

the development of higher education

the teaching of sciences in african universities

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The Development of Higher Education in Africa

The Teaching of Sciences in African Universities

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Report of the Seminar
on the Teaching of Basic Sciences
in African Universities
Rabat, 13 to 22 December 1962

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INTRODUCTION

In December 1962, a group of participants from English-, French- and Arabic-speaking countries of Africa met in Morocco to discuss their common problems related to the teaching of basic sciences at university level.

The occasion was the first Unesco Seminar on Basic Science Teaching in African Universities. Since this was a pioneering effort, the programme was frankly an exploratory one. The thirty-four participants from nineteen African countries were all persons actively engaged in teaching the basic sciences in African universities and were united in their recognition of the essential role of science education for nations striving to achieve a high level of social and economic development. They also realized that knowledge of the present situation was necessary before a rational plan of action to meet the science education needs of Africa could be drawn up. The seminar provided the necessary opportunity for formal and informal communication about what is being taught and how it is being taught in the different science faculties of Africa. The task of discussing all the basic sciences and the needs of all African universities was obviously too great to be dealt with at a single conference, and for this reason discussions were limited to some selected problems. The unanimous wish was expressed therefore that seminars on each of the basic sciences should be organized in the future.

The purpose of the seminar was to examine problems related to the teaching of mathematics, physics, chemistry, biology and geology at university level, with special emphasis on African needs. Unesco commissioned one expert in each of these fields, from countries outside Africa,¹ to write working papers for the seminar that would focus the attention of the participants on the general problems of teaching the basic sciences, as seen by experts from other parts of the world, and lead to a consideration of what approaches and solutions were adaptable to African needs. These five basic documents on science teaching appear as sections II to VI, inclusive, in Part Two. Several of these experts were present in Rabat as consultants and shared in the exchange of experiences on an international scale.

Through a questionnaire prepared by Unesco and distributed to the participants further useful information was obtained concerning the science faculties in their respective countries. Some of this material was used in the preparation of the document by T. L. Green (p. 37-46).

1. Except for Professor J. Miège from Dakar University, Senegal.

The 'Essential Conclusions and Recommendations' which follow give a summary of the most important ideas which were the outcome of the discussions.

The seminar, in which representatives of the United Nations and Specialized Agencies and several observers from non-governmental organizations also participated, was opened by H. E. Youssef Ben Abbes, Minister of Education of Morocco. The closing session was presided over by H. E. Mohammed El Fasi, Rector of the Mohammed V University. Professor V. Kovda, Director of the Department of Natural Sciences represented the Director-General of Unesco.

The agenda included two parts: (a) problems related to the teaching of each particular science; (b) inter-disciplinary problems and those related to organization and administration. The seminar elected the following officers:

Chairman of the seminar and general rapporteur: Henri Arzelies (Morocco).

Chairmen and rapporteurs for particular topics:

(a) *Problems related to each particular science*

Mathematics: Alemayehu Haile (Ethiopia), chairman; Arsène Poaty (Congo—Brazzaville), rapporteur.

Physics: Edward L. Yates (Rhodesia and Nyasaland), chairman; Mohammed Aduan Zmerli (Tunisia), rapporteur.

Chemistry: Mustapha Hassan (Soudan), chairman; Yusef Salah El-Din Kotb (U.A.R.), rapporteur.

Geology: Mr. Mohammed Diouri (Morocco), chairman; Hajjoub Msougar (Morocco), rapporteur.

Biology: Mr. Hussein Said (U.A.R.) and Antoine De Bont (Congo—Léopoldville), chairmen; Mrs. Gladys Anoma (Ivory Coast) and Albert Sasson (Morocco), rapporteurs.

(b) *Inter-disciplinary problems and those related to organization and administration*

Relations between science teaching in secondary schools and university science teaching: Rachid Oussedik (Algeria) chairman; Pie N'Dayizigamiye (Burundi) and Denis Morgan (Basutoland), rapporteurs.

University-government co-operation: Henri Masson (Senegal),- chairman; Ebenezer Laing (Ghana), rapporteur.

New teaching methods: Arthur Hunter (Kenya), chairman; Jean Charette (Congo—Léopoldville), rapporteur.

Place of research and teaching; and training of university teaching staff: Ebenezer Laing (Ghana), chairman; Mrs. Gladys Anoma (Ivory Coast), rapporteur.

Co-operation between African universities: Bede Nwoye Okigbo (Nigeria), chairman; Albert Delvaux (Burundi), rapporteur.

The participants wished to express their deep gratitude to the Director-General of Unesco who was responsible for having organized the seminar which had presented an opportunity for the discussion of problems of major importance for the development of science teaching in African universities.

They also desired to express their warm appreciation both to the Government of the Kingdom of Morocco for the generous welcome and effective co-operation of the Moroccan authorities, and to the Rector and the scientific staff of the Mohammed V University whose active assistance and kind hospitality contributed so greatly to the success of the seminar and to the creation of a friendly international atmosphere.

The opinions expressed in this publication are those of the authors and do not necessarily reflect Unesco's point of view.

ESSENTIAL CONCLUSIONS AND RECOMMENDATIONS OF THE RABAT SEMINAR

In order to improve science teaching in African universities the seminar makes the following recommendations and requests Unesco's aid and assistance in this field.

GENERAL RECOMMENDATIONS

1. Meetings devoted to each specific science should be periodically organized: (a) conferences at which participants would exchange the results of their experience in teaching methods, course content and laboratory work; (b) extended seminars on recent developments in each science.
2. National or regional scientific societies should be formed for the purpose of establishing and maintaining contacts with international scientific unions in the field of research and teaching.
3. The relevant authorities in African States are urged to hasten the setting up of national bodies (national scientific councils, academies of science, etc.), to organize and co-ordinate scientific research.
4. Unesco is requested to give support by all possible means to the protection of ecological stations and of animal or plant species that are dying out.
5. It is recommended that a specialized agency, Unesco for example, collect information which would make it possible to evaluate the admission standards for different universities and to learn more about the educational systems of different countries in relation to higher education.
6. It would be useful if the organization concerned could draw up a list of existing trained personnel and those who will be available in five years and in ten years time. This list is absolutely essential for drafting a plan designed to encourage studies in specialities that are lagging behind and for organizing effective assistance.

BASIC TEACHING AND AFRICANIZATION OF CURRICULA

7. The essential aim of education should be to develop the scientific attitude and the ability to use the scientific method. This is particularly important in the modern age, when the body of scientific knowledge undergoes considerable development during a single lifetime. Our students must become capable, through their studies, of adapting themselves to subsequent changes. This

orientation of education implies that the accent should be placed in all fields on principles and methods.

8. On the other hand, and this is not a contradiction, this basic training should be inspired and guided by local conditions. In writing textbooks, authors should take care to use language that will appeal to the student's imagination. In other words, scientific concepts should be reformulated, using analogies and images based on local nature and culture.
9. The Africanization of curricula seems particularly necessary in geology and biology. However, and all delegates insisted on this point, Africanization should never lead us to forget the universal nature of education. In biology, as in other subjects, a leading place must be given to unifying principles.
10. There is an urgent need to set up supply bodies responsible for providing whole, live and preserved specimens (as well as slides of zoological sections) for teaching.

RELATIONS BETWEEN THE CLASSICAL DISCIPLINES AND NEW DISCIPLINES

11. The various classical disciplines have increasingly numerous and complex relationships. The relations between physics, chemistry and biology are drawing ever closer; they have led to the creation of new sciences such as biochemistry and biophysics. These sciences should be given a leading place in our universities through the establishment of teaching and laboratory chairs.

SECONDARY AND UNIVERSITY EDUCATION

12. It is essential that universities and secondary schools collaborate closely in the preparation of modern curricula for secondary schools and in the training of science teachers.
13. Any committee responsible for modifying an education system must take into account the points of view both of the university and the secondary school. The general consensus was that both systems proceed from the same guiding principles, that there is no hiatus. Thus from the secondary level the student should gradually be trained in the scientific attitude and not merely in the acquisition of knowledge. The need for modern training is obvious in higher education and it should be recognized as equally important in secondary education. The only difference is a difference in level.
14. It is essential in the modern world that a minimum general scientific training should be given to everyone. Specialization, and particularly the division between scientists and non-scientists should not occur too soon; it was also recommended that the division should never be absolute.

TEACHING AND RESEARCH

15. A university teacher must necessarily be engaged in research work. Research is an essential condition for the continuous development of the intellectual standard of teaching staff, and for a living education adapted to the modern world.
16. Teacher training for science teachers is often neglected. It is strongly recommended that seminars and meetings between teachers be arranged to permit exchange of teaching experience and discussion of problems.

ORIENTATION AND CONDUCT OF RESEARCH

17. The orientation of research should be decided in relation to African needs, while preserving the universities' freedom in this field. In no case should basic research be abandoned or decreased. On the contrary, it should be developed in harmony with applied research.
18. It is essential to ensure the continuity of research, which is closely bound up with the stability of university staff. Ways must be found (i.e. suitable conditions) to encourage national and expatriate specialists to remain as long as possible at the university. Foreign professors are too often appointed for short periods which do not allow them to develop and continue research work.

P A R T O N E

REPORT OF THE SEMINAR

In Chapters I and II that follow¹ will be found the practical, or what might be termed the 'visible', results of the discussions. This should help the technicians of education, with the support of a specific text, to influence their respective administrations by suggesting internal reforms, Unesco assistance, collaboration with other States, and so on, in particular fields.

But there are other results, perhaps more important although they are 'invisible'. The personal contacts established in this way, many of which will be lasting, cannot fail to further understanding between nations and contribute to the harmony sought after by all men of good will. There can be no doubt that in this respect education plays the principal part. If young people the world over are educated by teachers who regard the different countries as the voices in a single choir, who lay stress on the ridiculous and totally outmoded nature, in the Space Age, of hostility between peoples, mankind will embark on a course that is beneficial to all.

1. Text prepared by Professor Henri Arzelies, in collaboration with the Unesco Secretariat, on the basis of the reports of the meeting and drawing also on the material contained in the working papers for the seminar.

I. PEDAGOGICAL PROBLEMS

GENERAL PROBLEMS

GENERAL PURPOSE OF EDUCATION; THE SCIENTIFIC ATTITUDE

The essential aim of education should be to develop the scientific attitude and the ability to use the scientific method.

Obviously, this attitude rests on the acquisition of a certain complement of knowledge; there can be no attitude or principles in the abstract. But the volume of knowledge must not, or should not, overwhelm the student. This idea was expressed by the French moralist, Montaigne, in the classic phrase: 'A well-formed mind rather than a well-packed one'.

Every student, even if he is later to undertake technical studies, must first receive a basic training. The technical applications that follow, whatever their importance, must be secondary. It is inadvisable to adopt a purely utilitarian attitude too soon; a solid basic training is bound to have a good influence on later specialization, and even on the speed of learning.

This is particularly important in the modern age, when the body of scientific knowledge undergoes considerable development during the span of a single lifetime. Our students become capable, through their studies, of adapting themselves to changes.

This orientation of education implies that in all fields the accent should be placed on principles and methods.

For instance, in chemistry, the study of monographs should not be regarded as an end in itself, but as a means of demonstrating and learning to understand the structures and mechanisms of reaction.

We must offer a truly modern education, not by merely adding new subjects each year, but by constantly rethinking education in relation to the current state of the sciences. Our students must become the scientists of tomorrow, not of yesterday or the day before.

Finally, several delegates insisted that the development of the scientific attitude must explicitly include the social training that such an attitude demands. The student should be encouraged to apply the scientific attitude both in his personal life and in his life as a citizen, which would imply a certain struggle against superstition

and prejudice. However, other delegates considered that caution should be exercised in this respect: how was one to distinguish between prejudices and respectable customs? The distinction was not always self-evident and, in particular, the scientific attitude should not be confused with the attitude of European civilization towards certain problems.

THE CLASSICAL DISCIPLINES AND THE NEW DISCIPLINES

Throughout the seminar stress was laid on the need for modern education, one aspect of such modernization being concerned with the relations between the various classical disciplines. It was strongly advised—and this is particularly feasible in the African universities which are being set up or developed—that rigid and outmoded compartmentalization which in no way reflects the real world should be avoided.

The relations between physics, chemistry and biology are drawing ever closer, and have led to the creation of new sciences, such as biochemistry and biophysics. These should be given a leading place in our universities through the establishment of teaching and laboratory chairs.

THE PHILOSOPHY AND HISTORY OF SCIENCES

There was much support for the suggestion that courses or seminars on the philosophy of science (so far restricted to the study of philosophy) be introduced into the cycle of scientific studies. In physics and chemistry especially, there is great need for this kind of training. General concepts such as those of time and space have become the object of study and definition. Indeed, they present scientists with difficulties to which they are not accustomed. It is therefore highly important, in certain theories, to give these terms a precise meaning, and not the ordinary or philosophical meaning. An examination of physics theories and of the concepts of causality and determinism, etc., is also essential to modern physicists.

In geology and biology the problems of biological time, transformation, etc. would gain from an examination as a whole. Obviously these courses should be given by a professor trained in scientific research and well-versed in the philosophy of science. The first condition is essential, since the aim is not to transplant certain courses from the philosophy faculties to the science faculties, but to create a new scientific education. There is often a wide difference of attitude to such problems between philosophers and scientists.

The history of science is much less important. It is inadvisable to use the historical method of instruction for what we must teach our students is the science of today, not its history. The historical form of presentation is only very rarely the best and, in any case, it would either be serious and much too long, or it would be superficial. On the other hand, it is desirable that, in the form of observations or annexes to his course, the student should be given some idea of the historical development of the question. It is not a bad thing to show that certain results which are now common knowledge were once discussed at length (for instance, the existence of two categories of charge, positive and negative).

AFRICANIZATION OF CURRICULA

We have just emphasized the point that all good scientific education should have a general character. However, and this is not a contradiction, this basic training should be inspired and guided by local conditions.

The Africanization of curricula seems particularly necessary in geology and