NOTES CONCERNING UNESCO'S POLICY IN THE FIELD OF TECHNICAL EDUCATION

I. GENERAL OBSERVATIONS

Unesco's policy in the field of Technical Education cannot, as everybody will readily understand, be separated from the overall policy objectives of the Organization as they have been defined by the appropriate organs. This paramount goal of Unesco finds its best expression in the Constitution of the Organization, which reads:

"The purpose of the Organization is to contribute to peace and security and to advance the common welfare of mankind by promoting collaboration among nations through education, science and culture in order to further universal respect for justice, for the rule of law and for human rights and fundamental freedoms which are affirmed for the peoples of the world, by the Charter of the United Nations" (Art. I, 1).

The paragraph which follows this Article mentions activities to be undertaken by the Organization so as to realize this purpose: collaboration in the work of advancing the mutual knowledge and understanding of peoples (a) giving fresh impulse to popular education and to the spread of culture (b) and maintaining, increasing and diffusing knowledge. It is here not the place to quote from Unesco's constitution extensively so as to refer to all instruments through which the aforementioned activities can be executed. One consideration, however, may not be out of place: If in the Constitution only education, science and culture are mentioned as the fields through which Unesco is to contribute to peace and security, how and where does technical education find its rightful place in the framework of the Organization's activities?

As a province in the wide domain of education, its place is significant. But there are other reasons why technical education ranges amongst the most important activities of Unesco. The few mentioned below do not claim to be exhaustive.

1. Education must be seen in our world of change in a different way than it was possible during periods of relative stability. In those former days it was possible to consider education as an end in itself, suited rather to the possibilities of a leisure class. Nobody would, of course, deny that education even nowadays is a noble pursuit if it does not aim at usefulness in life, the democratization of education had the effect that education is now widely considered as a means. Education, then, must also be seen as a means to prepare people to master the complex task of contemporary life. Technology, together with science, from which indeed it is inseparable, does a great deal to shape our present époque, and will do so even more in the future.

In the light of this, it can safely be said that no education is truly responsive to the needs of our days if it does not comprise technical education as one of its determining factors.
2. It has been said that science and technology are inseparable from each other. Here again one would readily admit that pure science has its own right and dignity and that the search of truth for the sake of truth is one of the noblest pursuits of man. Notwithstanding, there exists in modern science a tendency according to which through a marriage with technology, research findings may be applied in such a way as to shape even our everyday environments. At almost every step we take, we run across devices which owe their existence to scientific research.

But the observation that pure science has a tendency towards application must be supplemented by another one, namely that modern science in itself is in need of technology, since only by employing huge and sophisticated technical devices, from the microscope to the synchro-cyclotron, it is possible to sustain scientific progress.

But science and technology which both penetrate into almost every aspect of modern life are not by themselves and automatically a blessing. What can be used can also be abused. And everyone knows that the abuse of science and technology constitutes a menace and can threaten humanity with extinction. If both science and technology are being looked at in the light of the Organization's foremost objectives, it is clear that an educational approach towards science and technology becomes a necessity so as to make sure that they do contribute towards peace to the greatest possible extent. This, then, constitutes another reason why technical education occupies such a prominent place among the activities of the Organization.

3. The greatest threat that science and technology can imply lies, one can say paradoxically, in their absence. Indeed, the view has frequently been expressed that the greatest danger to peace in our days can result from the gap between the so-called industrialized and under-industrialized countries.

Before considering why this gives rise to the need for technical education, it should be mentioned that the term "industrialization" is not used just so as to mean a set-up of industrial enterprises and the infrastructure that goes with them - important as they may be. "Industrialization" should rather indicate a way of rationally organizing all aspects of economic life, employing scientific methods, and utilizing modern machinery. It would not therefore be inappropriate to speak even of an industrialized agriculture.

Why then has the gap between industrialized and under-industrialized countries such a significance? A glance into the past of some of the industrialized countries may provide an answer: here the existence of different standards of living for various groups of the population had threatened to upset the social fabric of the countries and this changed only when it was possible to arrive at a more even distribution of wealth and security amongst all people. Similarly, if it is permissible to speak of national standards of living, existing differences in themselves constitute an element of unrest and insecurity which needs to be overcome for the sake of world peace. Every possible step must therefore be undertaken which is liable to lead to a more even distribution of wealth. And since it has been largely due to science and industrial technology that the gap between those enjoying a high standard of living in industrialized countries and those who did not have access to it could be, if not closed, at least narrowed considerably, science and technology are an important and even the most important vehicle through which the gaps that exist between different standards of living of entire nations can be narrowed and eventually closed. Herein, we feel, the ultimate reason for the prominent rôle of technical education in the activities of Unesco must be found.
In summary: the great importance which Unesco attributes to technical education emerges from its obligation to render its services to Member States in such a way that the cause of peace, security and common welfare of mankind can be propagated through these services.

II. THE INTERNATIONAL RECOMMENDATION CONCERNING TECHNICAL AND VOCATIONAL EDUCATION

The fact alone that the Organization attributes such great importance to technical education has, no doubt, great significance for the policy pursued by the Organization in this field. It does not, however, constitute a policy in itself.

Yet, the official policy of the Organization has been formulated when the General Conference of Unesco at its twelfth session adopted the RECOMMENDATION CONCERNING TECHNICAL AND VOCATIONAL EDUCATION. Since copies of the Recommendation are being distributed at this Seminar, and since the relevant Ministries of Member States have submitted to the Unesco Secretariat reports concerning the implementation of this Recommendation (document 13 C/11 Add.1), one can be brief in elaborating on the contents of the Recommendation, and it may be sufficient to outline its main features:

The Recommendation applies "to all forms of education provided in schools or other educational institutions in order to prepare persons for the exercise of occupations in such fields as industry, agriculture, commerce and the related services" (Art.1). To define the scope of the Recommendation was necessary so as to clearly identify the fields of competence of the various international agencies concerned with technical education, either in general, or in their specific fields; mention should be made in particular of the International Labour Organisation for vocational training in general, the World Health Organization and the Food and Agriculture Organization in their respective fields. However, the actual scope of the Recommendation is somewhat wider, as shown, for example, in a subsequent Article, where reference is made to "correspondence courses" in technical education (Art.30 g).

Definitions concern the different levels of technical education which are distinguished for the purpose of the Recommendation. Since the topic of "definition of levels" is to be dealt with in greater detail further below, all that needs to be said here is that a distinction is made between three levels: the skilled craftsman, the technician, and the engineer or technologist.

A number of Articles (Art. 4-10) put technical education into the perspective of scientific and technological progress, and in so doing emphasizes that technical education is capable of extension, and should be accessible to women. Technical education should not neglect the cultural content of technology, and should contribute to the development of personality and character. The importance is being stressed of a sound background of general education which should prepare students for an active participation in life.

Under the heading of General Principles and Aims of Technical Education, it is said that it should be adaptable to changing needs, and should, therefore, provide not only basic skills, but at the same time basic scientific knowledge which would lead to a certain versatility on the part of those trained. To this end, premature specialization should be avoided, and a proper balance between general, scientific and specialized subjects should be maintained. The dignity of manual labour and its importance even for modern production processes should be recognized, and, whereas
suitable forms of technical education should be accessible for physically or mentally handicapped persons, the technical system as a whole should be so organized that "every person can continue his education until his potentialities have been developed to the full", for which reason a great deal of permeability between different levels and branches of technical education should be sought (Art. 11-15).

The idea behind this is that even the skilled or semi-skilled worker should have the chance, provided his intellectual capabilities permit this, to eventually become even a university professor. In other words, no way of technical education should lead up a blind alley-street, and technical education may provide a ladder to social progress for those who, for whatever reason, did not have the chance to reach the highest levels of education the direct way. Desirable as this is in principle, nobody would deny that in this respect a difference may occur between under-populated countries which are short of skilled manpower and in particular at the highest levels, and over-populated countries, where the return on each investment in technical education must also be considered. In other words, where the means are limited, it may not be desirable to upgrade someone who has undergone expensive training as a skilled craftsman (unless in an exceptional case) to that of a professional engineer, in which position neither he, nor, in fact, the entire community, would have the full benefit of his craftsman training.

A subsequent chapter (Art. 16-24) deals with the planning and administration of technical and vocational education. The need is emphasized of forecasting economic development and the manpower requirements resulting thereof. Where economic development is based on development plans, manpower development should form one of its essential chapters. Since development is not a thing which goes on automatically, but rather must be constantly adjusted to changing needs, the necessity also exists to continuously keep up to date plans for the development of national manpower. The most up-to-date methods should be used in this process.

It is obvious that in certain cases an allowance must be made for the fact that not only does the manpower go to the industries, but in certain cases the industries go to where manpower can be found. In other words, it may become necessary to train people even before the respective industry in which they can find employment has been established, to the end that availability of trained manpower may attract investment capital. It is inevitable that in cases where a development that took generations in the highly-industrialized countries is to be made in a much shorter span of time, tensions will arise from a disparity between employment facilities and the actual output of technical education institutions, be it that training is in excess of employment facilities, or be it even that the manpower needs exceed the availability of manpower. Actually, the picture may be even more complex, since an under-supply in one field or at one level can in certain cases be found simultaneously with an under-supply in other fields. The Recommendation, therefore, states an ideal which may never materialize to the full, but which should not be lost sight of as a goal.

The important rôle that technical education administration has to play is being emphasized and a close co-operation between all administrative bodies concerned with it should be established; in federal states there should be a body for planning technical education at the national level (Art. 19-21).

Facilities for technical education should be equipped so that transition from school to employment can be made with the least difficulty, and to the same end, technical education institutions should have workshops, laboratories, farms and/or commercial offices at their disposal for the teaching of practice subjects (Art.22-24).
Concerning the relationship between primary education and technical education, the Recommendation calls for encouragement of trends to include certain technical subjects in general education curricula (Art. 25-27).

A high degree of flexibility should be maintained in any system of technical education; systems should provide diversity in specialization and adaptability. Technical education should be organized on the assumption that the need for it will be even greater than forecasts of manpower requirements would indicate. So as to attract students, it should be effective and truly educational. This calls for every problem of technical education being considered as an individual case (Art. 28-29).

The Recommendation itself sets an example for the flexible approach, in that it refrains from emphasizing one particular system of technical education. Indeed, the possibilities of organizing technical education are manifold, and which one is being chosen is often a matter of historical development which varies from country to country, from region to region. Thus, the Recommendation gives a great many examples of possible organizational patterns, of which either one or more may be usefully employed in any given country. These patterns are:

(a) full-time technical and vocational education, including practical training, provided in the school itself;

(b) theoretical education provided by the school while part of the practical training is obtained by periods of work in the chosen occupation;

(c) the day-release system providing for workers to attend school for one day a week;

(d) the "sandwich" or "co-operative" system under which periods of school alternate with periods in a factory, farm or other undertaking;

(e) the block release system whereby employees are released by their employer to attend technical and vocational education courses for one or two short periods a year;

(f) evening courses for persons in full-time employment;

(g) correspondence courses;

(h) refresher courses for persons who have already received vocational and technical education, or for those having practical experience in the occupation.

Adequate facilities for training at each level should be available in each country. Again this is no dogma, and the Recommendation therefore suggests that developing countries should examine the desirability of establishing joint facilities for technical and vocational education, especially at the highest level (Art. 30-33).

Regarding the economic requirements, the Recommendation points out that account should be taken of human resources and of foreseeable manpower requirements.
Efforts should be made to ensure employment for the graduates of technical education institutions, whereby their personal wishes and inclinations should be taken into account. It will readily be seen that technical education should lead to employment so as to utilize the investments made in the education for the benefit of the individual and the community. To this end, the Recommendation even calls for a placement and guidance service (Art.57).

The need for close co-operation of all parties engaged in activities having a bearing on technical education is stressed, and the Recommendation calls for the establishment of advisory commissions and committees at the national and even at the local level, in which representatives of, amongst others, employers and employees' organizations should sit (Art. 39).

Regarding the programmes of study, general principles along which the curricula might be planned, are given in the Recommendation. For the skilled worker, technical education should be directed to practical skills, together with technological knowledge, as is necessary for future employment. Training of technicians should lay stress on the technological aspects of a particular occupation, without neglecting practical skills and knowledge, and training of engineers should be broadly based while providing a sound working knowledge of relevant sciences. Here, adequate opportunities should exist for the pursuance of post-graduate studies. In addition to a specialist knowledge, technicians, engineers and technologists should also study the social and economic aspects of their respective fields. They should also study one foreign language of world-wide use so as to be able to keep abreast with new developments.

For practical purposes, the Recommendation makes a distinction between different sections which can be found in technical education curricula:

(a) general subjects, such as languages, social sciences, etc.;
(b) basic sciences, such as mathematics, physics, chemistry, biology, etc.;
(c) general technical subjects, such as applied mechanics, strength of materials, thermodynamics, fluid mechanics, agronomy, accountancy, etc.;
(d) specialized subjects, such as thermal engines, compressors, machine tools stability of structures, electronics, accounting machines, agricultural machines, etc.

However, the Recommendation does not include specific suggestions as to how the distribution of these sections within the entire curriculum might be organized. Rather, the Recommendation refers to specimen schemes annexed to the Recommendation. The reason for this seems to be that practices vary to such an extent that no agreement on any one specific scheme was likely to be accomplished, since the patterns followed in different Member States vary to such a great extent. Obviously the study programme of a country which devotes a relatively long period to practical training prior to institutional engineering education and where practical training is given in industrial establishments, would have to follow a pattern different from that of another country where, owing to lacking industrial training facilities or on other grounds, practical training has to be provided within the frame of institutional engineering education. And it will be realized that established patterns of technical
education cannot be changed within a short period of time. It may even be said that certain forms of industrial organization correspond to modes of engineering education, and that, consequently, a pattern of training which yields good results for one country may not be applicable to other countries where industry is organized in a different way. None the less, it is felt that the specimen schemes attached to the Recommendation do not provide a good basis for the discussion of how study programmes might be organized in newly-to-be established institutions for engineering education.

The greatest number of paragraphs under any of the chapters of the Recommendation can be found under the heading "Staff". This signifies the great importance of this question for all technical education institutions. Here, distinctions of levels are made which follow those concerning the level of technical education as are being dealt with in the first Article of the Recommendation.

For the education of engineers or technologists, the staff should be so recruited as to facilitate carrying out of both pedagogical duties and research of the scientific or technical subjects taught by the individual staff members; the right balance between these two functions should be maintained. As a rule, the teaching staff in technological institutes, polytechnics, engineering colleges and other institutions in the field of higher technical education should consist of graduates from universities or institutions of a similar level, and the senior teaching staff should possess higher scientific or technical qualifications. The need for practical experience in the special technical field is being emphasized. In order to create a closer link between industry, agriculture and commerce, engineers or technologists working in this field should be invited to join the teaching staff of such higher institutions, and a good balance between the number of full-time and part-time staff should be maintained (Art. 58-66).

The teaching staff for the training of technicians should possess either a degree or a higher technician's qualification in an appropriate field, and should have industrial or comparable experience in their particular discipline. Teachers for the teaching of skilled workers should also have received training at a high level, although no degree is being called for. Whenever possible, they should have at least three years of practical experience in their trade or specialization. For the workshop instructors, extensive trade or craft experience is considered necessary (Art. 67-73).

Teaching staff employed in technical education institutions should have received special training including teaching practice, in either of the following forms:

(a) full-time studies in appropriate institutions;

(b) part-time courses;

(c) in-service training as assistant teachers or instructors;

(d) advice on teaching methods from a specialist.

Actually, the Recommendation states that training of teachers should be considered as a process continuing throughout the teaching career; this should be facilitated through a periodic release of teachers (Art. 74-76).
Regarding the post of principal of technical education institutions, the Recommendation states that it should be entrusted to a person who is not only fully proficient in the actual pursuit of one of the specializations taught at the institutions, and who has a sound teaching experience, but who also has sound administrative abilities. He should receive the assistance from adequate administrative staff. This staff should comprise inter alia guidance personnel, staff for the preparation, supervision and co-ordination of practical work and experiments, and for the maintenance of instruments and other equipment (Art. 77-82).

In order to attract and retain highly qualified personnel into the technical education system, the emoluments and conditions of service which are offered should compare favourably with those enjoyed by persons with similar qualifications and experience in industry. In particular, salary and pension scales for the staff of such institutions should take into account the practical experience acquired before entering into a teaching career (Art. 83).

Following in the Recommendation are Articles concerning the utilization of active and participation methods in teaching, and the use of carefully selected audio-visual aids (Art. 84-86). A wide range of evaluation methods might be used which should facilitate amongst other things self-appraisal on the part of the students (Art. 89-91).

The Recommendation emphasizes the need for research in technical education institutions, which should comprise both technological and science research, as well as curriculum and pedagogical research (Art. 92-93). The final three Articles refer to international co-operation in the field of technical education, but since the Seminar is in itself a lively example of the practice of such co-operation, it may not be necessary to elaborate on these last Articles (Art. 94-96).

Taking the Recommendation as a whole, one will realize that it was developed as a truly international instrument which should, at the same time, be applicable to a large range of different technical education systems, and yet provide impulses for even the most highly industrialized countries without, however, discouraging less highly-industrialized countries. The experience so far gained with the Recommendation has been positive indeed, and without exaggeration and self-praise one may say that a large number of Member States have benefited from it. But positive as these experiences are, the Recommendation remains an instrument, or a tool. It is not a dogma. And the day may come where the need arises for a revision in the same way as the old Vocational Training Recommendation of the International Labour Organisation of 1939 has been replaced by the new Recommendation concerning Vocational Training of the ILO of 1962.

III. THE NEED FOR A FLEXIBLE APPROACH: CATEGORIES OF TECHNICAL EDUCATION

The main principle of Unesco's policy in the field of technical education is to make available to the Member States who so desire, the resources at its disposal. Implementation of concrete project, thus, is the aim of this policy. It will be understood that a flexible approach is necessary if this goal is to be reached. Not only does the history of technical education systems and philosophies differ from country to country, and not only is every national system of technical education embedded in differing social and cultural environments, but changes or modifications in national concepts affect the implementation of projects much earlier than that they would necessitate modification of a recommendation like the one to which reference was made above.
Another aspect need also be taken into account. Experience is that assistance in the field of technical education which is given on a bilateral basis had a very natural tendency to be closely linked to a conception of technical education which is typical for a donor country. The danger may arise that through technical education institutions which are being established on such a basis, an element of complication can be introduced into a national system, which renders it more difficult to administer and, therefore, less effective, even if the direct results of such an institution are good ones. International assistance in this field, however, has to be free from any such national bias or concept, and must, therefore, be adapted to national patterns which have already been established in a country at the time a project is being developed.

As an example of the flexibility of Unesco's policy in this field, some considerations regarding levels of training or education will follow. Although this seems to be a fairly academic subject, it is felt that it none the less has a considerable bearing on the implementation of projects, since uncertainties resulting from the utilization of a terminology which is not indigenous to Member States receiving, through Unesco, assistance for technical education institutions by the United Nations Special Fund, have in the past lead to certain difficulties.

The definition of Technical Education in the Unesco Recommendation, which was quoted above, is being followed by a reference to distinct levels of technical education: that of the skilled workers, the technician, and that of the technologist or engineer. Whereas the skilled worker is defined by the broad training he has received for the exercise of a trade or craft, the technologist/engineer is not defined by his function, but by the level of institution at which he has received his training. The term engineer or technologist applies to persons "in occupations for which the need of education in appropriate sciences in universities or equivalent institutions... is officially or traditionally recognized". Between these two stands the technician. This term applies to persons "in occupations requiring a knowledge of technology and related sciences between that of a skilled worker and that of an engineer".

The uncertainty which thus appears to prevail relative to the term technician, is not accidental. Historically, training of skilled craftsmen was the first step in the development of technical education. A variety of informal apprenticeships or indentureships appeared even in the early stages of human cultural development not the least to which the countries of the region being represented in this Seminar bear witness. Although the forms, contents and methods of apprentice training or other forms of training skilled craftsmen have altered very considerably in the course of history, the understanding of the rôle and function of craftsmen remains and continues to be rather stable. A seed of uncertainty arose only recently with the increasing importance of automation, and there has even been talk of the "semi-skilled technician" who is said to be replacing the traditional craftsmen in automated industries.

With this statement, however, the controversial field of what is in fact a "technician" has been entered, and before elaborating on this, something should be said about the training of professional engineers, or technologists in the terminology of the Recommendation. Historically speaking, this is far less old than the training of skilled workers. Only in the Nineteenth and Twentieth centuries were the institutions, faculties of engineering or technical universities founded, which are
charged with the training of engineers at the professional level. But although these institutions are thus relatively new, they have been able to benefit from the already established patterns of university education, and from the social esteem that goes with it. The self-apprehension on the part of these institutions if firmly established.

This cannot be said of institutions which train "technicians", and in a number of industrialized countries these institutions are only in the course of being developed. Formal training of technicians seems to be only a requirement of our times. This is not, of course, to say that in earlier phases of industrial development there were no intermediate positions to be filled. But these were occupied in most cases by craftsmen with superior experience and skill, and by foremen or master craftsmen. Their functions involved skills rather than theoretical knowledge, and it remains from there that the technician is widely considered a distinctly practical man. However, practical experience no longer suffices for a technician, and his function is changing from that of one who can demonstrate techniques to one of an organizer of complex work processes. His responsibilities have been augmented very considerably, and in fact it appears doubtful whether it is still justifiable to speak merely of the "technician level". In fact, there appears to be a whole spectrum of technician levels.

The disparity in the interpretation of the term "technician" which has thus arisen would not in itself be a matter of great importance were it not for the widely-shared opinion that it is precisely the "technician" who is in too short a supply in most developing countries. The assistance to technical education institutions financed by the United Nations Special Fund and executed by Unesco in a great number of cases is channelled to institutions whose function it would be to train technicians. Difficulties have arisen in the implementation of such assistance schemes, which in some cases took the form of a tendency on the part of these institutions to aim at university status and to achieve it eventually. What may be the reasons for this phenomenon?

Many answers have been given to this question, answers which one hesitates to accept, since they offer themselves too readily. Social reasons, for example, would already suffice to render this phenomenon understandable, but there is certainly more to it than meets the eye. Could it be that the conviction by which so much emphasis is placed on the training of technicians in the framework of industrialization, is at least partly at fault, since it follows so closely the pattern of some of the industrialized countries? Could it even be that the whole idea of the traditional three levels of technical education is in the course of being overtaken by the reality of industrial and technological development? To examine these questions, it may be helpful to look at conditions in highly industrialized countries.

One factor of cardinal importance in this context is the rôle of automation. A competent and confident technologist once remarked, though perhaps somewhat over-confidently: "If now labour costs too much, we engineer it out". Actually a trend can be observed, following which skilled human labour retreats from the production line wherever the objective is industrial mass production. The dilemma of vocational education in this situation has once been described as meaning "training of people without jobs for jobs without people". This is, of course, an exaggeration. There is still a great deal of skills required, more and higher skills even than before. However, they are not so much required in production itself, but rather in its preparation or in the ever-growing sector of occupational activities which has been called the service sector. It is not as though human beings have altogether

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disappeared from production, but their function is different from that of a traditional craftsman. It is not so much "production" but supervision and control of processes, and theoretical knowledge and intellectual habits are required even more than manual skills. In exercising his function this new type of industrial worker performs a task which would traditionally have been one of a technician. It is obvious that this distinction here is not one between "levels" but one between functions in different fields of occupational activities.

Is a similar distinction, i.e., a distinction which refers to functions rather than levels, applicable to engineers or different groups of engineers? The fact that there have been proposals to speak of practical engineers is an indication that such a functional distinction is indeed required. The term, however, is not very attractive, since it implies that there may be even unpractical engineers.

Perhaps some clarity can be gained by looking at the rôle research is to play in modern industry. In earlier days of industrial development, one would be justified to say that research in technology used to follow industrial development. Technological progress at this stage was sometimes made through an approach which resembled the trial-and-error method, and it was the rôle of technological research to find out why new industrial processes or techniques worked. This, however, was in the past, and the rôle of technological research nowadays is the leading one. As far as technology is concerned, the border-lines between pure and applied research are hardly distinguishable any longer, and research is almost omnipresent in the entire industrial set-up. This results, of course, in a much greater demand for technologically trained people with a high standard of attainment than was conceived only a few years ago in particular in industrializing countries, where for reasons which are only too clear, the need exists to set up a modern industrial fabric in a far shorter time than industrial development took in the industrialized countries of today, the need for this type of personnel being immense. Industrializing a country, whether large or small, is in itself a process which cannot be mastered without technically trained people of a high calibre in positions which are neither directly related to production work, nor do they involve work on the development of new products or techniques. Such personnel find their vocation in government services which are concerned with the planning, executing and follow-up guidance of industrialization plans. They must have a distinctly practical operation, as used to be the mark of a technician, because they must be able to find practical solutions so as to safeguard smooth implementation of the national plans, solutions which do not bear the marking of a scientific "ebony tower". At the same time they must have the intellectual habit of the technologist, since without it they would be in danger of losing sight of the overall objective of implementing urgent and great schemes, being inundated by petty problems, importance as they may be.

Such people are in their function comparable to the modern skilled worker who is engaged in the preparation of production, or on the service sector of a national economy. Their functions are different from an engineer engaged in research work, but this does not necessarily imply that their level of attainment may be lower. Here again, the difference is that of functions rather than that of levels. Are they "technicians", are they "engineers"? As long as they are being trained and are being trained well, the question may be left open.
Why has this excursion its legitimate place in a paper on Unesco's policy in the field of technical education? As has been mentioned, cases have arisen where the tendency on the part of institutions receiving assistance through Unesco from the United Nations Special Fund has led to difficulties in as much that such a tendency implies a deviation from the concept of training "technicians". Unesco has in such cases taken the view that even in such cases the institutions remain to play a vital function in the framework of industrialization. The purpose of this excursion has been to evidence that this attitude has not arisen from what harsh critics may call opportunism, but from a desire on the part of the Organization to let its activities be guided by a full understanding of the needs on the part of the Member States as is conceived in all intellectual honesty as must be expected from an Organization bearing in its title the words "Education, Science and Culture".

IV. UNESCO'S MEANS FOR ASSISTANCE IN TECHNICAL EDUCATION

Even the best formulated and most flexible policy will achieve little if an organization does not have any means at its disposal through which the policy can be implemented. A brief account of the means which can be employed by Unesco belongs therefore in a discussion of the policy, since turning concepts into reality is the ultimate goal of a sound policy.

When discussing the means or instruments Unesco has for the implementation of its policy in the field of technical education, reference has to be made to the various programmes of Unesco or for the execution through Unesco. In doing this, it appears to be unnecessary to mention fully the differences that exist between different programmes relative to their initiation, their budgeting and the technicalities of their implementation. This is not the place to mention figures on the actual allocation for the various programmes, since this would not contribute much to the comprehension of their nature. The different programmes should rather be illustrated by concrete examples which would cast a light on their nature.

For activities organized under the Regular programme of Unesco, the Conference on the Application of Science and Technology to the Development of Latin America (CASTALA) may serve as an example. This was the second in a series of conferences, the first of which was the "International Conference on the Organization of Research and Training in Africa in relation to the study, conservation and utilization of natural resources", held in Laos in 1964. The conference is obviously not limited to the field of technical education, since many more aspects than this had to be considered. The Conference was organized in co-operation with the United Nations Economic Commission for Latin America (ECLA) and was held from 13 to 22 September in Santiago de Chile. The purpose of the Conference was to "set in motion the appropriate machinery for the application of scientific discoveries for the benefit of Member States and (to) examine the possibility of applying suitable modern technological techniques for economic development" (from 13 C/5 approved). It brought together engineers, scientists and economists delegated from 18 Member States and a number of international, intergovernmental and international non-governmental organizations, for an exchange of views and experience.

The subject of the Conference was not to discuss problems relating to technical education, but if the application of technology to development of a certain region is the theme of the Conference, the questions relating to the formation of human resources and their best utilization arise by necessity. Thus, the working group on Human Resources and Formation of Scientific and Technical Personnel contributed an important chapter to the final report on the Conference, which in turn will be stimulating governmental or intergovernmental actions to remedy any shortcomings still existing in the region.

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The impact of a Conference like CASTALA cannot be easily or directly measured but it is a well known fact that once problems have been adequately brought to the attention of a whole community of people who are officially or professionally competent to deal with them, the first, and sometimes even the most important step towards a solution is being taken. Once the complexity of a given situation has been properly recognized, it is possible to take remedial actions which would not have been easily possible otherwise. A Conference like CASTALA passes recommendations and suggestions. It is not Unesco's functions to decide upon the adoption of such recommendations and to act accordingly but Unesco will, if Member States so require, go at length to make the resources at its disposal available to them. Decisions must be passed and implemented by the governments regardless of the assistance they are able to obtain, but whereas it would be true to say that recommendations cannot be a substitute for actions, it would be equally true to say that, without the recommendations which emerge from profound discussions on a regional level, the chance of decisions being taken which would have a beneficial effect on the whole region, would be much lower. Thus the recommendations of the CASTALA Conference will lead and have already led to the initiation of actions. In this fact lies the importance of the Conference. The success has been such that it has already been decided to organize a similar Conference in Asia (CASTASIA) in 1967 and it is envisaged that yet another may be held for the Arab States.

Conferences like the one mentioned are not the only activity under the Regular programme that have a bearing on technical education, though they may be the most important. It is not possible to give an exact definition of "Regular programme" because this would be a repetition of the Unesco Constitution and other documents relating to the rôle and function of the Organization.

It is different when we turn to another programme, the Participation programme. The "Programme of Participation in the Activities of Member States" was conceived as a complement and counterpart to the planned special activities (generally of a limited character relative to scope and duration) carried out on the Organization's initiative. It is designed to help expand development at the national level of education, science and culture. (Manual 545 of 1 July 1960). In relation to the Participation programme, it would not be necessary to cite an example in extenso, since the Seminar itself, owing to the fact that its purpose is improved co-ordination at national level of technical education and that it enjoys the hospitality of the Kingdom of Libya, is such an example of Participation programme.

Still another programme is the Expanded programme of technical assistance (EFTA) which was established "for the purpose of helping underdeveloped countries and so strengthen their national economies". The programme is established by the United Nations; Unesco is a participating organization of EFTA and, as such, is responsible for advising the field of competence of Unesco and for carrying out these programmes once they are approved. (Manual 500 of 25 March 1963).

Four kinds of technical assistance are provided under EFTA:

1. Expert advice and assistance; 2. Individual training in the form of either fellowships or training courses; 3. Provision and dissemination of technical information by means of demonstration projects, scientific and industrial research and pilot plants, exchange of technical information and expert seminars, and 4. Equipment and supplies as integral parts of projects. High in importance amongst the
fields: in which Unesco executes technical assistance, ranks technical education. This is a necessary consequence of the fact that technical education has to play a key rôle in the economic development of Member States.

A typical activity in the field of technical education of EPTA may be the services of an expert whose terms of reference would comprise:

(i) making a survey on the technical education facilities of a country or part of it, including a multitude of specialities or one, and one or more different levels;

(ii) drawing up a plan for the improvement of the technical education system or sector thereof and doing so in co-operation with the government and non-governmental authorities concerned;

(iii) setting up a co-ordinating machinery comprising what authorities and/or bodies might be concerned with technical education;

(iv) estimate the financial needs resulting from plans for improving or reorganizing the technical education system or section thereof;

(v) assisting in the design of buildings, workshops and laboratories;

(vi) drawing-up of equipment lists;

(vii) advising on suitability of curricula;

(viii) advising on examination pattern and papers;

(ix) training of one or more national counterparts.

Although the terms of reference quoted above would refer to a general technical education adviser, there are, of course, more specialized advisers who would be concerned with one narrower defined field, such as micro-paleontology. Their functions would include the design of curricula and teaching in the appropriate institution. The advisory capacity of the experts furnished under this programme is characteristic for EPTA. These experts do not have executive functions and they come under the administrative responsibility of the Specialized Agency rather than that of the government. The impact of EPTA can be and has in fact been very considerable. In a good number of countries technical education facilities do exist, together with a large number of professionally competent staff. However, there may be difficulties in using these institutions to full advantage, either because duplication of administrative functions by different authorities create obstacles, or because low appreciation of technical education on the part of potential students does not permit full utilization, or for any other reason. In this case the advice of somebody looking at the situation from a fresh viewpoint and acting like a catalyst in a chemical process, has greatly contributed to a full use of what already exists. In other cases, where no adequate facilities yet exist, his surveys, evaluations and/or proposals have, in many cases, led to a request for assistance under a different programme, that of the United Nations Special Fund.

The name of the programme which is by far the greatest as far as personnel services and financial commitments are concerned, has already been mentioned: the Special Fund programmes. The fact that national directors of institutions,
receiving assistance under this programme through Unesco, have been invited to this Seminar, signifies that its importance is indeed paramount. On the other hand, the fact that they are represented here, together with the Chief Technical Advisers appointed by Unesco, both of whom are the real experts in the practice of Special Fund assisted projects, makes it difficult to say anything new on this subject.

However, a summary of different types of projects which may be executed by Unesco with assistance from the Special Fund may be justified. The reason for this is that it has often been experienced, in the course of implementing a project, that a need arises for a related project. That this is so lies in the very nature of industrial development, which in itself is in no way static, and about which one could neither say: once we reach this and have this type of institution, we are industrially developed. Satisfaction of needs creates new needs and the ultimate purpose of the Special Fund is not to contribute to all the needs in the fields which can be assisted by the Special Fund but rather that the receiving countries should, through this and other assistance and mainly through their own efforts, be put in a position to sustain what additional institutions may be required in the course of further economic development by their own personnel and means. This target may be reached in a longer or shorter time but it will be reached, as can already be seen by the results of the tremendous efforts made.

But, in the meantime, a need for assistance from the Special Fund in the field of technical education may exist and may even arise. A higher technical college that has already been established may need extension and addition of new departments to cater for new specializations according to a diversified economy. After the most urgent need for the training of professional engineers has been met, more efforts may have to be made in the field of training intermediate level technicians. Extension of the technical education system necessitates the establishment of a technical teacher-training institute. These are examples of how the satisfaction of one need can create new needs. In the following paragraphs, sectors of technical education in which Unesco's execution of Special Fund assistance can render valuable services to Member States, will be indicated. The sequence does not in any way indicate an order of priority or preference.

**Faculties of Engineering:** The purpose of this type of project is to initiate either the creation and establishment of new faculties of engineering or the improvement and extension of existing ones. Emphasis may be either on increasing the number of graduates or improving their academic standards by the introduction of new curricula and teaching methods, improving field practice or excursions, introducing a greater amount of laboratory work, encouraging research, introducing new systems of students' evaluation and admission or final examinations, or through any other adequate and appropriate means. The entrance level to faculties is normally being established by the normal university admission practice but, in certain cases, it has been found necessary to lower the entrance requirements in order to attract an adequate number of students. In such cases the duration of the course has been extended accordingly.

**Higher Technical Institutes:** As already mentioned when the question of "levels" was discussed as an example for the flexibility of Unesco's policy in the field of technical education, the delineation between these institutions and the university level institutions is not an easy one to make. However, emphasis in this type of project is laid on practical work in laboratories, workshops and, where adequate arrangements can be made with industry, even industrial practice. That
the level of attainment need not necessarily be below that of faculties of engineering
at universities, but the outlook of the graduates would be different. Seen in this
light, the question of whether or not these institutions are to grant degrees to
their successful graduates is, from the programme point of view, only of secondary
importance. The graduates are being trained to occupy positions not so much in
research and development but in the government services or industries and these
positions can be of even higher responsibility than university posts.

Institutes for the training of middle-level technicians: There may be a
discrepancy between the desire of the students relative to the level of the positions
they wish to occupy and the actual needs of an economy. It is quite understandable
that those students whose level of general education would entitle them to admittance
to a university, are not enthusiastic about the idea of being trained for
positions for which the emoluments are disproportionately less attractive. As long
as admission requirements for faculties of engineering and high technical institutes
on the one hand, and institutions for the training of middle-level technicians on
the other, remain the same, one must anticipate the tendency of students to shy away
from the latter. There may be, however, a large demand for this middle-level per-
sonnel in industry, even in the form of, for example, technical draftsmen, site
supervisors, etc., in government services. Once such a situation exists, the desir-
ability of establishing special institutes for the training of middle-level technicians
may be contemplated. To attract students to these institutions, the entrance re-
quirements would be clearly below the ones of the aforementioned institutions. Due
to this, the age at which students leave the institution would be less than the age
at which students graduate from faculties or higher technical institutes, although
the duration of the course at such institutes may not be much less than the duration
of the course at the former. The duration of the course is to be defined in the
light of the local conditions. Reference to the regulations in highly industrialized
countries does not necessarily clarify the issue since it is obvious that the time
required to train middle-level technicians who have already obtained considerable
practical experience by working in industry, will be less than in the case where
even practical training has to be provided in the institution. Thus the distinguishing
factor between the two different types of institutions would not be the duration
of the courses but the entrance level, the level of attainment at the end of the
course and, as a result of these, the approach to familiarizing students with their
field of speciality.

Institutes for the training of technical teachers: Two different types
of technical teacher-training institutions have been developed and are receiving
assistance from the Special Fund, the difference between them being mainly the
different entrance standards. In one case, students enter the institution after
completion of their engineering studies, at whatever level. Students are thus
already university graduates, diploma holders or technicians. In such a case, the
curriculum of the technical teacher-training institute contains educational subjects
only, such as pedagogy, psychology, sociology, curriculum development, design and
utilization of modern teaching aids, methods of teaching and instruction, etc.
This does not mean that such institutes are not in need of practice workshops and
laboratories, since the principles of teaching are not being dealt with in an
abstract form but rather in their practical implication. For this purpose, practice
schools have even been attached to these institutions. The level of teaching is
not necessarily limited to one type of institution, be it technical secondary
schools or even higher technical institutes. Nowadays, it is widely acknowledged
that a certain pedagogical training is desirable even on the part of university
teachers.
In the second type of technical teacher-training institutions, students receive both engineering and pedagogical training. Entrance to such institutions is after secondary education or after what other level of general education may be required. Obviously, the rôle of workshop and laboratory practice is different in this instance and the duration of courses may be much less in institutions which confine their activities to pedagogical training. It should also be mentioned that where the economic situation of a country does not warrant the establishment of special institutions for the training of technical teachers, facilities for the training of such teachers may be attached to other existing institutions for technical education at the appropriate level. Both forms of training technical teachers may be combined in one institution.

Technical education administration and in-service training institutes: Where technical education facilities already exist but are not, for one reason or another, being utilized to the fullest advantage, it may be desirable to place the main emphasis on increasing the efficiency of technical education administration, including the establishment of an inspection and supervisory service, and on the introduction of in-service training of technical educators at their respective levels. In-service training does not only involve training in the technical aspects, although this may be necessary, but includes pedagogical aspects. In such cases, it is worthwhile to associate in-service training with an institution for the development of teaching and instruction materials and making these means available to existing technical education institutions. Through such projects remarkably good results can be achieved even with relatively modest investments on the part of recipient governments.

The above examples may suffice in outlining the main types of activities which are assisted by the Special Fund and executed by Unesco. There are, of course, many other possibilities. One could think of projects which would facilitate a regular exchange of experience between technical education institutions through the organization of projects in applied research, drawing on technical personnel from both industry and technical institutions. It has been emphasized that Unesco's policy in the field of technical education is flexible. This refers in particular to the development of projects which are to reply to particular needs of the Member States requesting Unesco's assistance.

One final word should be said about Special Fund projects and that is that in reality these are projects undertaken by the governments with marginal but decisive assistance from the Special Fund. Although the contribution in most cases comprises experts' services, fellowships and equipment, the decisive contribution will be that of the government. Thus the following criteria have been included amongst those to be taken into account for the evaluation of Special Fund requests:

(i) prospect of early and tangible results and greatest possible impact in advancing the economic, social or technical development of the country;

(ii) effective co-ordination with national development programmes and other programmes of assistance;

(iii) technical, organizational and financial feasibility, including full participation of the recipient government;

(iv) early transfer of responsibility to assisted countries.
In conclusion to what has been mentioned about Special Fund projects in the field of technical education, it may be stated that the main objective of Unesco's participation in them is not only the training of a given number of engineers, technicians or technical teachers during the years of assistance, but rather that the assistance leads to firmly establishing the new or extended institutions in the national technical education system, so that not only the present generation may have the benefit of it, but even following generations.

We believe that this is true not only in relation to Unesco's execution of Special Fund assisted projects, or to the establishment of institutions in the field of technical education. It is the noblest objective of Unesco's policy in this and even in other fields to render its services, resourceful and imaginative, to the Member States so that now and in the future people may live in peace and security.

V. CONCLUSIONS

It may be possible to conclude from what has been said above that Unesco's policy in the field of technical education does not exist in the form of a preconceived idea, but rather is in a state of continuous development in response to challenges as they emerge from concrete tasks. Though such a statement would not be completely erroneous, it would not convey the full truth. In the pursuit of concrete tasks and projects in which Unesco has collaborated with its Member States upon their invitation, it becomes necessary from time to time to step back so that we can define where we stand at present - and by we are meant both Unesco and the Member States. This Seminar provides such an opportunity where room is gained for a detached view from which the basic features and principles which underlie the phenomena with which all of us are being called upon to deal day by day become apparent. A Seminar like this, it is felt, could gain its full importance and make the desired impact only if it does not remain an isolated incident. Rather, it is believed that the full benefits from it can be derived for all parties concerned if this Seminar is followed up by others of a similar nature.

It may be too early at this stage to say what the themes for discussion at another seminar could or should be. One can envisage, however, that the complex of questions which have been posed in Chapter III, and which concern the adequacy of a terminology for technical education which is derived from the patterns of technical education in the highly-industrialized countries of today, may become a major topic of discussion for the future. Without reopening the struggle between "realists" and "nominalists" of the European scholastic philosophy of the Middle Ages, one can say that the use of a certain terminology has a tendency to impose certain features which have their full right only within the system from which the terminology itself has been derived, and to which it implicitly refers.

The tasks that everyone has before him when occupying a responsible position in the field of technical education, be it a particular institute or be it at the national or the international level, are enormous, and the responsibility to be carried is a great one indeed, since this field is of such paramount importance to future industrial development. But the greater the responsibility the greater the need to discuss and reason together, whereby the emphasis is on together. It is for this reason that this Seminar is being held.