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Report

Education curricula in space science and technology: the approach of the UN-affiliated regional centres☆

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Abstract

UN-affiliated regional centres for space science and technology education are being established or are in operation in Africa (Morocco, Nigeria), Asia and the Pacific (India), Latin America and the Caribbean (Brazil, Mexico), and Western Asia (Jordan). Education curricula at the university level, embracing remote sensing, satellite communications, satellite meteorology, and space science have been developed for these centres. This article briefly reports on the structure of the most recent updated education curricula in the four disciplines that have been made available for implementation in 2002 and 2003, in the six official languages of the United Nations. This is also an effort to bridge the gap between such education curricula as they vary significantly between nations and among educational institutions in nations.

1. Regional centres for space science and technology education

> Science (and technology are) great intellectual forces which liberate the mind from outworn prejudice and provide understanding and illumination (Isidor I. Rabi, Nobel Laureate Physics, 1944).

As has been discussed in an earlier article in this journal [1], the UN General Assembly has supported the establishment of regional centres for space science and technology education in four regions of the developing world, with the objective of advancing their scientific, economic and social development. Such centres—all affiliated to the UN—have been established in India, Morocco, Nigeria, Brazil, Mexico and Jordan. Each provides post-graduate education, research and application programmes in the fields of remote sensing and GIS, satellite communications, satellite meteorology and climate studies, and space and atmospheric sciences. In addition, in the case of central, eastern and south-eastern Europe, cooperation among the governments of Bulgaria, Greece, Hungary, Poland, Romania, Slovakia, and Turkey has led to the utilization of a network of space science and technology education and research institutions (Fig. 1).

2. Education curricula in space science and technology

The regional centres' curricula have been reviewed at various meetings, where it was noted that education varied significantly between countries and even between institutions within the same country [1]. While the model curricula have contributed to resolving these problems,[1] and collaboration with other organizations has led to the holding of COSPAR education workshops on space science for educational development at professional level at the regional centres in Latin America and the Caribbean, and Asia and the Pacific,[2] it was felt that further progress could be made by updating the curricula. This was done at a meeting in Frascati, Italy,

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[1] UN Document A/AC.105/649. Centres for Space Science and Technology Education: Education Curricula, United Nations, Vienna; the document is available in English and French at http://www.oosa.unvienna.org/SAP/centres/centres.htm.

[2] See World Wide Web sites of the workshops at http://www.inpe.br/unidades/cep/atividadescep/calendario/chandra.htm and http: //www.prl.ernet.in.

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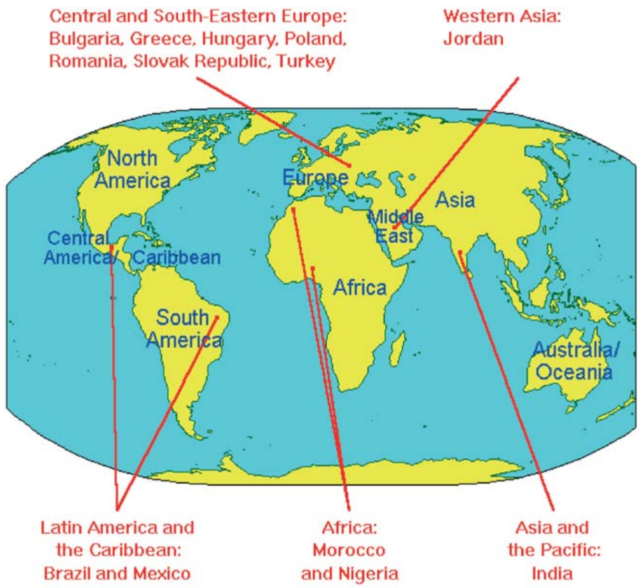

Fig. 1.

in 2001; the composition of the new curricula is presented below.

The nine-month post-graduate courses at each regional centre are undertaken in two major phases. Phase I emphasizes the development and enhancement of the knowledge and skills of university educators and research and application scientists. This will be accomplished through rigorous theory, research, applications and field exercises over a nine-month period as laid out in the following. Phase II focuses on ensuring that the participating scholars apply the knowledge and skills gained in Phase I in pilot projects. The pilot projects are to be conducted over a 1-year period in the scholars' own country.

Phase I of the curriculum on remote sensing and geographic information system is divided into three modules:

Module 1: Fundamentals of remote sensing and geographic information system;
Module 2: Common stream (advanced concepts of remote sensing and geographic information systems; satellite meteorology; earth processes; natural disasters, integrated resource management and environmental analysis) and thematic areas (remote sensing and geographic information system applications to agriculture and soils, forestry and ecology, and geoscience; human settlement and urban analysis; water resources and marine science);
Module 3: Project planning (pre-field data analysis) and field data collection (post-field data analysis).

Phase I of the curriculum on satellite communications is divided into 11 modules:

Module 0: Orientation module;
Module 1: Communications systems and digital signal processing;
Module 2: Satellite communications systems;
Module 3: Earth station technology;
Module 4: Transmission, multiplexing and multiple access;
Module 5: Broadcasting using communications satellites;
Module 6: Applications and trends in satellite communications;
Module 7: Operational communications satellite systems;
Module 8: Network planning, management and operational issues;
Module 9: Satellite communications for development;
Module 10: Pilot project preparations.

Phase I of the curriculum on satellite meteorology and global climate is divided into three modules:

Module 1: Concepts in meteorology and climatology; concepts in satellite meteorology; and image processing and interpretation;
Module 2: Geophysical parameter retrieval; applications of satellite-derived parameters; and global climate and environment;
Module 3: Pilot project preparations.

Phase I of the curriculum for space and atmospheric science is divided into two modules:

Module 1: Structure, composition and dynamics of planetary atmospheres; ionospheric physics; solar wind, magnetosphere, and space weather; astronomy and astrophysics; and basics of spacecraft design, construction and launch;
Module 2: Operation of Langmuir probe; ionospheric sounding using an ionosonde; surface monitoring of ozone; optical imaging of plasma depletions; photometry of binary stars; measurement of temperature of outer planets using IR detectors; mass of suspended particles using quartz crystal microbalance; optical depth measurement using filter photometer; modelling experiment on atmosphere/ionosphere; characterization of interference filters; radio-pulsar studies; and solar spectrum studies.

The curricula are available, in the six official languages (Arabic, Chinese, English, French, Russian, Spanish) of the United Nations, as United Nations documents.[3]

3. Conclusion

After making the four education curricula available in 2002 and 2003, further reviews have been invited from space education institutions from around the world to harmonize and expand the contents of the curricula, taking into account the needs of countries in the four regions. Particular emphasis will also be placed on available software, data and teaching material that can enhance the use of the education curricula. The results of this review process will be the subject of a third United Nations Meeting of Experts on the Development of Education Curricula for the Regional Centres for Space Science and Technology Education, scheduled for 2006. Currently, further efforts are being undertaken so that the regional centres can grow into a network of nodes in each of the regions.

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References

[1] Haubold HJ. Educational curricula of the UN-affiliated regional centres for space science and technology education. Space Policy 2003;19(1):67–9.

[3] UN Documents A/AC.105/L.238 (satellite meteorology and global climate), A/AC.105/L.239 (satellite communications), A/AC.105/L.240 (space and atmospheric science), and A/AC.105/L.241 (remote sensing and geographic information system) and http://www.oosa.unvienna.org/SAP/centres/centres.html.