SCIENCE AND TECHNOLOGY EDUCATION

1948

- Assistance to science teachers
- Publication of Suggestions for Science Teachers in Devastated Countries

1950

Etablishment of the Kalinga Prize for the Popularization of Science

1957

The launching of Sputnik I resulted in Western countries in a dramatic increase in funding for science programmes, and a concentration on education in the basic sciences

1963

Regional pilot projects for basic sciences at secondary level

- Physics, Latin America, 1963
- Chemistry, Asia, 1965
- Biology, Africa, 1967
- Mathematics, Arab States, 1969

1968

Introduction by UNESCO of the Integrated Science Teaching Programme

UNESCO is unique as a specialized agency of the United Nations in that it has competence and responsibility in both science and education linked to a special concern for developing countries. In promoting science and technology education, UNESCO has constantly harmonized intellectual cooperation and operational action, ensuring that each one reinforces the other.

THE EARLY YEARS: RECONSTRUCTION AND POPULARIZATION

The early years were dominated by the needs of post-war reconstruction and the importance placed on the popularization and social impact of science.

Not being an operating agency like UNRRA, which was in charge of a global reconstruction programme, the tasks of UNESCO in school and university science education in the late 1940s were primarily to identify needs in the war-devastated countries and to publish pamphlets [1] and materials that would aid teachers in various ways, including by describing temporary ways of alleviating the shortage of teaching equipment, especially simple scientific apparatus, until new equipment could be manufactured.[2]

From the outset, efforts were also directed to non-formal education with the aim of enabling the general public to understand the practical applications of science to modern life. Travelling scientific exhibitions [3] were approved by UNESCO's first General Conference and monographs were published on various aspects of popularization such as Food and People and Energy in the Service of Man. The quarterly review Impact of Science on Society [4] was initiated in 1950 to discuss the effects of scientific developments on modern society. Since 1950, UNESCO annually awards the Kalinga prize [5] to further the popularization of science, encourages science clubs, science camps, science fairs and other out-of-school scientific activities [6] and supports the work of science writers and journalists.[7]

1960s: EDUCATION IN THE BASIC SCIENCES AT THE SECONDARY LEVEL

In the late 1950s and during the 1960s, both an emphasis on the peaceful uses of atomic energy, which was the theme of a United Nations Conference in Geneva in 1955, and the launching of Sputnik I stimulated efforts to modernize science curricula in the United States and some European countries, involving leading scientists. Collaboration between UNESCO and the International Council of Scientific Unions (ICSU) led to the establishment, in 1961, of an Inter-Union Commission on Science Teaching (CIES), a mechanism which served to co-ordinate the educational activities of the various scientific unions. In the same year, UNESCO established a Division of Science Teaching, staffed by personnel who had been leaders in curriculum reform in their countries, not only for the purpose of giving greater visibility to UNESCO's existing activities in science education at all levels, but also and especially, of giving increased attention to education in the basic sciences at the secondary level. Science education had become an important area of co-operation with the newly-independent and developing countries, many of which established their own agencies for curriculum development, for example, the Institute for the Promotion of Teaching Sciences and Technology in Thailand. The first UNESCO regional pilot projects helped incorporate modern approaches, methods and materials within science education programmes (biology, chemistry, mathematics and physics).

(1) UNESCO has published a second edition of the booklet, Suggestions for Science Teachers in Devastated Countries for sale in all countries. The first edition was distributed free by UNESCO to schools in devastated areas. Prepared by J.P. Stephenson, science master at City of London School, this 88-page, fully illustrated booklet shows how teachers lacking elementary scientific equipment can make apparatus from simple, everyday materials and at little cost.' (The UNESCO Courier, April 1949)

(2) War Devastated Science Laboratories, UNESCO, 1949. The Construction of Laboratory Apparatus for Schools, UNESCO, 1954-1955, 2 vol.

(3) Such as: Our Senses and the Knowledge of the World, The Atom, Men against the Desert.

(4) Impact was published from 1950 until 1992.

(5) Of £1,000 from a fund established by an Indian industrialist, Mr B. Patnaik.

(6) Handbook for Science Clubs, Mrs K. Sen Gupta, UNESCO, 1953, UNESCO Source Book for Out-of-School Science and Technology Education, Paris, UNESCO, 1986.

(7) The Popularization of Science through Books for Children, Annabel William-Ellis, UNESCO, 1949. Pamphlet Nuclear Energy and its Uses in Peace, UNESCO, 1955.

1970s AND 1980s: INTEGRATED SCIENCE TEACHING AND INTRODUCTION OF TECHNOLOGY IN GENERAL EDUCATION

By the late 1960s, it was clear that major changes were taking place in the international contexts of science and technology education. Concerns about national development were strong and it was recognized that it was urgent to relate education to the development of society. In 1971, ECOSOC launched the World Plan of Action for the Application of Science and Technology to Development.[8] UNESCO's response to these contextual changes was twofold: first came the promotion of integrated science teaching and, soon after, support for technology as a component of general education. In both areas, UNESCO exercised worldwide leadership and has played a pioneering role.[9] It has encouraged pooling of innovative activities and the organization of high-level international meetings; through its publications, UNESCO has helped Member States to evaluate their innovations in order to enhance and broaden their efforts, particularly through the creation of networks. It has also sought to transfer these new approaches to teacher-training, as well as in the development of operational projects.

The Integrated Science Teaching Programme was launched in 1968; it comprised publications, workshops, advisory services and pilot experiments in Member States. A series of international conferences in Bulgaria (1968), United States (1973) and The Netherlands (1978) respectively attempted to clarify the concept, to consider how best to train teachers of integrated sciences, and to review integrated science teaching worldwide. By 1990, six volumes of New trends in Integrated Science Teaching had been published, together with regional contributions on the same theme.

A major impetus towards the re-evaluation of the place of technology in general education was the publication in 1972 of Learning to Be,[10] which argues for a broadening of everyone's basic general education to incorporate technological knowledge so that we might better control 'everything man does to modify his world' and for an initiation to the world of work.

A BESTSELLER FROM 1948 ONWARDS

The UNESCO Source Book for Science Teaching

This book, which became a UNESCO bestseller has an interesting history that goes back to the years immediately after the Second World War. UNESCO had produced a pamphlet entitled Suggestions for Science Teachers in Devastated Countries, which also turned out to be very successful in other regions where there had been little or no equipment for science teaching. In 1956, the above volume was considerably expanded with suggestions for making simple equipment and for carrying out experiments using locally available materials. It thus became in 1956 the first edition of the UNESCO Source-Book for Science Teaching which, periodically revised, and updated, had been translated into thirty languages, reprinted twenty-four times and by 1973 had sold over 750,000 copies. The New UNESCO Source-Book for Science Teaching was published in 1973, translated into many languages and very favourably accepted worldwide.

(8) UNESCO contributed with a chapter on Science and Technology Education.

(9) In 1973, to ensure success in making science and technology an integral part of general education, the responsibility for these programmes was transferred from the Science into the Education Sector.

(10) The report of the International Commission on the Development of Education.

Jaime Torres Bodet (Mexico)

Director-General of UNESCO from 1948 to 1952

What we call the World centre of scientific liaison is not just for the benefit of the few professionals. It is an effort to make scientific knowledge more accessible to everyone. We are encouraging the popularization of science.

The UNESCO Courier, August 1949

Albert V. Baez (United States)

Director of the Division of Science Teaching, UNESCO, from 1961 to 1967

There are many different categories of people who are in a position to make an effective contribution towards science education improvement. One group, including scientists, educators and individual classroom teachers, generates the innovative ideas. Another group, the designers, hopefully including some members of the first group plus specialists in the use of media, develops materials and programmes from these ideas. Finally, there is the small but influential group of people with the power to make decisions about funding and later to implement such activities by, for example, introducing them into the school systems. Without their support, the work of the innovators would never be implemented on a large scale.

Innovation in Science Education Worldwide, UNESCO, 1976

Bogdan Suchodolski (Poland)

Philosopher, educator, historian

Education through science [...] should arouse curiosity and wonder, stimulate interest in the various problems and projects.

'Science forms the Personality'. Document prepared for the International Commission on the Development of Education, 1971

1971

Introduction of Technology as a Component of General Education

1975

International Environmental Education Programme (IEEP) launched

1981

International Congress on Science and Technology Education and National Development, UNESCO, Paris

1985

INISTE (International Network for Information in Science and Technology Education) established

1992

Project 2000+ Scientific and Technological Literacy for All

1993

Publication of the first issue of UNESCO's World Science Report. (A second issue was published in 1996)

MAKING AND USING LOW-COST EDUCATIONAL MATERIALS

A problem for many Member States is lack of adequate resources. This, combined with the fact that ready-made teaching aids are both expensive and not easily available on the market, makes it imperative that countries be able to design, develop and produce their own low-cost, simple educational materials, using locally available resources.

A typical, very traditional, teaching method of the time was the so-called 'chalk and talk' approach. This did nothing to stimulate pupils' active participation in the teaching-learning process, more often than not resulting in their mechanical memorization of facts and figures of little use to them in everyday life. So, the efforts of countries participating in the Asian Programme of Educational Innovation for Development (APEID) to promote the development and use of low-cost educational materials was very opportune, and led to a series of activities being organized at national and regional levels. The first was a Regional Workshop on Educational Technology held in Malaysia in December 1977. Attended by thirteen Member States, this meeting placed special emphasis on the development of low-cost teaching aids.

Following these activities, teachers were able to produce teaching aids, such as models and charts, from locally available materials and resources; these simple aids were cheap and easily manipulated, and extensive use was made of them. In some cases, students also took part in design and production, practicing 'learning by doing' and 'discovering science' whilst experimenting with the devices they had helped to make, and in this way enhancing their knowledge and skills.

In 1978-1980 several national and sub-regional workshops were organized on the same subject in Afghanistan, Bangladesh, India, Japan, Laos, Malaysia, Nepal, Pakistan, the Philippines, Papua New Guinea, Republic of Korea, Sri Lanka, Thailand and Vietnam. Various materials designed, developed and used in these countries were identified before convening the workshops, and then demonstrated, evaluated, improved upon by participants, and later described in case studies.

One of the most valuable outcomes of these activities was the initiative taken by the APEID Secretariat at UNESCO's Regional Office for Education in Bangkok to select the most original teaching aids and, together with instruction sheets on how to make, how to use, and how to adapt these aids, to publish four volumes of Inventories of low-cost educational materials. These inventories gradually became one of APEID's most popular publications, widely distributed within the region. They have also served as a model for countries in other parts of the world.

From the beginning of the 1980s, emphasis was placed on the application of science and technology education to the needs of daily life and the development of society. In this context, UNESCO convened an International Congress on Science and Technology Education and National Development in 1981. New pilot projects involving the co-operation of several institutions in different Member States, were initiated;[11] consultative meetings between national working groups were held and projects were extended to other geographical areas with additional themes, including the teaching of science and technology in an interdisciplinary perspective. A Science and Technology Education Document Series was inaugurated in 1981, forty-eight publications haing been issued by 1995. An International Network for Information in Science and Technology Education (INISTE) was established in 1985.[12] A series of volumes on Innovations in Science and Technology Education was launched in 1986. Volume V (1994) was devoted entirely to technology education.[13]

(11) Including ones on science and technology in rural areas (three countries in Africa), science and technology and productive work (three countries in the Arab States); technology in general education (four countries in Asia); new methods for the pre-service and in-service training of personnel (four countries in Latin America, one in the Caribbean, one in Europe).

(12) Including some 260 institutions in 147 countries, out of which 27 non-governmental organizations.

(13) Summary of other key UNESCO publications on Science and Technology Education:

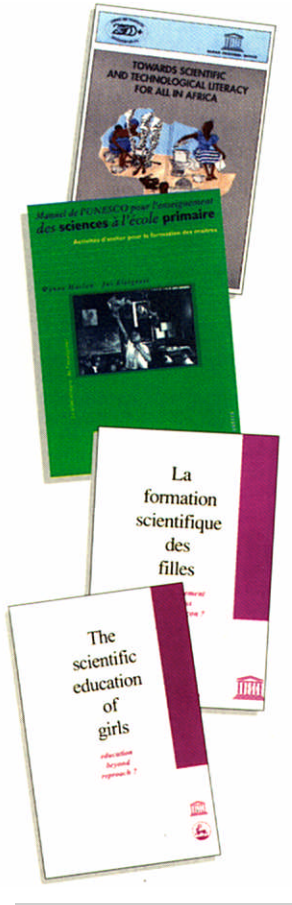
- UNESCO Handbooks for Teaching in Tropical Countries Series (10 volumes 1953-1958)
- Reports on the Role of Science in Education (nine publications: the role of Geology, Biology, Geography, Agricultural Sciences, Chemistry, Medical Sciences, Astronomy, Mathematical Statistics... in general education)
- UNESCO Source Book for Science Teaching, 1956
- Out-of-School Science Activities for Young People, 1969
- The Teaching of Basic Sciences Series:
  - New Trends in Integrated Science Teaching (6 volumes from 1971 to 1990),
  - New Trends in Biology Teaching (5 volumes, 1967-1987),
  - New Trends in Chemistry Teaching (6 volumes, 1967-1992),
  - New Trends in Mathematics Teaching (4 volumes, 1966-1979),
  - New Trends in Physics Training (4 volumes, 1968-1984).
- Studies in Mathematics Education (8 volumes, 1980-1992)
- Science and Technology Education Documents Series (STEDS) (48 publications, 1981-1995).

(14) For more details on STL see Prospects, Vol XXV N°1, March 1995, Open file : Science Teaching for Sustainable Development.

(15) See also page 208 et seq.

(16) The Project 2000+ Declaration. The Way Forward.

(17) ICASE, an international NGO enhancing the efforts of regional and national associations of science teachers.



THE 1990s: SCIENTIFIC AND TECHNOLOGICAL LITERACY FOR ALL

As we approach the end of the century, development problems and their humanistic and social aspects are becoming a top piority for the international community, as reflected through the major United Nations conferences organized between 1992 and 1996, on Environment, Population, Social Development, Women, Human Settlements and Food. For some decades now, there has been growing concern at how successful science teaching has been because students seem unprepared for using science in ordinary life. Therefore, just as it has been necessary for nearly a century to be able to read and write to make one's way in society, so a certain kind of knowledge is necessary today in order to get by in a world that is steeped in science and technology. This so-called 'scientific and technological literacy movement'(14) goes hand in hand with new developments in computer literacy and environment education.(15)

In recognition of this need for 'a world community of scientifically and technologically literate citizens' a major initiative, Project 2000+,(16) was launched in 1992, much of the impetus coming from the International Council of Associations for Science Education (ICASE).(17) An initial survey and pilot project phase was followed by the holding of an International Forum on Scientific and Technological Literacy for All in 1993, where guidelines for designing, implementing and evaluating projects were developed, including one on scientific, technical and vocational education for girls in Africa. It was recommended that, by 2001, all countries should have set up appropriate structures and activities to foster scientific and technological literacy for all.

In the same spirit, the opening section of UNESCO's World Science Report 1996 consists of an introduction to scientific literacy by the Chilean biologist Francisco Ayala. The Report also draws attention to science and technology's 'gender dimension', the disparity remaining high in favour of boys and men.

TO KNOW MORE (see also CD-ROM, Vol. I)

- UNESCO Handbook for Science Teachers. Norman K. Lowe et. al. UNESCO, 1980. (Arabic, English, French, Spanish)
- New Trends in School Science Equipment. Norman K. Lowe. UNESCO, 1983. (Arabic, English, French, Spanish)
- Innovations in Science and Technology Education, Vol. 3. David Layton. UNESCO, 1990. (English, French, Spanish)
- UNESCO Sourcebook for Science in the Primary School: a Workshop Approach to Teacher Education. Wynne Harlen and Jos Elstgeest. UNESCO, 1992. (English, French)
- International Forum on Scientific and Technology Literacy for All. Sheila M. Haggis, UNESCO, 1993. (English)
- The Scientific Education of Girls: Education Beyond Reproach? UNESCO, 1995, (English, French)

Edgar Faure (France)

Chairman of the International Commission on the Development of Education

As technology affects more and more people, compelling them to understand and master the technical world, so education in theoretical and practical technology becomes necessary to everyone.

Learning to Be, UNESCO, 1972

Amadou-Mahtar M'Bow (Senegal)

Director-General of UNESCO from 1974 to 1987

A key feature of these 1960s pilot projects was that the ideas and materials for them were produced mainly by scientists and teachers from the regions concerned. At a time when this was not yet widely known, these pilot projects demonstrated that the education authorities in the developing countries could solve their problems by themselves.

Histoire mondiale de l'éducation. L'apport des organisations internationales à l'éducation contemporaine, G.Mialaret et J. Vial, PUF, 1981

Federico Mayor (Spain)

Director-General of UNESCO since 1987

Science and technology have played a key role in economic and social development in the century now drawing to a close. They have increasingly shown themselves, in the context of an accelerating growth of basic research and an even more rapid application of its results, powerful instruments for the promotion of one of the main goals of the UN Charter – 'social progress and better standards of life in larger freedom'.

World Science Report, UNESCO, 1993

Project 2000+ is a commitment to work actively to reach the goal of scientific and technological literacy for all.

Opening session of the Project 2000+, Forum, 1993