that every pupil who leaves the eight-year-school should have acquired some elementary knowledge and skill in handling the commonest

electrical equipment and electric appliances.

In the workshops they learn to read and prepare very simple technical drawings, sketches and blueprints to transfer the data to the material. The basic method of instruction consists in interpreting the drawings of articles which have to be prepared in practice. The work with drawings at all stages of school workshop activity is organised in such a way as to make use of the knowledge and skill which the pupils have acquired in their studies of drawing, mathematics and (from Grade VII onwards) technical drawing.

Various methods are used for instruction in the workshop; oral instruction (talk, explanations, discussion), demonstration of natural objects, visual aids and working methods, exercises; individual and group instruction; independent work from drawings or instructional charts; graphic work, special laboratory work for the practical elucidation of its properties and peculiarities of materials, the construction of tools, components and appliances, the interaction of tools and materials, and other technical and technological questions; excursions to industrial undertakings to familiarise the pupils with the organisation of work at plants and factories, the mechanization of production and the construction of individual machine tools and appliances with the help of which the pupils carry out the operations which they have studied and mastered in the school workshops.

In Grades VII and VIII, the pupils are given set tasks on their own, commensurate with their capacity, in making components and complete articles.

The technical and technological knowledge imparted to the pupils broadens their general technical outlook and is an essential factor in correctly developing their skill in the use of materials. In its turn, the acquisition of practical skills enables them to acquire a deeper appreciation of technology and an understanding of the working principles of machine operation in processing materials, and of mechanised production in general.

The teacher's explanations, with their marked technical bias, are based on the knowledge acquired by pupils in their studies of the fundamentals of the various sciences. On the strength of what they have learnt in Physics, for example, they can be given the scientific reasons for a number of technical phenomena and technological processes; again, in studying the mechanical properties of materials and machine parts, the construction and operation and mechanisms, machines and machine tools, they make use of their knowledge of mechanics.

A prominent feature of this instruction is the comparison made between the processes and tools used in woodwork and metalwork, and the elucidation of their similarities and differences, depending on the characteristics of the materials processed. The pupils steadily enlarge their knowledge of the correct use of tools, correct working stance,



proper rhythm of work and the essential technical and health measures to ensure high productivity and the necessary standard of workmanship with the minimum loss of energy.

Apart from wood and metals, the pupils in grades VII and VIII get to know materials such as plastics and glass, which are very useful for making items of school equipment or items ordered by factories and farms.

In order to broaden the pupils' polytechnical outlook, comparisons are also made between their work in the workshop and similar technological processes carried out under production conditions, and also between manual and machine processing, and the syllabus accordingly provides for excursions, demonstrations of diagrams, mechanisms and machines, and the showing of films and filmstrips. With the same object in view, some of the jobs are executed on the basis of a division of labour as regards particular ideas and operations, and this form of organisation of labour gives the pupils an insight into how work is organised at an industrial plant.

The school workshops provide favourable conditions for conducting out-of-class technical work on a large scale; many school clubs have been organised in grades V-VIII so that they can engage in technical modelling, electrical engineering and radio engineering, or delve deeper into and become proficient in carpentry, light engineering lathe work with wood and metal, wood-carving, fret-work, etc.

Workshop activities in these grades are different for boys and girls. Whereas the boys take both woodwork and metalwork, the girls take only woodwork in grade V and only metalwork in Grades VI-VII. They do less mechanical engineering than the boys in grade VIII, but the syllabus in electrical engineering is identical for boys and girls alike.

To take account of the special characteristics of technical instruction for girls, the eight-year-school gives them a training in domestic science which provides them with knowledge and skills in housekeeping work. The main aims are to develop in them a conscientious attitude towards their obligations to share in the general domestic duties of the family and to be self-reliant at school and at home; to acquaint them with the principles of domestic economy, give them the necessary knowledge and skill to carry out various forms of everyday domestic work, and inculcate good taste and a constant desire and ability to keep a place tidy, clean and comfortable.

In the course of their domestic-science work they are familiarised with the social arrangements for everyday domestic work and the communal forms of public service such as communal catering, the work of domestic-service centres, the organisation of communal sewing-room for making and mending clothing, underwear and footwear, and to get to realise how the everyday

household work of the Soviet family is being systematically and steadily lightened. A special point is made of familiarising that with the use of modern labour-saving devices and with new materials, fabrics, foodstuffs and so on. The result is that they learn to be tidy, thrifty and punctual, and develop a love of cleanliness and order<sup>and</sup> the ability to make their homes and clothes attractive and sensible and use foodstuffs and materials economically.

The study of domestic science in these senior grades is based on the knowledge and skill acquired in the work lessons in the junior grades, and also on lessons in Russian (or the mother-tongue) on the subject of 'The Care of Health' (in Grades I-III) and on the natural-history lessons on the subject of 'The Human Body and Its Care' (in Grade IV).

In studying the subject 'Cutting and Sewing', the girls become acquainted with fabrics, with the preparation of designs and patterns for articles they are making, with methods of sewing and finishing, and with the construction and operation of the sewing-machines. They also acquire a basic knowledge of the care of clothing; of laundering, ironing and storing linen, of cleaning wool garments, and of laundering knitwear containing synthetic fibres.

One important section of the syllabus is the elements of cookery, including instruction in dietetics,

and in the foodstuffs required by the human body. The girls learn how to prepare simple vegetable dishes and cook simple and nourishing meat and fish dishes, handle kitchen equipment, crockery, and table linen and serve and behave at table.

Under the heading of 'Housework' they acquire a basic practical knowledge of home hygiene and sanitation and the essentials of housekeeping (daily, periodical) and spring cleaning; ventilation, lighting and heating. In addition, they learn how to arrange furniture and handle tablecloths, curtains, carpets, pictures, photographs, reproductions and decorative tapestries.

To widen their horizon and enlarge their knowledge in various fields, excursions are arranged to public restaurants or food-processing factories (canteens, mechanised restaurants, canneries, butter factories, bakeries), garment-making establishments (tailoring and dressmaking workshops), or to domestic-service centres. The excursions are arranged during the school year in accordance with a timetable drawn up by the teacher.

All the pupils at urban and rural eight-year schools receive initial training in both agricultural and industrial labour, for familiarisation with agricultural production is one of the tasks of polytechnical training. This work is closely coordinated with the biology course, and is of great educational significance. It is carried

out both on the school experimental plot and under actual production conditions, and as it takes place for the most part in the open, it promotes the children's physical development and improves their health.

To meet local conditions, the school is empowered to spread the practical and experimental work evenly over the school year, or to concentrate it in the first and fourth quarters. And since it is of a seasonable nature and is to some extent governed by the weather, it is not included in the timetable but is carried out in accordance with a time-schedule approved by the school director.

In the course of this work, the pupils acquire basic practical skills in cultivating the main agricultural crops (vegetables, fruit and berries, fickle crops) and in rural areas - in raising calves. At the same time, they acquire a knowledge, during their excursions, on mechanised cultivation and animal husbandry.

The work in Grades V and VI is largely conducted on the school plot. In Grades VII and VIII (at rural schools) the pupils work on collective and state farms and fields where they operate in groups on jobs suited to their capacity. Looking after poultry, rabbits and young farm animals, or doing suitable field work, depending on local conditions (the tilling of the soil, and often sowing and harvesting, are done by pupils in Grades X-XI or by collective farmers with

the aid of agricultural machinery).

At urban schools which have no school plots, the practical and experimental work in Grades V-VII is carried out in greenhouses on grounds belonging to pioneer homes, or Young Naturalists' Centres, in conservatories, parks and squares coming under the Greenery Trust and at specialised suburban agricultural undertakings. In addition, plots of pioneer camps are made available to the children for educational and production work during the summer.

Their excursions to agricultural production points give the children an insight into the mechanised side of agriculture on collective and State farms. In Grade V, for example, they study the mechanisation of market-gardening, in Grade VI they learn about mechanical work in horticulture, and in Grade VII (in urban schools) they become familiar with the mechanisation and cultivation of field-crops and with heavy work in stock-raising. The Grade VIII syllabus (at rural schools) provides for a more detailed study of soil-working implements, seed-drills and grain-cleaners and harvesters. The pupils get to know the local collective or State Farm and the lines on which it is developing and this generally acts as a factor in the vocational guidance of the school-leavers.

The content of the syllabus for practical and experimental work during the eight-year period of schooling ensures that the pupils conscientiously

apply the knowledge acquired in their biology lessons.

Due account is taken, in following the syllabus, of local soil and climatic conditions and the main crops in the area concerned. Some of the jobs, for example, can be replaced by other equivalent ones (for instance, the syllabus recommends the autumn sowing of fruit trees but on heavy clay soil the seeds are stratified and the sowing is done in spring; or in southern areas, seedlings are cultivated in seed-beds instead of under glass).

The experimental bias is particularly important. Experiments on the school plot which have given the most productive and economic results are repeated on the plot the following year and then tried out on the collective or State farms, where the pupils carry out so-called 'productive' experiments. Where the results prove positive, they are incorporated into agricultural production.

Many eight-year general schools have started an original type of fruit and berry plantation stocked with the finest strains. The cultivation of seedlings of fruit trees and ornamental plants (in urban schools), the taking of cuttings of the finest strains of currants and other soft fruits, and the grafting and cultivation of the best strains of fruit trees are in fact an important element in practical school-work.

The cultivation of seedlings and the work in the nursery garden plays a very important part in agricultural education in Grades V-VII (and also in Grade VIII at rural schools). In the latter, the pupils study the cultivation of apple trees, while in urban schools they

study the propagation of valuable types of trees and of perennial flowering plants such as phlox, lilac, roses, etc. A substantial area (300 to 500 square metres) is provided at rural schools for nursery seed-beds; while urban schools can arrange for nurseries to be established in the gardens of dwellings in the neighbourhood.

An equally important item in grade V practical work in the cultivation of vegetable seedlings in greenhouses, under glass and on hotbeds. Where a greenhouse is available on the school plot, practical work can be carried out in early spring. Apart from growing vegetables the children grow fruit trees from seedlings, propagate current bushes, and learn by practical experience the best time and methods for thinning out seedling trees, the best method of taking cuttings of current bushes, the best way of applying organic and mineral fertilizers to the various vegetable crops and seedling stock and the amounts needed, the best times to sow and plant vegetables and the correct amounts of mineral fertilizer to be used as a top-dressing for vegetables. At the urban schools, experiments are conducted to find out the best methods of vegetative propagation of perennial flowering and ornamental plants, the best system of feeding and tending them, the best system of rooting cuttings, etc.



In Grade VI, the pupils experiment on the accelerated propagation of valuable strains of raspberries (or trees, in schools in large towns); they learn about the best methods of grafting scions and discover the best means of preparing maize and potatoes for planting, the richest areas for arable crops, the effect of various methods of treatment in increasing the yield of maize, potatoes and seed-plants of biennial vegetables. These experiments, the object of which is to apply and develop the children's knowledge of biology, are carried out on sub-divisions of the experimental plot.

In Grade VII at rural schools the experimental work is carried out under agricultural production conditions. The pupils grow maize, potatoes and industrial crops on plots provided for the school and divided up in accordance with the number of pupils in Grades VII and VIII. They also tend farm animals on collective and State farms.

The points on which the work is focussed, and the subjects of the experiments, are chosen to suit local conditions and lines of future agricultural developments.

As stated, the children at urban schools plant greenery in the towns and on workers' estates, look after trees and bushes in the public squares, streets, etc. and help collective farms to look after tree belts and plantations along the main roads. The cultivation of greenery in courtyards and squares, and work in parks and conservatories, is treated as a matter of major importance.

Included in practical work is the campaign against agricultural pests, which takes various forms - mechanical,

chemical and biological. Special attention is paid, in the children's experimental and practical work during school hours, in their educational production practice during the summer and in the socially useful work, to the observance of health requirements and the inculcation of habits of hygiene in connection with work.

All these arrangements for systematically raising the level of the children's agro-technical and zoo-technical knowledge, and familiarising them with the principles underlying agricultural production are of great importance in training efficient workers who have an all-round education.

#### SOCIAL PRODUCTION PRACTICE

The work done by the pupils in the course of instruction is very definitely splanted in the direction of social usefulness, and two periods a week are devoted to socially useful work in every grade (V-VIII) with the object of coping with the subject of manual and technical instruction more effectively and forging links between education and life. In addition, twelve days are set aside at the end of the school year for social production practice - three periods a day in Grade V and four periods a day in Grades VI-VIII. This socially useful work takes place outside school hours, and is therefore not included in the timetable. The general educational direction of this work is in

the hands of the class-teacher, who prepares a plan of work for each successive week, but the immediate handling of it may be entrusted to other teachers, depending on its nature.

Social production practice in urban and rural schools forms a continuation of the manual and technical instruction given in the school workshops and on the school plots, and is based on the knowledge and practical skills acquired by the pupils in the various grades. It includes doing work suited to the pupils' age in the school's training and production workshops, making various articles for use in the school itself and the kindergarten and fulfilling orders from industry. In agriculture, it constitutes a continuation and extension of the experimental and practical work prescribed by the syllabus, thus making it possible to arrange for the systematic tending and observation of plants sown in spring at the proper sowing times and bring in the harvest and evaluate the yield by the due date.

This work ensures the continuation and completion of experiments with vegetable crops and fruit-tree seedlings, conducted in Grade V, and with fruit crops, maize, potatoes and the seed-plants of biennial vegetables on the school plots in Grade VI, the pupils carrying out practical work and making the corresponding observations at the proper time in accordance with a schedule prepared by the school director.

In Grade VII at rural schools, the work involves tending maize and other field crops on collective or State farms and conducting experiments relating to them, raising poultry and rabbits, and looking after fruit-seedlings on the school plot. The pupils carry out these jobs in accordance with the director's schedule, working in groups (in view of the need to complete the experiments begun during school hours). At urban schools, the Grade VII work is limited to tending field crops on the collective or State farm, or, where it is impossible to organise this in agricultural production, to tending trees plantations and ornamental flowering plants for parks coming under the Greenery Trust.

COMPOSITION OF THE WORKING GROUP ON  
SCHOOL COMMUNITY RELATIONS

1. Shri L.R. Desai, Vice-Chancellor, Gujarat University, ... Chairman
  2. Dr. K.G. Saiyidain, Member, Education Commission
  3. Shri J.P. Naik, Member-Secretary, Education Commission.
  4. Dr. V. S. Jha, Member, Education Commission.
  5. Dr. R.K. Singh, Director, Rural Institute, Bichpuri, Agra.
  6. Shri P.N. Mathur, Banasthali Vidyapeeth, Banasthali.
  7. Shri H. B. Majumdar, Director, National Institute of Basic Education, New Delhi.
  8. Shri.H. Radhakrishna, Sarva Seva Sangh, Rajghat, Varanasi.
  9. Prof. Hulbe, Rural Life Development & Research Project, Ahmednagar College, Ahmednagar.
  10. Shri M.P. Balakrishnan, Research Officer, Education Commission, ... Secretary
-