

RECOMMENDATION No. 49
concerning
MEASURES TO INCREASE FACILITIES
FOR THE RECRUITMENT AND TRAINING OF TECHNICAL
AND SCIENTIFIC STAFF

The International Conference on Public Education,

Convened in Geneva by the United Nations Educational, Scientific and Cultural Organization and the International Bureau of Education, having assembled on the sixth of July, nineteen hundred and fifty-nine for its twenty-second session, adopts on the fifteenth of July, nineteen hundred and fifty-nine the following Recommendation:

The Conference,

Considering that all countries are making increasingly systematic efforts to improve both the material and cultural conditions of their populations,

Considering that at each phase of their advance nations will require greater numbers of scientific and technical personnel in order to attain their objectives,

Considering that the increasingly rapid development of science and technology requires the constant adaptation of the methods of training staff,

Considering that the very serious shortage which some countries experience in this field risks perpetuating and increasing the economic leeway they have to make up,

Considering that sufficient young people are to be found everywhere who would make good technical and scientific staff provided they receive the necessary training,

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Considering that, every year, a shortage of funds, teachers and accommodation prevents education authorities from providing such training for a considerable number of young people in their respective countries,

Considering that it is desirable to give women *de facto* the same rights and facilities for occupations of a technical and scientific nature as men,

Considering that practical training is always of capital importance in technical and scientific education,

Considering that in technical and scientific training as in other branches of education the teacher remains the essential factor,

Considering that an increase in the technical and scientific potential of the nations which is not accompanied by a corresponding rise in their cultural and moral standards might endanger peace,

Considering that technical and scientific activity should be increasingly directed towards peaceful ends,

Considering that a knowledge of present and future needs for the training of scientific and technical staff is a great advantage in the preparation of programmes and plans for training to meet these needs,

Considering that any form of discrimination likely to deprive young people of access to technical and scientific training institutions, whether it be due to inequality of means, to disparity in the educational system in different areas, to prejudice or to regulations, should be condemned as contrary to the Universal Declaration of Human Rights,

Considering that all these problems are particularly urgent in the least favourably placed countries,

Considering that the field of technical and scientific training offers wide scope for practical and effective mutual assistance and collaboration on the international plane,

Submits to the Ministries of Education of the different countries the following Recommendation:

Requirements and planning

1) The extent of the shortage of technical and scientific staff generally requires the introduction of special urgent measures to accelerate the recruitment and training of such staff; to achieve greater efficiency it is advisable to base plans and the corresponding courses on a periodic

survey, which should be as complete and thorough as possible, of present and future needs at the various levels (scientists, engineers, technicians and skilled workers) without prejudice to any one category.

2) In view of the complex nature of a survey of present and future needs for technical and scientific staff, the maximum facilities must be made available to the specialists responsible for this work; it is highly desirable for the body concerned to be permanent, to have access to all available sources of information at national level and to work in close contact with economic planning agencies where these exist.

3) A study of the present and future need for technical and scientific staff should include, among other things: (a) a survey of staff already employed, an estimate of the present shortage and a forecast of future requirements; (b) a survey of the diplomas awarded in the various subjects during the previous year and a survey of staff in training (potential technical and scientific staff receiving instruction at secondary and higher level); (c) a survey of training facilities (present facilities, number of institutions and vacancies, number of teachers, etc., a forecast of future requirements, present and future equipment; (d) an estimate of the funds at present allocated to the training of technical and scientific staff and of the additional funds required to meet present and future needs as shown by the above-mentioned survey; (e) an analysis of possible ways of financing these requirements, bearing in mind probable trends in national revenue and possible aid from regional or international organizations.

4) Conclusions furnished by the survey of present and future requirements for technical and scientific staff will be used to inform public opinion about any major innovation in this field; this should help to carry conviction of the necessity of making a financial effort and of accepting such reforms and changes of habit as may be entailed in the implementation of plans and the continuous adaptation of technical and scientific training to the country's general development, these same conclusions will also serve to inform young people as to the sectors of the economy where the need is greatest.

5) The number of years involved in technical and scientific training schemes will vary according to the conditions prevailing in the country concerned; plans should be sufficiently flexible to permit of modifications in the light of experience.

6) In their estimates, countries responsible for the administration of other countries should take into account the needs of the countries under their care; when constituting panels of experts it is advisable to

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include a suitable number of nationals of the country concerned in order to represent that country's point of view and to help in informing local and national opinion as to the importance and desirability of proposed reforms and developments, thus encouraging the full cooperation of national staff in technological progress.

7) It is advisable to draw up precise definitions of terms, occupations, trades and professions and to standardize them, at least on the national level; if conducted on a regional or international level, such standardization would greatly facilitate the exchange of staff with neighbouring countries and other countries whose cooperation is desired.

Administrative measures

8) It is important that systems of education worked out to meet the new requirements of technical and scientific training should be sufficiently flexible in conception to allow for rapid changes in science and technology.

9) The promotion and coordination of measures to advance the recruitment and training of technical and scientific staff (plans, courses documentation, etc.) should be entrusted to specialized agencies (general department of a ministry, ministerial or interministerial commission, planning commission, foundation, etc.) of the required competence and authority.

10) It is highly desirable for these specialized agencies to enjoy the cooperation of consultative bodies representative of teaching, science and technology, and of both management and work-people in industry and agriculture.

11) The agencies concerned in the training of technical and scientific staff should be able to participate in the framing of national policy in the educational, scientific and economic fields.

12) When several bodies are concerned with the training of technical and scientific staff, either under different government departments or at federal, central, regional or local levels, it is highly desirable to ensure that their activities are so coordinated as to avoid any overlapping.

Financial measures

13) Whatever economic or cultural level a country may have reached, it is important to provide for an increasingly large financial effort in order to meet growing requirements in the matter of technical and scientific

tific staff training; although this financial effort must not in general be made at the expense of other branches of education, it might be desirable in some instances to revise the structure of education and the relation between the different branches of teaching in order to avoid undue emphasis on purely general studies or the humanities.

14) Even in the least favourably placed countries, where the effort required may seem disproportionate to the total resources available and to the magnitude of the greatest possible results, it is important to use every possible means of training technical and scientific staff, as this is an essential pre-requisite for all economic development.

15) In determining the amounts to be allocated to technical and scientific training, increased requirements should be taken into account particularly in the following fields: (a) new institutions based upon numbers of pupils and on new forms of technical and scientific specialization; (b) the recruitment, training, appointment and remuneration of teachers, laboratory technicians and workshop staff; (c) a sufficient number of buildings including the necessary classrooms, laboratories and workshops; (d) essential technical and scientific equipment for teaching and research; (e) the maintenance and running cost of the various installations; (f) social assistance for students, etc.

16) The urgency, in most countries, of the problem of increasing the number of qualified technical and scientific staff may entail the adoption of exceptional measures in addition to the ordinary budgetary provisions; such measures may take the form of extraordinary budgets, the establishment of special funds, both national and international, appeals for special contributions. etc.

17) The fullest coordination of funds provided by the different organizations concerned with the training of technical and scientific staff must be ensured, especially in countries where responsibility for such training is shared by more than one government department.

18) In countries with a federal constitution a varying degree of assistance from the federal government may be necessary, however, it is desirable that the rights and cultural characteristics of the various component units of the federation should be safeguarded.

19) In countries with a centralized educational system, it is advisable, whenever circumstances permit, to encourage regional or local authorities to cooperate in the financial measures taken to promote the recruitment and training of technical and scientific staff.

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20) Where the economic system of the country permits, industry, which would be the first to benefit from an increase in the numbers of technical and scientific staff, should be encouraged to contribute to the expenditure involved; among measures which foster private contributions of this kind may be mentioned tax exemption.

21) The following types of contribution from private sources should be noted: the establishment by large firms of institutions for technical training or scientific research; the creation of a special fund by a group of firms or contributions by private initiative to more general funds set up by the government; direct subsidies to certain institutions; a special contribution for the promotion of staff training; special scholarships to encourage certain studies or research work, etc.

Educational measures

22) Every effort must be made to increase the number of institutions for training technical and scientific staff at secondary and higher levels; the number of vacancies in existing institutions should also be increased, but it must be ensured that any increase does not result in a lowering of standards.

23) Any complete scheme of education should include, in addition to provisions for professional engineers and scientists, courses and qualifications specially designed for technicians and skilled workers which will have a recognized standing in their own right.

24) As far as possible, institutions for technical and scientific training should be distributed fairly throughout the country and in the case of specialized training the nature of the occupations found in the areas served by such institutions should be taken into account.

25) As far as possible the training of technical and scientific staff should be carried out in the national language, which is the only means of conveying to the bulk of the population and the workers the basic elements of science and technology.

26) Progress in science and improvements and innovations in production techniques require an increasing degree of specialization in technical courses and qualifications; overspecialization should, however, be avoided, particularly in secondary level training, both in the interests of education and of possible transfer at a later stage from one type of work to another.

27) The need for technical and scientific staff cannot be met by merely multiplying the number of special courses; complete new sections, departments or even faculties may require to be set up.

28) It is desirable to introduce more advanced specialized studies which would follow on from those provided in the regular courses at secondary, under-graduate and post-graduate levels.

29) In order to raise the standard and improve the efficiency of technical and scientific training, it is desirable to integrate theory more closely with practice by paying more attention to practical work in firms laboratories and research institutes and at the same time increasing the number of advanced courses in physics and mathematics.

30) The shortage of technical and scientific staff has an adverse effect upon the recruitment of teachers for training such staff; serious steps must be taken to draw into and retain in the teaching profession technicians, engineers and scientists, who might be tempted by the better conditions of employment offered to them in industry, and to attract a sufficient proportion of the best secondary school pupils and university students of both sexes into teaching and research.

31) Among measures to increase the number of qualified teachers, especially those engaged in full-time instruction, may be mentioned: facilities for widening the field of recruitment and for providing teacher training at both secondary and higher levels, adequate salaries, greater recognition of the value and importance of the teacher's work and social security for members of the profession, in addition to full-time teachers it may be found useful to engage production and research staff from industry to give instruction part-time.

32) In-service training courses will in general be necessary to keep staff abreast of progress made in the field of science and technology and in related demonstration and teaching methods.

33) In order to attract and to train the most highly qualified scientific staff for teaching and research to meet present day needs, it will be necessary to provide in institutes of higher technology and in universities, laboratories with first-class modern equipment and comparable technical and scientific library facilities.

34) In order to increase pupils' interest in technical and scientific studies from the primary school onwards, it is desirable to use appropriate activity methods which will develop in them an experimental outlook.

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35) Mathematics and science should receive due emphasis in primary and secondary school curricula, and adequate time should be devoted to practical, experimental, manual and agricultural work, etc.

36) The increasingly rapid development of science and technology requires that materials used in schools should be adequate and kept up to date; there should be continuing collaboration between teachers and scientists in studies to determine and develop materials and equipment necessary for the basic understanding of science by secondary school pupils and university students; mass medium techniques (radio, television, cinema, etc.) may play a large part in informing young people about and arousing their interest in technical and scientific careers.

37) It would be useful to set up an educational guidance service for primary education and post-primary studies which would operate in conjunction with the vocational guidance service; for these two services have an increasingly important part to play in the discovery and selection of future technical and scientific staff; where there are no guidance services proper, teachers should be introduced to techniques which may be used for the successful educational and vocational guidance of their pupils.

38) The compilation of guides to secondary and higher studies dealing with the conditions required for entrance and the careers to which they lead, may constitute a valuable aid for pupils and their parents in the choice of courses and professions.

39) The structure of the educational system should not permit the choice of pre-vocational courses to be made too early; this may be achieved by the inclusion at the beginning of the secondary school course of a period during which pupils may be guided.

40) When attempting to develop the specialized training of future technical and scientific staff, it is desirable to give adequate emphasis in their education to general subjects and to everything which may contribute to the development of the mind.

41) It is important to give workers who are already employed every opportunity (particularly in the form of paid practical training) to follow technical or scientific courses at secondary or higher level, enabling them to qualify for higher posts.

42) Among methods of part-time vocational education for workers evening courses in technical and scientific subjects have played and will continue to play their part; in many cases, however, the scale and complexity of modern technology demand technical and scientific education for which evening classes cannot be satisfactory.

43) It is desirable to point out the usefulness of the system whereby employers agree to release certain of their workers without loss of pay during a part of each week for part-time day courses of technical and scientific study; an alternative method is to provide a course for an equivalent length of time each year in one or more continuous periods.

44) It is desirable to mention also the system which consists in fully integrating theoretical instruction in technical education establishments with practical work in industry; this system normally provides for equal periods spent alternately in recognized practical training in industry and in academic study, both training and study being carefully coordinated and supervised; a common arrangement is for students to be employed throughout their courses by the industrial organizations which provide their practical training.

45) Correspondence courses, possibly supplemented by appropriate audio-visual aids (radio, television, cinema, etc.), may also provide a means of assisting workers wishing to improve their technical or scientific knowledge in order to gain promotion.

46) Access to higher education and to the university should be granted not only to holders of the general secondary school certificate, but, also, by means of a preparatory course or an entrance examination to holders of the technical secondary school certificate and to workers in employment.

47) Generally speaking, any measure to advance the general or further training of workers in employment — and this is as much in the firms' interests as in those of the workers themselves — should be considered as an indirect contribution to the training of technical and scientific staff, and consequently deserves every encouragement.

48) Facilities should also be provided for persons who initially pursued secondary or higher studies in a non-technical field and later wish to take further training in order to take up employment in a technical or scientific post.

Social assist

49) The award of scholarships or grants for tuition and maintenance is one of the most effective ways of increasing the number of candidates for technical and scientific studies.

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50) It is strongly recommended that registration and tuition fees should be kept as low as possible and that students of modest means should be able to obtain direct or indirect exemption; the ideal is that all types of public education at all levels should be provided completely free of charge.

51) The wide-spread use of students' hostels is one of the best solutions to the problem of lodgings; in the same way, school or university refectories offer a means of providing nourishing yet economic meals.

52) Among methods used to extend the field of recruitment of future technical and scientific staff, concessions to students and trainees such as reductions in the cost of transport, social security measures including free medical attention, free or reduced-price holidays, etc., are worthy of consideration by responsible authorities.

53) Offers of paid work which is compatible with study, preferably in the form of practical training complementary to theoretical work, may be considered as a form of social assistance which it would be advisable to adopt; it is also desirable to take all necessary steps to avoid any possibility of abuse on the part of employers as regards students' work or remuneration.

54) Private or governmental agencies should be responsible for assisting young people who have completed their course to find a post and should help them in the early stages of their trade or profession; to safeguard the interests of industry, as well as those of the young staff themselves, it is desirable to ensure that they are always appointed to and employed in posts corresponding to their qualifications.

55) In countries where young people who have recently completed their studies are posted to areas in which they are considered to be of greatest use, their preferences, their place of origin, their family responsibilities, etc., should be taken into account, a system which deserves to be more widely used is the placing of young qualified staff on the basis of vacancies listed by technical schools and universities, provided those concerned have not been able to find a post for themselves.

56) Among measures to assist the beginner in his trade or profession should be mentioned: advances or loans enabling him to meet his initial expenditure; a discreet check on the reception given to young staff in the firm where they start work; in places where staff are often trained abroad, a system of placement and aid on their return to their own countries, etc.

International cooperation

57) It would be desirable to intensify, within the framework of technical assistance, the training of technical and scientific staff, by means of aid for opening new institutions, the enlargement of existing ones, etc.

58) In some cases, several countries would be well advised to pool their resources in order to set up regional technical or scientific institutions, and possibly technical teacher training schools also on a regional basis.

59) It is necessary for even the least favourably placed countries to send students and specialists abroad, for although the financial outlay required may seem scarcely compatible with the country's resources, it is nevertheless indispensable to its development; in this case, as in the case of all other problems arising from the desire to accelerate the training of technical and scientific staff, financial difficulties may find a partial solution within the framework of technical assistance.

60) It is important to adopt special means to procure modern scientific laboratory equipment for countries where it is lacking.

61) International, regional or national organizations which send experts on missions should pay particular attention to requests for the secondment of specialists or teachers for the training of technical and scientific staff; it is essential that the experts nominated should have a good knowledge of the characteristics and needs of the country to which they are sent.

62) The initiative taken by various international, regional or national organizations, both public and private in increasing the number of scholarships for young technicians or scientists to study or take further training abroad or else to go abroad for practical work relevant to their training, should be encouraged.

63) The international exchange of educational administrators technicians and teachers of technical and scientific subjects, also contributes towards the improvement of the training of future staff; this is very important from the point of view of international harmony and understanding.