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Satellite Observation in the service of Sustainable Development

Since the launch of the first civil earth observation satellite until today, a great deal of work has been accomplished in applications of satellite observation in the US, Europe, Africa, Asia and Latin America. This work has been carried out in various domains such as disaster evaluation, plant studies, mining prospection, detection of anthropic or natural dynamics (pollution, drought, periodic or forest fires) and small and large scale thematic cartography. Scientists agree that satellite observation (SO) can be of great help in the evaluation and assessment of the natural resources of the planet and thereby for sustainable development (SD) notably, as concerns environmental issues. But this also poses the problem of access to this information. What are the interests that will determine the utilisation of such information? How will it be used and under what conditions? All such questions need clear and precise answers for these data constitute veritable strategic arsenals that are part of the forces that characterise the current trend of globalisation. Indeed, the Brazilian geographer Milton Santos speaks of a "scientific, technical and information system" where only a few companies of certain nations really know the planet thanks to their scientific and technological advance, whereas others do not hesitate to qualify this state of affairs as "colonisation of the sky".[1] These specialists were obviously not mistaken if we take into consideration the numerous conflicts that can be seen currently in the application of space technology notably concerning the placement of tele-communication satellites in geostationary orbit where places are hard to come by. Indeed, according to sources of the Venezuelan External Affairs Ministry, countries of the Andean Nations Community (CAN) have encountered many problems for placing their satellite system Simon Bolivar.

According to Roger Lesgard, former Secretary General of the French CNES (National Centre of Spatial Studies), to the extent that all space programmes, without exception, are financed out of public funds, new international solidarity norms must be put in place for a democratic globalisation of the applications of this technology.[2] Such information has indeed all the necessary characteristics for it to be classified as the heritage of all humanity and so should be put at the disposition of all human beings. This is, in effect, the preoccupation that comes out of the text on the Principles of Spatial Tele-detection adopted by consensus at the UN General Assembly in December 1986: Tele-detection activities are conducted for the weal and in the interest of all countries whatever their level of economic, social or scientific development, taking due account of the needs of developing nations.[3]

Thirty years of research in Satellite Observation have led to the constitution of a network of laboratories which have allowed for considerable progress in the field of digitalising satellite imagery as well as in that of scientific applications. Several university labs, in and out of Europe, have specialised in the applications of SO in southern nations. Their research work will contribute to the spread of information through meetings, congresses and fora while "international experts" continue to travel unceasingly to southern countries looking for new "research matter".

1. ***Decornoy, J.*** *1995. Assujetissement des esprits par les images marchandises. Les conquêtes de l'espace. Raisons et passions d'un défi. Coll. Savoirs du Monde Diplomatique.*
2. ***Lesgards, Roger.*** *1998. Conquête Spatiale et Démocratie, La Bibliothèque du Citoyen. Presses de Sciences Po, 119 p.*
3. ***Colliard C.A.*** *1989. Les Principes régissant la Télédétection Spatiale. Annuaire Français de Droit International; XXXII: 697-714.*

SO and economic considerations

On the economic level, given the astronomical financial investment of the principal nations in space programmes, SO represents a veritable economic challenge. For example, in 1986 worldwide, almost US$25 billion were earmarked for space activities (v. Fig. 1)

Fig. 1

Investment in space activities in 1986

	(US$ million)
USA	21,201
EUROPE	2,200
Japan	775
Canada	114
India	246
Brazil	155

Source:
Database Ecospace of Euroconsul

Fig. 2

Civil & military space budgets in 1994

	(US$ million)
USA	29,000
Japan	2,000
France	1,600
Germany	1,000
China (*)	1,000
Belgium	1,000
Italy	500
Canada	500
U.K.	500
Russia (*)	200
India	200
Brazil	100

Source:
World Space Markets Survey, Ten Years Outlook, Euroconsult, Paris 1994

* Estimation

As can be seen in Fig. 2, US domination in the field of space is almost total - despite the changes in the international situation in the last decade. Fig.2 also reveals that countries such as China, India and Brazil have come to join the restricted group of space powers and continue to finance their own programmes despite domestic socio-economic problems. We are now witnessing a race in public offers at the international level for projects that can go from forest or agricultural inventory to the creation of a geographical information system or the installation of a ready-to-use satellite reception station in a southern country. SO materials and services are obviously extremely expensive and do not necessarily correspond to the real issues of southern nations. These countries are at times encouraged to invest heavily in sophisticated systems which only serve to aggravate their already catastrophic economic situations or to compromise part of their natural resources. This can easily be understood when we take a look at the costs involved for SO project in Fig. 3.

Fig. 3

Comparison of some space projects in terms of costs involved
(in billions of Euros)

*Category I: American initiated **"Giga-projects"***	
APOLLO	91.47
SDI (Strategic Defence Initiative)	76.22
Development of the Space Shuttle	15.24
International Orbital Station	27.44
*Category 2: **"Megaprojects"** with European participation*	
Development of Ariane I	3.05
Development of Ariane V	6.56
Constellation de satellites TELEDESIC	7.62
Constellation de satellites IRIDIUM	3.05
*Category 3: **"Big Projects"** with participation of other nations*	
4 telecommunications satellite system	0.61
Spot system (4 satellites in helio-synchronic orbit)	0.76
European military telecommunications system	2.29
Space probe	0.15 to 1.52

Source: Lesgards, Roger. 1998. Conquête Spatiale et Démocratie

The relationship between the possibilities offered by SO of natural resources and SD is of major interest to those interested in finding solutions to the problems of Southern nations, notably that of hunger and malnutrition. Although SO is no panacea for a problem that has complex and far reaching roots, it can provide precise information that, together with other data, can allow for effective decision-making.

It is well known that the issue of hunger, in certain Southern nations, stems partly from technical problems that confront rural communities resulting in bad resource management, non-productive agriculture and poor crops. In other cases, they are related to natural disasters such as droughts or flooding. In all these cases, SO can be of great help by providing valuable information on:

- Identification of crops
- Agricultural, forestry and urban statistics
- Water resource management
- Characterisation of plant life (forest, mangrove, prairie)
- Ecosystem characterisation (tropical forest, delta, coastline, valley, mountain, desert)
- Manmade or natural changes (pollution, desertification, floods, fires, disasters)
- Basic cartography and surveys

It is easy to imagine the importance of cartography for decision makers since maps contain valuable information for the quantification, delimitation or evolution of natural resources. Such

information, which can prove indispensable in decision making, can be obtained very rapidly with the help of SO. The Dakar AUPELF forum, 21-28 November 1989, focusing on SO for combating desertification, demonstrated the diversity of SO applications in the framework of a collective action against a phenomenon whose effects can be catastrophic in the Sahel and North African countries.[4] Other works on SO published in the past decade have shown their utility in the understanding of eco-dynamics in fragile natural areas[5] and of water resource management.[6]

The results of SO applications for natural resource evaluation can also be used directly or indirectly in a collective effort to combat hunger in the world, i.e for SD. There is no doubt that the natural environment is in a bad shape and in the words of Prof. François Blasco, Director of the Thematic Network of Tele-detection of the AUPEL-UREF, *"SO should be at the bedside of the planet".*[7] Although SO still remains a privilege reserved for certain countries that have the necessary scientific, technological and economic resources, this is no reason why one should not reflect upon the best way to allow Southern nations to benefit from the technological progress of those of the North.

SO and International Cooperation

SO having become a privileged instrument of international cooperation, it is necessary to arrive at an international understanding which addresses the real concerns of Southern nations. In this regard, the UN text is very clear: *In order to promote and intensify international cooperation, notably concerning the needs of developing countries, a State conducting a SO programme should enter into consultation with whichever requesting State whose territory is under observation, so that the latter may participate in the programme and thereby multiply the resulting mutual advantages. (Principle XIII).*

As concerns creation of a qualified workforce in developing countries, educational activities are regularly conducted by the FAO's Teledetection Centre (AGRT) and UNDP, UNESCO, CNES and ESA regularly organise training programmes for nationals from Southern nations. The resulting benefit of these actions to the receiving countries in terms of providing solutions to their problems has not yet been fully gauged. But it is obvious that it is "the manner" in which scientific knowledge is transferred to countries of the South that is fundamental. For it is this that will determine the utility of SO for the Southern countries. Indeed, up to the present, many such 'transfers of technology', instead of helping the countries to become independent in the domain, have only resulted in making them dependent on the transfers.

As the report of the Africa-Europe meeting[8] shows:

- 50% of the Southern nations' debt is to be attributed to the purchase of scientific and technological information and patents
- 85% of research in Africa is carried out by experts from the North, quite often out of the continent, whereas African researchers have to emigrate to the North to find 'adequate' work.

The report goes on to state *"Partnership between North and South is sometimes made difficult by the temptation of certain Northern research workers to replace their Southern colleagues and to compromise efforts undertaken to bring Southern populations to take responsibility for their own development".* According to a French specialist, funds meant for cooperation in tele-detection are mostly used up in costly missions of French experts in stead of using local experts who could do the work just as well. In other cases, the money is used to finance expensive publicity for events like congresses, meetings, etc., which hardly serve the cause of either the African countries or tele- detection.

Similar problems arise in the transfer of SO knowledge and technology. There are several qualified high level workers from Southern countries who have received training at one of the organisations mentioned above. However, this has not benefited their countries as hoped. For according to specialists, very few qualified high level personnel from the South can make use of their know-how in their own countries due to lack of adequate infra-structure. And for want of using their know-how, they end up by losing it. In the words of a French specialist who confided to the author: *"It's all very well for us to make beautiful maps for Africans, but will they be able to use the information that's interpreted by us? Rather than providing them technical assistance to become independent, I wonder if our work is not making them assistance dependent."*

At the AUPEL-UREF Scientific Forum on SO, Dakar, 1989, and Toulouse, 1990, African specialists and officials complained about the fact that the French research labs were conducting SO applications in African countries without informing the concerned persons or communicating their results to them. The uneasiness of Africans who feel that they are being used as 'research objects' is all the more understandable that this sort of conduct can hardly be considered ethical. These examples illustrate the distance between political will in the matter of SO and the reality in the field. It is thus necessary to look for new instruments for a veritable North-South cooperation in the matter of science, technology and research particularly in SO. According to Canadian specialists, cooperative actions en SO could have

4. ***Acts of Forums*** *held in Toulouse, 1990; Montréal, 1991; and Liège, 1995.*
5. ***Puech C. Merdas M.*** *1990. La détermination de la limite nord du désert par télédétection. Sécheresse; 1 : 170-178.*
6. ***Yergeau M. Gozé Bénié B. Bonn F. Prévost C.*** *1991. Satellites et gestion de l'eau au Sahel. Sécheresse.*
7. *In the Symposium "Le droit face aux techniques de télédétection par satellite au service de l'environnement", June 1993.*
8. ***Report of Conseil de l'Europe-OUA.*** *Rencontres Afrique-Europe de Porto Novo (Bénin), 1989.*

given good results in knowledge transfer to Africa if they had been planned and supported with a long-term view and with the combined efforts of the government, industry and universities.[9]

Conclusion

SO is a work instrument which can help SD in Southern countries provided that the technology transfer is based on a sincere and unprejudiced North-South partnership because SD problems concern the whole world particularly as concerns the environment and the management and conservation of natural resources. In such a cooperation, it is capital for scientists and technicians of the South to be able to put into practice in the field the know-how acquired through training programmes.

It is clear that currently in Southern countries, there are institutions as well as qualified personnel capable of conducting projects of SO applications for SD. If one is sincerely interested in utilising persons directly concerned by SD, it is important to see to it that such persons are not sidelined when an international funding agency is willing to invest funds in the country concerned and that they are given the responsibility of dealing with their problems.

In the context of the North-South cooperation, SO is intrinsically the most appropriate technology for arriving at SD in the southern countries. SO associates a technology perfected in developed countries with the means needed to interpret and valorise images of the natural resources of the planet. If the developed countries master the science & technology, the countries of the South possess the knowledge of their natural resources, over which they intend to exercise their sovereign rights. It is the common interest that should prevail in the negotiations on projects of SO application as a practice of information in the service of SD. For this is nothing more than an extension of the basic human rights. In the words of R. Lesgard *"The future of humanity is not in a flight into space. It is more than ever on the earth, for the entire planet should be our common home and technosciences should contribute to form it and to respect it"* [10]

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9. ***Bonn F. Cliche G. Merzouk A.*** *1990. International Cooperation in Remote Sensing : How can a project become a success ? The 23rd International Symposium on Remote Sensing of the Environment, Bangkok, Thailand, April 17 to 26.*
10. ***Op.cit.***

A Paradigm Shift in Mathematics Education in the Context of Globalization

According to the Newtonian doctrine, "Time" is absolute, true and mathematical. It flows equally without relation to anything external. However, it seems that the time arrow while floating along the early years of the third millennium, is enchanted with the multidimensional systemic phenomenon of globalization which is compressing time and space, and transferring the whole world into a "global village" doted with unprecedented advances. This time-space phenomenon is impacting almost every aspect of the life of individuals and societies. Hence, current literature, conferences and meetings reflect a universal enthusiasm calling for radical shifts in the content and conduct of education to allow all world citizens to successfully face up to globalization.[1]

Within this context and reacting to the swirl of changes which have taken place in the last decades of the 20th century in mathematics education, it is necessary to address the need to shift the culture of mathematics teaching and learning to suit the new modes of development and the reform features of globalization, focusing on four aspects:

- The concept of globalization
- Questions raised about mathematics education
- Examples of changes in mathematics education
- Guidelines towards a paradigm shift

Globalization

Globalization has been defined as *"the increasing flow across borders and boundaries –whether national, economic, cultural, technological, or institutional– of people, goods, services, ideas, information, images and values".*[2] This is a big concept with loose definitions, sweeping generalizations and mostly with little accuracy. For present purposes it can be described, not defined, as a set of extended inter-relations all over the world in the fields of economy, culture, politics and civil societies.[3]

There is an interchange and two-way influence between globalization and advances in research and development. The traditional criterion for

1. ***Ebeid, William:*** *'Education in Egypt: A third Millennium Perspective", in, the Conference on Education in the 21st Century in the countries of Balkans and Mediterranean, Athens, Greece(1999)*
2. ***UNESCO, Medium Term Plan 2002 – 2007,*** *International Institute for Educational Planning, Paris (2001).*
3. ***Michon, Louis:*** *"The Global Economy", World Bank Institute-Development Outreach WBI, Washington, DC (2002)*

development in terms of "Gross Domestic Product – GDP" and/or "Gross National Product – GNP" is about to be replaced by the "National Information Reserve – NIR". For in an age where progress is gauged by the quality of persons - and not the quantity of their products - education, intellect and skills have displaced the old idols of the Industrial Age. In Math and Science education, accommodating globalization entails: bridging the technology and knowledge gaps between industrialized and developing countries as well as addressing the impact of market principles and the changing role of the state on education and their bearing on the planning and management of education. This cannot be achieved without the preservation of variety and richness of world heritage in a world becoming more and more homogenous.[4]

In fact, in many of the industrialized countries, emphasis is laid – as a national priority – on the importance of technological literacy of the citizens (meaning computer skills and the ability to use computers and other information technology (IT) to improve learning, productivity, and performance) giving rise to a new terminology: "Smart Schools" or technology-rich schools, that we now have at the summit of educational systems. Thus, striving for excellence, where mathematics is a pre-requisite, is a major factor in the preparation of "smart" competitors equipped with the main tools of cognition for research and development. Consequently, it is economically and socially important to produce "numerate" citizens, high order problem-solvers, scientists and engineers.

This could be a day-dream if the mathematical foundations for these skills and disciplines are not laid at the appropriate time and at the relevant placement of the learners.

One of the major commitments of the World Conference on Science (Budapest, 1999), is the consideration of the current process of globalization and the strategic role of scientific and technological knowledge within it, as well as the new relationship between mathematics/science and society in coping with pressing global problems such as: poverty, environmental degradation, food and water security. The conditions for the production and sharing of scientific knowledge are themselves changing as a consequence of increasing intensity of communication, growing interface between disciplines and tighter interaction between science and technology, universities and industry, laboratories and factories. Moreover, more diversified methods of teaching are crucial to the evolving educational system and hence, increasingly, formal education must be complemented through non formal channels.

Raised questions

The field of mathematics education has been and is still open to many research questions, such as:

1. Is the mathematics we teach the same as the mathematics used in everyday life?
2. Is mathematics becoming a subject at risk? What are the devils menacing the teaching culture in the mathematics classroom?
3. Can we teach – and is it proper to teach – mathematics as an experimental science rather than as "rhetoric verbatim"?
4. What are the mathematical skills and the underlying know-what and know-how considered essential for the new development of globalization?
5. How are curricula and evaluation affected by the shift from objectives and outcomes to standards and bench marks? And how should teaching be adapted to constructivism and interactive innovations?[5]

Such questions and others have been dealt with in some research projects and doctoral dissertations and research on some aspects of mathematics education, at the global level has been done in a certain number of universities across the world. Paradigmatic shifts for reform ought to be research-based and critically guided. Within this context, countries should aim to establish high-quality scientific institutions capable of offering research and training facilities in areas of special interest. In the new framework of increased globalization and international networking, universities are responsible for providing students with the capacity to deal with global issues as well as flexible and up-to-date knowledge. In order to achieve this, closer dialogue between donors and recipients of science and technology funding is called for.

Examples of shifts for reform

The following are a few examples of indigenous shifts, rather than mere changes through re-organization of the same content as a result of addition or deletion of the traditional topics and practices:

A perspective from China[6]

- Introducing useful mathematics to be learnt at the masters level so as to: acquire analytical skills, interpret computer-controlled processes, deal with real life applications such as cost, profit, forecast, risk evaluation, optimization, ecological systems etc.
- Emphasizing active learning such that the learners assimilate the new knowledge through construction of their own meanings and reconstruction of their cognitive structure.

US standards[7]

- Following guiding principles, ten standards have been focused on for thinking about and doing mathematics. Five standards are concerned with the "Know What" or what is called 'hard skills'. The other five are concerned with the

4. ***UNESCO, Medium Term Plan 2002 – 2007,*** *op. cit.*
5. ***Ashour and Obada, A:*** *"Mathematics and the 21st Century", World Scientific; Singapore, London, Hong Kong (2001)*
6. ***Er-Shing, Ding:*** *"Mathematics Reform Facing the New Century in China", Presented at UCSMP 4th Conference: University of Chicago, Chicago, USA (1998)*
7. ***Standards 2000 Group:*** *Principles and standards for school mathematics, NCTM, Virginia, USA (1998)*

"know how" or what is called 'soft skills'.
- Hard skills deal with: number and operation, patterns, functions and algebra, geometry and spatial sense, measurement, data analysis, statistics and probability
- Soft skills deal with: Problem solving, reasoning, communication, connections and representation

Victoria (Australia) Curriculum and Standards Framework (CSF)[8]
- This framework is adapted from the Australian nation-wide policy on mathematics education. It provides an outline and leaves the responsibility to schools for detailed development and delivery. It also places a clear emphasis on sensible use of technology, which is considered a valuable resource for learning mathematics
- Content is concerned with six strands: space, number, measurements, chance and data; algebra, mathematical tools and procedures.
- Learning outcomes and competencies are specified with time frames at each level of teaching – learning activities of the six content strands and sub-strands.

A South African Approach[9]
An outcome based approach was viewed by South Africa as a vehicle to ensure that learners would be prepared for life in a global society and understand the world they live in. The following cross-curriculum outcomes were identified:
- Identifying and solving problems in which responses show responsible decision-making based on critical and creative thinking
- Working effectively with others; communicating effectively, using visual and/or language skills in modes of oral/written persuasion organizing
- Collecting, analyzing, organizing and critically evaluating information and managing oneself and one's activities responsibly and effectively
- Using science and technology effectively/critically, showing responsibility towards the environment and demonstrating an understanding of the world as a set of related systems
- Using data from various situations to make intelligent and non-biased judgments and knowing how information is processed
- Analyzing natural forms, cultural products as representations of shape, space and time and acquiring experience with shape and space in one, two and three dimensions
- Making sense of aesthetic forms, relationships and processes from a variety of mathematical situations and using logical processes to formulate, test and justify conjectures.

A view from the Egyptian ECME[10]
The Egyptian Council of Mathematics Education (ECME), an NGO aiming to promote mathematics teaching and learning came up with some appropriate recommendations based on research papers and studies presented at its conferences, such as:
- Help the learners to see mathematics as a human longing and desirable activity in which thought interacts with the tokens of number, symbol, pattern, shape and model so as to deepen cognitive understanding and competent skills
- Construct curricula systemically around parent mathematical concepts
- Decrease of traditional geometric practices and mechanical arithmetic and algebraic operations such as operations on: ordinary fractions, algebraic fractions, logarithmic tables, determinants … different formulae of equations of straight line and circle, memorizing statements of theorems, giving pseudo proofs to plane and solid theorems, corollaries and problems
- Make room for new concepts and contemporary topics (i.e. discrete maths, probability, topology, chaotic phenomena …)
- Add application units by the end of each grade at each stage encompassing the use of what has been taught in that grade or stage.
- Do not insist on technical terms in the early grades: begin with the simple language of children
- Functionalize the maths content in technical education, using visual and experimental mathematics in technical contexts
- Adapt methods of teaching to individual situations, using constructive learning theories.
- Raise levels of aspiration to meet international standards and national ambitions
- Give more attention to the role of research as a solid road to real and sustainable reform

Towards a Paradigm Shift

The following exemplifies two dimensional guidelines:[11]

Guiding Principles
- Every child is apt to learn mathematics and every learner is eligible to reach a mastery-level. Hence, mathematics should be for all
- New theories of learning indicate multi-intelligence, some of them are latent. Hence, differentiation in content and delivery systems are needed so as to plan for multi-tracks which awaken appropriate potentiality and ignite creative powers.
- Authentic reform is an institutional systemic endeavour. Hence a paradigm shift requires collaborative efforts by mathematics educators, mathematicians, teachers and other relevant contributors. It works within sensibly planned policies, not through stickling politics.
- Experimentation has to precede dissemination. Feed forward and feedback are guarantees for sustainable reform.

Guiding Objectives
Such objectives ought to stem out of the goals and be compatible with the

8. ***Board of Studies:*** *"Curriculum and Standards Framework (CSF) – Mathematics", Department of Education, Victoria, Australia (1995, 1996)*
9. ***Volmik, John:*** *School Mathematics and Outcome-Based Education: A view from South Africa", in UCSMP Conference, op.cit (1999)*
10. ***Egyptian Council for Mathematics Education ECME,*** *Proceedings of Conference on Teaching and Learning Mathematics, Cairo, (2002)*
11. ***Ebeid, William:*** *"Research in Mathematics Education: Perspectives and Prospects", in, short Presentations, ICME-9, Tokyo, Makuharti, Japan (2000)*
    - ***Erickson, Lynn*** *(2001):"Stirring the Head, Heart and Soul-Re-defining Curriculum and Instruction", Corwin Press Inc., Calif, USA (2001)*
    - ***Usiskin, Zalman (ed.):"****Development of Mathematics around the world", UCSMP 4th Conference, Chicago University, Chicago, USA (1999)*

national standards accepted by the educational system which in turn stems out of the supreme goals of the country. Two main categories are to be considered:

Societal objectives:

- Appreciation of the practical use of maths in different areas and activities of the society which serve tools and technologies of production
- Preparation of citizens to the work force in the new techno-labour market
- Development of generic skills such as ability to be independent, work in collaboration with others, open-mindedness, decision making
- Propagation of mathematical culture and methods in the society.

Developmental objectives:

- Capacity building, developing number sense and space sense
- Ability to estimate, describe, approximate, compare, make error analysis and deal with probabilistic situations
- Thinking quantitatively and qualitatively; seeing phenomena underlying numbers, tables and graphs and making different representations of given mathematical situations
- Ability to reason rationally, make logical proofs, abstract, induct, deduct, interpolate, extrapolate, …according to specific situations and appropriate assumptions
- Imagining, inquiring, experimenting and making designs
- Using the language of maths in communication and connections with other areas of knowledge and using mathematical aspects in recreation and educational games
- Differentiating between mathematical proof and mere verification of some formula or generalization
- Demonstrating understanding about ways of working with different types of numbers and other mathematical entities as well as investigating patterns and mathematics related phenomena in social and physical phenomena
- Seeing mathematics as a human product to which all cultures, ancient, medieval, contemporary, have contributed in significant ways
- Analyzing mathematical relationships, so as to allow learners to develop critical thinking and capacity in order to help them to participate in decision-making which affects their life and supports their career.

Guiding Features

- In the light of access to technology, shift the emphasis from paper and pencil based operations to basic skills operations
- Organize maths content, at all levels, systemically so as to ensure: unity of thought, inter-relations between ideas across topics and branches, non-linear links among concepts, generalizations and skills. Avoid repetition and linear sequencing to give the learner a chance to predict, discover, construct and acquire generic skills.
- Incorporate, at relevant levels, new mathematical concepts and methods. Examples can come from: data analysis, sampling techniques, probability and dealing with uncertainty, chaos, complexity, patterns as well as with fractals, history and contributions of different cultures in the development of mathematics, activities which reflect aesthetics in mathematical constructions, patterns, methods of reasoning and creative solutions of problems
- Include applications of mathematics in real life situations, which reflect the role of mathematics in different academic disciplines, technological advances, vocational efficiency, social development, personal habits, etc.
- Train the mathematics teachers to work within standards, open-ended objectives and not enclaved in the classic behavioural-based bloom taxonomy.

Conclusion

Having decided to describe globalization as a set of extended inter-relations over the world in the fields of economy, culture, politics and civil societies, we must now tackle questions raised regarding mathematics education in the near future. Primarily, this entails asking ourselves how mathematics can be taught in such a manner as to contribute to the developments of globalization while remaining true to its essence as a discipline, meeting shifts/challenges in society/technology. Lastly, we must agree on formulating and adhering to the guidelines needed to navigate this paradigm shift, i.e. Mathematics for All, diverse delivery systems, modern teaching/learning methodologies as well as collaborative efforts on the parts of all relevant contributors to effect systemic institutional change.*

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** The full text of this article is available at: www.unesco.org/education/ste*

UNESCO activities in STEE

Capacity Building in Gender-inclusive Scientific and Technological Literacy for enhancing Life Skills

This one-year project has been launched within the framework of the Capacity Building for the EFA (Education for All) Programme with the financial support of the Nordic States. The four countries selected for the current year are Argentina, Burkina Faso, Egypt and Nepal.

The overall objective of the project is to help developing countries, notably the least developed and the E-9 countries[1] in reviewing their EFA plans to include gender-inclusive scientific and technological literacy (STL) for enhancing life skills and thereby helping poverty reduction.

The final objective of this project is to contribute to poverty reduction by promoting STL among boys and especially girls. The project proposes to support members of the national EFA forum, decision makers and curriculum developers of the Ministry of Education with technical support for capacity building in order to revise and improve national policies and strategies in STE. The idea is to make STE accessible to both boys and girls without discrimination on the one hand, and to be more attentive to their economic and socio-cultural needs by making them better equipped in basic life skills in order to improve their quality of life. Thus, this project will be linked not only to the EFA National Action Plans, but also to other action frameworks concerning development, in particular the Special Project for Poverty Reduction (SPPR).

The rationale of the project is that at the beginning of the 21st Century, in a society completely dominated by science and technology and its applications, STE must constitute an indispensable part of basic education. Today, on the one hand in order to participate effectively in a democratic society, it is essential that each citizen possess basic scientific and technological notions on subjects such as health, environment or development, which are based on scientific concepts. In the case of awareness-raising about HIV/AIDS, for example, it is too often forgotten that without a basic grounding in STE much of the effort is totally wasted since people are just not capable of differentiating between the essential and the non-essential. Proof of this can be seen in the numerous myths and false ideas that currently prevail on the causes and spread of the pandemic. Furthermore, basic knowledge of science and technology, including mathematics, is a precious asset for all youngsters setting out to earn their living at the end of school education. As recognised in the Framework of Action of the ICSTME Conference, Goa, 2001, STE not only contributes to open and critical thinking but also to strengthen people's capacity to face the challenges of modern society.

The EFA Programme, for its part, aims not just to increase the number of literate people in the world. The veritable objective is to equip them with the basic tools that are indispensable for facing the challenges of modern society successfully and thus improving their chances of better controlling their destinies. In the 21st century, where life is increasingly dependent on science and technology (S&T) and its applications, literacy in its true sense must include an understanding of the rudiments of S&T, i.e. Scientific and Technological Literacy (STL). This is all the more valid for specific social categories like women, girls, youths or marginalized communities who need to strengthen their life skills for their very survival. STL thus forms an essential part of EFA in its widest sense.

This project aims to make provisions within the EFA National Action Plans for a gender-sensitive and socio-culturally relevant STE in order to facilitate the acquisition of basic life skills for the marginalized sections of society. The project focuses on :

- Revising and improving national STE policies to make them more gender sensitive and socio-culturally relevant to national contexts
- Making a nation-wide survey of the STE at the school level
- Defining a strategy to integrate within EFA National Action Plans relevant aspects of the Framework for Action : Science, Technology and Mathematics Education for Human Development (ICSTME, Goa, 2001) as well as those mentioned in Guidelines for Policy-making in Secondary School Science and Technology Education (*v.* ***Connect,*** *Vol. XXIII, No. 3-4, 2003)*
- Building capacities of national stakeholders concerned with EFA and relevant personnel from the Ministry of Education for concrete follow-up actions
- Promoting development of relevant curricula and corresponding pedagogical materials with the help of local specialists, specialised institutions and bilateral donors
- Developing valid instruments for monitoring and assessment as well as follow-up of the project.

In this context the primary activities of the project will include:

- A Training workshop for representatives of the national EFA forum, curriculum developers from the Ministry of education as well as teacher trainers in formal and non formal education in order to revise and improve national policies in STE to make them more gender sensitive and socio-culturally relevant

1. Bangladesh, Brazil, China, Egypt, India, Indonesia, Mexico, Nigeria and Pakistan

- A National Survey of existing STE including teacher training, curricula, teaching/learning materials in order to better adapt these to existing local conditions and needs
- Setting up of a continuous monitoring and assessment system to evaluate on-going work and recommend actions for effective follow-up based on the results of the project.

For further information contact:
Science and Technology Education Section
EFA Capacity building project in STE
(address on last page)

Enhancing the Quality of Science & Technology Education in the Asia-Pacific Region

Tokyo, Japan, 20-28 October 2003

This regional workshop was organized by the National Institute of Educational Research (NIER) in the framework of UNESCO's programme in science and technology education for 2002-2003 (*v.* ***Connect,*** *vol. xxviii, no.3-4, 2003)* and in collaboration with UNESCO Bangkok in the framework of the Asia Pacific Programme of Educational Innovation for Development (APEID).

Sixteen countries were represented at the workshop: Afghanistan, Cambodia, China, India, Indonesia, Japan, Kazakhstan, Lao PDR, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Republic of Korea, Thailand and Vietnam, together with resource persons from the China Association of Science and Technology (CAST), the University Science Malaysia and the SEAMEO Regional Centre for Education in Science and Mathematics (RECSAM) as well as representatives from Indonesia, Japan, UNESCO Hq and UNESCO/Bangkok.

The major objectives of the workshop were:

- To bring together STE policy makers from the Asia-Pacific region to share information/experiences on STE developments related to national policies, curriculum reforms, teacher education, assessment and evaluation, and popularization of science and technology;
- To discuss policy issues based on the new UNESCO manual on guidelines for policy-making in STE;
- To familiarize participants with existing networks (e.g. INGOSTE (International Network of Governmental Officers of Science and Technology Education), APEID, SEAMEO (Southeast Asian Ministers of Education Organization) etc.) and other available resources (e.g. websites, materials, projects, science education institutions, etc.) and how to make the best use of them;
- To formulate action plans for improving/strengthening STE by introducing new policies for coherence of curricula, teacher education, assessment and evaluation and popularization of STE

In the course of the workshop, participants shared national experiences based on:

- policy support for STE
- strengths of the current STE programmes and their contribution to national development
- examples of 'best practices' in curriculum development, training of teachers, teaching-learning materials, systematic evaluation of learning achievements, popularization of science and technology, etc, and the challenges faced in implementing current STE programmes

After familiarization with existing national and regional networks and introduction to the UNESCO document on policy making in STE, working groups were formed for developing plans of action for implementation in Member countries, taking into consideration the relevance/coherence and effectiveness of STE.

The major outcomes of the workshop were:

- Familiarization with the development of and trends in STE in participating countries;
- Renovated ideas on policy decisions related to STE;
- Awareness of existence and functioning of relevant networks and services/information available through them;
- Project plans for improving/ strengthening STE at national, sub-regional and regional level with links at the global level;
- Commitments to improve/ strengthen STE in the region through partnerships and networking between and among participating countries and agencies;
- Identification of focal points for each participating country/region.

The final report of the workshop including the proceedings and contributions of the various participating countries is now available.

For copies contact:
Science and
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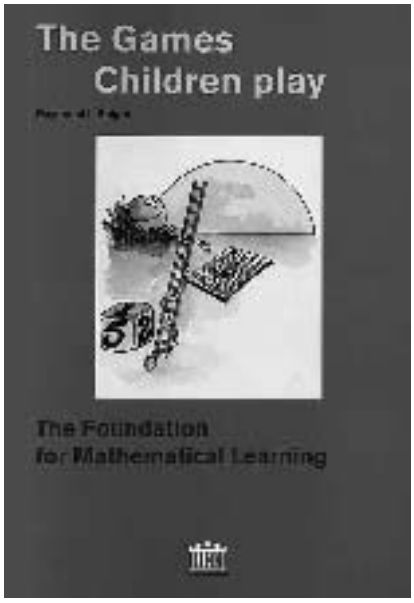
UNESCO/ED/STV/STE
(address on last page)

Games for Primary Level Mathematics

A UNESCO Study

For decades achievement results and research have shown that children's performance in mathematics has been poor. Researchers have tried to find the answer to this phenomenon, and changes have been made to approaches in mathematics and to teacher training, yet the solution to the problem seems elusive. Some researchers have linked performance in mathematics to certain races that consistently achieve higher grades in international evaluation tests. Others have pointed out that boys tend to perform better than girls in mathematics, particularly at secondary and higher levels of education. Failure in mathematics has also been linked to children's inability to read mathematical statements.



Despite the absence of conclusive evidence on why children perform badly or well in mathematics, one thing is certain, and that is, basic numeracy must be part of cognitive competence at the primary level. Mathematics goes beyond the manipulation of figures to the overall development of the intellect. Mathematics offers an approach to analysis and problem-solving. It provides the child with a way of thinking.

A study undertaken by UNESCO showed that very poor children already acquired skills in spending money and giving correct change, before they actually enter the school system. A closer look at children showed that the games they play involve numerous mathematical concepts. The question remains: Why is it that they do not achieve proficiency in mathematics, if at an early age they have acquired some of the basic functions and why do they not do as well as their counterparts in developed countries?

Much of the failure of the children can be attributed to the school and its processes. How does the education system determine the mathematics curriculum? What is the reference point for content and processes? How, and what, does it evaluate? What is its understanding of the development and experiences of children in third world countries? Piaget undertook studies of Swiss children, and arrived at a theory of development as it concerned certain basic functions in mathematics. But to what extent do such theories apply to children in developing countries? Very poor children are usually exposed early to "street life", and the UNESCO study showed that in fact these children acquired basic concepts in mathematics before their more privileged counterparts. Why then do they fail to do well in the school system?

A review of mathematics in third world countries points to the problems that are also evident for other subject areas. These include, inappropriate curriculum content and poor sequencing, inadequately trained and untrained teachers, badly written textbooks, insufficient textbooks and other learning materials, and little motivation for the learners. There is also a tendency to assign teachers with low mathematics levels of achievement to teach the lower primary grades.

The present study targets the games children play with a view to identifying all the mathematical concepts that they acquire from the games and to use them as the foundation for mathematics learning in Grades 1, 2 and 3. The design proposes that the affective domain plays an important role in performance in any subject and mathematics is no exception. The negative attitudes to mathematics that are acquired early in the children's formal education set the stage for their later performance. The early exposure to mathematics should emphasize the children's social and emotional readiness for the formal learning of mathematics. Many teachers rely indiscriminately on drills rather than on acquiring proficiency in mathematics during the primary cycle.

Mathematics is a subject that helps children to understand symbolism, develop analytic and reasoning skills, think logically, relate rules and ideas to symbolism and to learn its language. The importance of mathematics in the development of various essential skills demands the continuation of the search for an answer to ways of improving mathematics learning.

The study is limited to the learning experiences of grades 1 to 3 of the primary levels. At this level many children form concepts and attitudes to subjects according to their experiences. Regrettably many children start failing mathematics at this stage, and finally decide that it is too hard for them. This is a failing of the school system and not of the children. It appears that education systems do not make enough effort to transform mathematical knowledge gained in play into success at school. This study is calling on education systems to recognize that mathematics learning does not begin at school and that school should be a continuation of the children's education. The study does not go into details on how teachers may use these games. It is enough to say that the early grades should

help children to develop positive attitudes to mathematics learning as well as lay the foundations for living together.

A simple game of hop, step and jump offers various mathematical experiences. It involves addition and subtraction, shapes and design. Children in their daily lives learn quantities, "half full", handful, lapful, pocketful, they learn about money, especially the small denominations, they know long and short, and so on.

The study investigated a number of children's games and identified the mathematical concepts embedded in the games and how children learn them. It then built learning sequences for each concept, or group of concepts, from Grades 1 to 3, using the games as the basis for teaching and learning. Ultimately, it proposes that children should not fail mathematics during the first three grades of school. This book does not claim to be exhaustive in identifying the experiences children acquire through games. It simply gives a "kick off" point for the teachers.

The study is international, although the experiences of children in Jamaica and Kenya contributed to the practical aspects.

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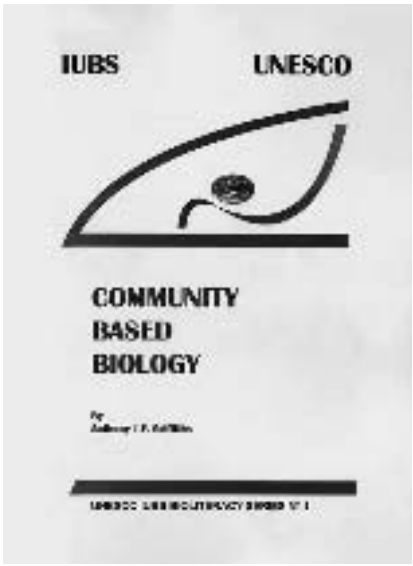
Community based Biology

An IUBS/CBE - UNESCO module

Community based Biology (2003, 51 p.) by A. J. F. Griffiths, is the first of the Bioliteracy Module Series developed on a collaborative basis by the International Union of Biological Sciences' Commission for Biological Education (IUBS/CBE) and UNESCO's Programme on Science & Technology Education.



Biology is something everyone can do. It is not restricted to professional scientists. The science of biology is simply trying to understand the living world around us through the application of logical thought and investigation.

The rationale for bio-literacy stems from the social, cultural and economic changes occurring as a consequence of scientific discoveries and technological inventions in the domain of biological sciences. Bioliteracy, by emphasising personal development, aims to promote biology education as an important contributor to the welfare and sustainable development of human society. The personal development aspect recognises the possibilities within biology curriculum to enhance students' personal skills in logical thinking, expression, personal management, self-directed learning, cooperation and responsible action. This module links biology to the community. Biology is often presented to a child as "book learning", something that other people have thought about and experimented on. Although some children find this interesting, others cannot see the connections to their own lives. Children start questioning the world around them from an early age and their initial interest is in their immediate environment, which we collectively call community. The module presents a set of interesting hands-on activities related to the biology going on in the child's neighbourhood. Most activities are designed to be cooperative ventures between parent/teacher and child. They are mostly relatively long-term projects which by their length promote good scientific habits involving patience, persistence, careful observation, recording and interpretation of results.

Future modules of this series will address include bioliteracy for health, new therapies and emerging diseases (gene therapy, prion diseases, etc); bioliteracy for sustainable development, biodiversity, carrying capacity; bioliteracy on genetically modified organisms and genetically modified food; etc. The authors of the series are prominent biologists and biology educators, members of the IUBS/CBE, from a large number of countries in both the industrialised and developing countries. A variety of approaches and methods were used in the development of the modules, reflecting the authors' broad range of expertise and natural and cultural environments.

The 14 activities contained in this module are presented in a set format with background information on the activity, necessary equipment, detailed methodology with illustrations and instructions and finally suggestions for carrying it further.

For copies contact:
Connect (address on last page)

GMO Teaching Kit

A UNESCO Intersectorial Project

Communication and Education on Genetically Modified Organisms (GMOs) is a joint Natural Sciences and Education Sector project being developed by the Life Sciences and the Science and Technology Education Sections in collaboration with the Technical University Münich, Germany.

The major objective of the project is to develop a teaching kit on the topic of genetically modified organisms (GMOs) to empower educators and policy makers to educate and communicate on developments, potential uses and risks of new technological advances, as in the case of genetic engineering and more specifically in the use of GMOs. In its initial phase, the project is aimed at secondary school teachers, in the long term at policy-makers and ultimately the general public.

Further, this project aims to strengthen interaction among stakeholders to facilitate information sharing and dialogue on the issue of GMOs in a balanced manner. Developing guidelines and an educational programme and raising the understanding of the debate will stimulate critical thinking and ultimately empower students to take informed decisions as citizens and consumers.

The teaching kit will contain accurate background and instructional material on GMOs, special attention being paid to the variety and flexibility of the material used. The material will include information on various aspects of GMOs, with emphasis on the scientific principles involved, safety (risks and benefits) issues in the broad setting of our society, as well as some aspects of sustainability, global economy and trade. Some examples of specific "case studies" on the use of GMOs will also be included.

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UNESCO Activities in Latin America and the Caribbean
III International Congress on Science Education

Havana, Cuba, 9-13 February 2004

Following the adoption at the ministerial level of the Havana Declaration, 2002, the Regional Educational Project in Latin America and the Caribbean (PREALC) took up the task of setting up a regional cooperation within and among the member states and establishing a political/technical forum. The objective was to promote dialogue, joint construction of knowledge and interchange among educational authorities, teachers and educators in order to produce substantive changes in educational policies and practices in keeping with the EFA goals for 2015.

Since one of UNESCO's major objectives is to promote exchange of ideas and experiences among nations, UNESCO/OREALC organised the III International Congress on Science Education together with the VIII International Workshop on Physics Education.

The Congress was attended by representatives from the Ministries of Education and research workers, teachers and teacher trainers from Argentina, Chile, Cuba, El Salvador, Mexico, Nicaragua, Panama and Venezuela as well as specialists from UNESCO Hq and UNESCO/OREALC.

The major themes of the Congress were the following:

- Issues and perspectives of science education in the region: the Ministerial viewpoint
- Major issues facing science education for achieving a quality and equity based training: the specialists' viewpoint
- Scientific literacy and science for all in compulsory education
- Teacher training
- UNESCO associated centres for innovative education

The inaugural address underlined the fact that science in the 21st century should be a commonly shared wealth for the benefit of all people. In keeping with this viewpoint, science education should not limit itself to merely teaching science. It should be an education for science, through science and on science. This implies a reconstruction based on the characteristics of scientific activity since it offers opportunities to pose problems, formulate ideas and explanations, take decisions that allow a person to advance, construct, reflect, interrogate and exchange with oneself and others in a collective effort based on dialogue and discussion where each contributes to the common benefit.

The discussions and exchanges that took place in the course of the Congress, brought to the forefront commonly shared difficulties concerning

issues related to science education for children and youths in the region. The contributions of the participating countries revealed the different strategies adopted by each country to encounter some of these issues.

The major recommendations to emerge from the various panels, round tables and workshops highlighted the need to:

- Create links between pre-service training, in-service training, research (with special emphasis on pedagogy), teaching in educational institutions and dissemination.
- Promote pedagogical innovation and research at all levels of education, test and disseminate excellent practices in the countries of the region with emphasis on quality postgraduate programmes.
- Contribute to the development and improvement of science education at all levels.
- Analyse the relevance of the current curriculum keeping in mind STL for all.
- Ensure that research yielded data and elements that facilitate access of marginalized parts of the population to educational resources and strategies thus allowing them to benefit from quality science education.
- Promote activities highlighting the Science - Technology - Society - Environment relationship in formal education as well as for the general public.

The Congress concluded notably that continuing training of teachers should be grounded in the schoolroom and issues that arise from the teaching process and pedagogical research should be directed to quality classroom teaching. Continuing training should create possibilities for contrasting innovations and facilitate teachers learning from one another, from research findings and innovations. It recommended that national focal points should detect and integrate in the network institutions and research workers engaged in innovative work at the national level and communicate this information to UNESCO for subregional/regional dissemination.

UNESCO support was solicited for:

- Immediate and intensive training – including follow-up - in updating processes, for which backstopping could be provided by the Regional Network
- Collaboration at the national level with various countries for assessment, materials, trainers, teachers and innovations.

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UNESCO Activities in the ASIA-PACIFIC Region

Curriculum Reform in Science and Technology Education

Cambodia and Lao PDR

Two countries, Cambodia and Lao PDR were awarded the Mobile Training Team (MTT) in Science and Technology Education in the Year 2003. This was funded by the Japanese Funds-in-Trust, within the framework of the Asia Pacific Programme of Education Innovation for Development (APEID), Asia and Pacific Regional Bureau for Education, UNESCO Bangkok.

Cambodia and Lao PDR are in different stages of curriculum reforms. Cambodia is undergoing curriculum revision to be implemented in year 2006, Lao PDR is currently implementing a curriculum developed from 1987-2000 and implemented since 1994.

The two countries, Cambodia and Lao PDR indicated their need for capacity-building for curriculum developers, in designing, implementing, and teaching the curriculum especially in science and technology education. With the MTT in Science and Technology Education, key science educators observed developments in Malaysia (Curriculum Development Center and the SMART Schools), the Philippines (National Institute for Science and Mathematics Education Development (NISMED), Primary, Secondary and Non-Formal Education Division Department of Education, SEAMEO-INNOTECH and SEAMEO RECSAM.

On their return to their institutions, the MTT participants organized national training of trainers workshops for a core team of national experts of curriculum developers, teachers and trainers in science and technology. The workshops were organized with the assistance of international resource persons, and had hands-on experiences in analyzing their national curriculum and improvement of teaching-learning practices, with special attention to the design and implementation of relevant and practical materials to facilitate practical skills, creativity and higher-order thinking skills in science and technology education.

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Environmental Education for a Sustainable Society:

Principles and Practices of EE for School Children
UNESCO APEID Seminar, February 2004

The 2004 Asian-Pacific Environmental Education Research Seminar was organized by the Miyagi University of Education, Japan, in collaboration with the UNESCO APEID Seminar Committee. The theme was "EE for a Sustainable Society: Principles and Practices of EE for School Children". The seminar brought together environmental education (EE) specialists/teachers, from different countries: Afghanistan, China, India, Indonesia, Laos PDR, Malaysia, Mongolia, Nepal, New Zealand, Philippines, South Korea, Thailand, Vietnam and UNESCO Bangkok to share experiences on EE activities supporting school education; encouraged information exchange among participants, and shared concrete examples of EE activities linking school and community; organized a roundtable for the joint planning of participating countries and stakeholders in the implementation of the UNESCO biennial plans on EE, and in contributing to the Decade on ESD; strengthened the networking and cooperation on EE for the DESD.

The seminar was organized in an interactive manner through country exchanges, forum presentations at the school and community level involving children, teachers and the community, roundtable discussions and reporting sessions. The participants had the opportunity to share information and experiences, listen to experts, observe school and community activities on EE, plan together EE activities for the celebration of the DESD, and discuss strategies for strengthening networking among EE practitioners and stakeholders for the DESD. The Final Report of the seminar can be obtained from: Prof. Dr. Kazuyuki Mikami, Director of EE Center, Miyagi University of Education, Sendai 980-0845, Japan. (Tel/Fax ++022-214-3300. http://www.miyakyo-u.ac.jp)

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Experts' Meeting on the Arabic Version of the UNESCO Science and Technology Education Kit

Amman, Jordan, 10 – 12 November, 2003

This experts' meeting was jointly organized by UNESCO/Beirut Regional Office and UNESCO/Amman and held in Amman, Jordan.

The overall aim of the meeting was to examine, review and finalize for publication and dissemination in the Arab States, the translation of the UNESCO Science and Technology Education Kit *(v. Connect, vol. xxiv, No.4, 1999)* prepared by UNESCO/Amman and the Jordanian Ministry of Education/Directorate of Curriculum and Textbooks. With this perspective, prior to the meeting the Arabic version was distributed to a group of specialists in the Arab region including some members from the International Network of Governmental Organizations for Science And Technology Education (INGOSTE).

The participants, from Bahrain, Egypt, Lebanon, Jordan, Palestine, Syria and Tunisia, included experts in science & technology education, mathematics education, technical and vocational education, curriculum and text book development, as well as teacher trainers and education inspectors from Ministries of Education.

The specific objectives of the meeting were

1. to review the contents of the educational modules of the kit in the light of the curriculum frameworks in the Arabic region
2. to update some modules in view of recent developments in science and technology, since the original English version had been prepared more than four years before the translation in Arabic
3. to encourage the implementation of the kit in educational programmes in the Arab region.
4. to support UNESCO's efforts in disseminating science and technology publications and increase the number of publications in Arabic in the field of science and technology.

After the introductory sessions and overall explanation of the work schedule, the participants were divided into three working groups who came to the following notable conclusions:

1. The title of the kit would be more adequate as: "UNESCO Resource Kit: Teaching Science and Technology in the 21st Century".
2. The main titles of the modules should be written Arabic and English.
3. The Acknowledgement sections could be eliminated from the body of the modules.
4. It would be more convenient that each module should have separate numbers.

5. Scientific terms appearing for the first time in the text could be put in English as well as Arabic.
6. Contents and dates should be updated.
7. Number of questions in the activities of each modules needed to be reviewed.
8. Measuring units in each module needed to be reviewed.
9. The Alcohol Unit needed to be reformulated to suit the characteristics of the Arab region.
10. The text on twins and cloning needed correction.

The main recommendations to emerge from the meeting were the following:

1. The finalized version of the kit should be disseminated to all Arab countries.
2. Educational stockholders in the Arabic countries should be contacted in order to hold training programmes on the use of the kit.
3. Science and technology educational resources should be developed by Arab experts that include new strategies for teaching methods and assessment methodologies.
4. A bi-annual brochure should be issued by the various UNESCO offices in the Arab region, to present their work in science and technology programmes and activities.
5. UNESCO offices in the region should be encouraged to nominate their representatives in INGOSTE.

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STEE Activites Worldwide

Advancement of Science Knowledge In Language Learning (ASKILL)

A Project on English Language Acquisition through Science Education
U.S.A.

The Advancement of Science Knowledge in Language Learning (ASKILL) project focuses on enhancing English language acquisition at the middle school level by English Language Learners (ELLs) through the study of science, scientific processes in general, and through the use of science kits in particular. The project operates under the auspices of the English as a Second Language Education Program at the University of Colorado at Colorado Springs. ASKILL is in the beginning stages of collecting and analyzing data for ELLs in middle school science to compare with U. S. National Science Foundation standards for students. The data collection will focus on the importance of classroom educational resources, how these resources correlate with effective education practices, and literacy development for the ELL student.

Sharp increases in ELL student enrollment lend importance to the task of improving the achievement of all students, especially those who face the greatest hurdles. Between 1976 and 1996, the percentage of ELLs in U.S. public and private schools increased from 24 to 36 percent. By the year 2010, the number of ELLs is projected to reach 42 percent based on U.S. Census Bureau estimates (1999). The four million ELLs in the United States represent approximately ten percent of the total student population of our public schools (National Center for Educational Statistics, NCES). The project goal is to enhance English language learning through the study of science content and processes.

In the words of the U.S. National Science Education Standards (NSES standard D), "Skilled teachers recognize the minority English learner and organize the classroom so that all students have the opportunity to participate fully." NSES further notes: "Make the available science tools, materials, media, and technological resources accessible to students. A student with rich experience in a topic might need access to additional resources within or outside the school; a student with a different language background might need supporting materials in that language….If policies are enacted without consideration for the resources needed to implement them, schools, teachers, and students are placed in the untenable position of meeting demands without the availability of the requisite resources." The NSES standards validate the purpose of this study. For important changes to occur, quality resources must be coupled with standards and best practices to be implemented in the classroom.

The goal of this investigation is to discover how ELLs rank in relation to NSES standards in science. Once identified, we intend to locate curriculum that provides the most appropriate materials for inquiry-based experiences. Our curriculum will emphasize hands-on, minds-on exploration and activities, processes of critical thinking, and the linguistic adaptation of content for ESL students.

Our technological age demands problem solving skills, increased resources, time, and the ability to interpret scientific data. All students should be able to use scientific processes to understand their environment and world. Middle school education is a transition period for the students as they move from primary to the secondary school

where self-concept is fostered and success is essential. Teachers must engage students in interactive classrooms using varied instructional approaches. The goal for all students should be to immerse them in challenges and for them to enjoy greater levels of success. The achievement gap separating ELLs and non ELLs can be traced to gaps in core content. These differences in achievements occur for numerous reasons, whether they are within school control or outside school control, they affect student achievement.

In some cases teachers enter their own classrooms without the proper resources. As a result, much of the teacher preparation and excitement for best practices for teaching the ELL student is lost. The goal is to increase the overall academic achievement of ELLs by involvement in science inquiry through a pilot program that would develop materials/resource kits for teachers, and by teachers, to produce a resource rich classroom.

The first phase of this pilot project of investigation is the following:

- Conduct a review of the research literature related to teaching science and technology with ESL/Bilingual students
- Develop a profile of currently available science resources that are suitable for ELL students.
- Survey a nationally representative sample of public school science teachers and identify what ESL/Bilingual materials they use in their classrooms, and what is working for them in science and technology.
- Identify science resource needs that are currently unmet.
- List what resource(s) teachers would most like to have in their ESL Science classroom if money and time were not factors.
- Present research results to educational publishers and begin to construct science/technology educational support for teachers.

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The authors look forward to receiving input from readers, reactions and suggestions on ways to implement this work. The web site for your input is: ***http://web.uccs.edu/esl/ASKILL.htm***
As the investigation progresses, the authors will be pleased to share the results with you.

Centres, Networks, Associations,...

Centre for Studies in Science and Mathematics Education

University of Leeds, U.K.

The Centre for Studies in Science and Mathematics Education, the only in Europe dedicated to science education, was formally established on 1 March 1970. It is one of the leading international centres for work in this field. Members of the Centre are drawn form a number of academic departments within the University of Leeds. The Centre is dedicated to the highest standards of scholarly work in the study of science and mathematics education at all levels and to disseminating the outcomes of this work so as to influence policy and practice. Much of the research work of the Centre is undertaken in schools and other educational institutions and most usually practitioners in these institutions are active participants in its work.

The Centre has been involved in a range of research and policy making activity and its capacity to undertake high quality research which influences policy and practice is growing, not least because of its involvement in the National Science Learning Centre. It has maintained and developed its links across the University, notably with science departments, with medicine and with history and philosophy of science, in keeping with its interdisciplinary character. Its work encompasses such diverse fields as curriculum evaluation, discursive practices of the classroom, teacher supply, evidence-informed practice in science education and undergraduate mathematics education. Internationally, the Centre is involved in joint projects with the University of Gothenberg, Sweden; University of Oslo, Norway; Federal University of Minas Gerais, Brazil and Harvard University, USA.

The Centre is excellently placed in relation to a range of influential changes in the science curriculum and research into understanding of the aims and practices of science education. This involvement extends both to carrying forward such work and ensuring that it is subject to careful scholarly examination.

The Centre's influence is felt in areas other than research: the involvement of its staff with Initial Teacher Training is particularly noteworthy. The Centre forms the university base for the training of some 100 secondary science teachers annually and approaching 200 teachers in the primary sector. Many stay in the geographic area and form the basis of a growing partnership with practising teachers.

For further information contact:
Dr Jim Donnelly, Director
Centre for Studies in Science and Mathematics Education
University of Leeds, LS2 9JT
U.K.
http://www.education.leeds.ac.uk/dev t/research/cssme_ScienceEd.htm

The Public Library of Science (PLoS)

The Public Library of Science (PLoS) is a non-profit organization of scientists and physicians committed to making the world's scientific and medical literature a freely available public resource. It was formed in 2000 through a grant form the Gordon and Betty Moore Foundation.

More than 30,000 scientists around the world, including 13 Nobel Prize winners are supporting PLoS. Other reinforcement comes from a new House Bill, the Public Access Science Act (PASA) that would exclude copyright protection on non-classified research substantially funded by the US federal government.

Traditionally, research data are disseminated through for-profit professional journals, which often have prohibitive subscription costs that limit access to a narrow segment of amply funded institutions. Scientific organisations unable to afford them – including many colleges and universities, nonprofit and foreign research facilities – inevitably lag behind elite institutions, restricted by lack of access to cutting-edge research.

PloS' plan is make these publications available through a global network of online libraries of science. Immediate unrestricted access to scientific ideas, methods, results, and conclusions will speed the progress of science and medicine, and will more directly bring the benefits of research to the public. The internet and electronic publishing enable the creation of public libraries of science containing the full text and data of any published research article, available free of charge to anyone, anywhere in the world. One way to make this possible would be to include publishing costs in research budgets, which PLoS estimates would amount to less than 1% of the project total. However PLoS commitment to publishing overrides the ability of authors and institutions to cover the costs, and it has pledged that decisions on whether to publish will never hinge on this.

To realize this potential, a new business model for scientific publishing is required that treats the costs of publication as the final integral step of the funding of a research project. To demonstrate that this publishing model will be successful for the publication of the very best research, PLoS will publish its own journals. *PLoS Biology* launched its first issue on October 13, 2003, in print and online. *PLoS Medicine* will follow in 2004. PLoS is working with scientists, their societies, funding agencies and other publishers to pursue its broader goal of ensuring an open-access home for every published article and to develop tools to make the literature useful to scientists and the public.

For more information go to :
www.PLoS.org

1st European Networks Conference on Sustainability in Practice

1 – 3 April 2004, Berlin, Germany

ENCOS 2004 – the 1st European Networks Conference on Sustainability in Practice focuses particularly on examples of "best practice" in Europe. The conference goal is to obtain an inter- and transdisciplinary understanding on the latest developments in international practice, research and education on sustainability issues. The conference is under the patronage of Jürgen Trittin, Federal Minister for the Environment, Nature Conservation and Reactor Safety in Germany. As the first of a series, the conference offers a communication platform for the various, partly independently operating networks, associations and organisations in Europe. It aims to jointly investigate the possibilities of a long-term cooperation in the form of a meta-network.

Central and Eastern European players as well as interested researchers and practitioners are particularly invited to participate in the conference.

A networks fair, workshops and panels are being organized to present and discuss examples of European "best practice", such as case studies, training programs and research/project papers. The participants will discuss potentials in transferring and managing expertise in Sustainable Development between science, business, politics and society. The following issues will be examined:

1. Modelling and Gaming for Sustainability
2. New Forms of Knowledge Production
3. Communication of Environmental Information
4. Competences for Sustainability Management
5. Education for Sustainability
6. E-Communication and E-Learning for Sustainability
7. EU-Enlargement and Sustainability

ENCOS 2004 is initiated by the European Networks ESSENCE - Network of Environmental Sciences (in cooperation with KMGNE and the interdisciplinary centre Holistic Environmental Protection at the Technical University of Berlin), COPERNICUS-CAMPUS - The University Network for Sustainability, ItdNet - International Transdisciplinarity Net on Case Studies for Sustainable Development, td-net - Network for Transdisciplinarity in

Sciences and Humanities and CIEH - International Certificate of Human Ecology.

Further information from:
www.encos2004.net

Kolleg für Management und Gestaltung nachhaltiger Entwicklung gGmbH
Warschauer Strasse 58 a
10243 Berlin, Germany.
info@encos2004.net
http://www.kmgne.de

or
TU-Berlin, Fakultät III
Interdisziplinäres Projektezentrum
Ganzheitlicher Umweltschutz
ER3 Strasse des 17. Juni 135
10623 Berlin, Germany

Doing it & Telling it

Creating Awareness about Biodiversity Conservation

India

Place: West Bengal – Nadia district and South 24 Parganas district

Target Groups: Students and village community

Introduction: Biodiversity, both agricultural and wild, at the village level is well known in Nadia and South 24 Parganas. But rapid land use changes, intensive agriculture and urbanization are leading to erosion of biodiversity in aquatic and terrestrial habitats.

Objectives:

- To create awareness about the biological resources, their current and potential uses and the need for conservation
- To train students to document biological resources and traditional knowledge in 10 selected villages
- To encourage farmers to save traditional, folk rice varieties, save and exchange seeds and practice organic farming
- To save wetland habitat and reintroduce rare and vulnerable fish species
- To establish a biodiversity resource centre and seed bank.

Resources: Support for the programme was obtained from the Small Grants Project of the Global Environment Facility (GEF/SGP)

Methodology: A seven-day intensive field training programme was organised for 200 students and 10 teachers, i.e. 20 students and one teacher from each village. Village level meetings were organized for 18 months to encourage participants document biodiversity, promote conservation of traditional rice varieties and practice organic farming. This was done in collaboration with one Community Based Organisation in each village cluster (of 5 villages) in the district.

Evaluation: Every four months, an evaluation workshop was conducted at each village cluster.

Results: Increased awareness and weekly field work led to the collection of valuable data on land use, water bodies, agricultural practices, traditional knowledge, collection of folk rice varieties, as well as on observation of plants and animal resources – pests and pollinators, fishes, herpeto-fauna, birds and mammals. This has resulted in 10 People's Biodiversity Registers (PBRs) which will help management of resources and establish rights of the village community over their resources. Two seed banks containing 150 folk rice varieties have been set up as well as Demonstration plots for organic farming. Each village cluster has now one "Biodiversity Resource Centre" with a database, illustrations, herbaria and voucher specimens.

Sent by: *Dr. Asish Ghosh, President, ENDEV – Society for Environment and Development, 329 Jodhpur Park, Calcutta 700 068, India*

*Readers are invited to send us their **FIELD experiences in Science, Technology, Environmental Education activities** involving the teaching/learning process - but not necessarily limited to students and teachers. They should be as brief as possible and set under the following headings:*
Place: Locality where the activity was carried out
Target Groups: For whom the activity was intended
Introduction: Background information - reasons for initiating the activity
Objectives: What was the activity expected to achieve?
Resources: Materials/funds needed for the activity
Methodology: The way in which the activity was carried out
Evaluation: How was the activity judged? By whom?
Results: Did the activity produce any concrete changes in the target group(s)?
Selected experiences will be published with the name and address of the author. Please address your contributions to: ***Doing it and Telling it*** *(address on last page)*

News & Publications

"Scientific understanding of the Earth is a prerequisite for good management and sound decision-making": Koïchiro Matsuura, Director General of UNESCO

At the opening of the UNESCO-IUGS (International Union of Geological Sciences) Information Meeting on "Earth Sciences for Society" at UNESCO Hq, Paris, Director-General Koïchiro Matsuura emphasised the importance of sensitizing UNESCO Member States on advances in the geosciences, including disaster prevention and response.

The new "International Geoscience Programme (IGCP)", formerly the "International Geological Correlation Programme", serves as an international forum for multi-disciplinary geo-environmental research. Stressing that "scientific understanding of the Earth is a prerequisite for good management and sound decision-making," Mr Matsuura drew attention to the tragedy of the Bam earthquake, saying that it provides "a cautionary lesson about the importance of linking the global and the local so that systemic thinking and comprehensive approaches are joined with local responsibilities and specific applications."

Noting that UNESCO is unique within the UN system in having a specific programme on earth sciences and capacity-building in geosphere-related areas, the Director-General said that the IGCP is the 'backbone' of UNESCO's Earth Science work and plays an important role in developing understanding of the Earth as a holistic system. Several thousand scientists from more than 140 countries have been involved in IGCP activities since its launch 32 years ago.

As part of UNESCO's continuing follow-up to the World Summit on Sustainable Development held in Johannesburg 2002, the Director-General recommended that efforts be made to "end the isolation of institutions and researchers, especially in the developing countries" and to "bridge the gap between scientific specializations." He called for "dialogue among disciplines" that would help to heal the divide between different forms of knowledge.

For further information on the IGCP contact: *Wolfgang Eder, Director, Division of Earth Sciences (SC/GEO), UNESCO, 1 rue Miollis, 75732 Paris 15, France. Fax : (33-1)45.68.58.22*
E-mail : W.Eder@unesco.org

To prepare and build momentum for the United Nations Decade of Education for Sustainable Development (2005-2014) adopted by the United Nations General Assembly in December 2002 (resolution 57/254) and for which UNESCO was designated as lead agency for the promotion of the Decade, UNESCO is developing an interactive website.
The DESD website ***(www.unesco.org/education/desd)*** seeks to give visibility to local, national and international Education for Sustainable Development activities, initiatives and events, and to allow for exchange of information and resources. To ensure greater accessibility, this website is now available in English, French and Spanish.

The ***Proceedings of the International Seminar: Implementation of Science Centers and Museums,*** *(Rio de Janeiro, Brazil, 2002)* have been published. They contain papers presented on the 5 main themes of the seminar as well as résumés of the 5 workshops in English and Portuguese. For copies contact: *PADEC, Universidade Federal do Rio de Janeiro, Av. Brigadeiro Trompowski, s/n, Ilha do Governador, Rio de Janeiro, RJ,* Brazil.

Conferences, Workshops, Courses...

(Please also consult "New & Events" on our website: www.unesco.org/education/ste)

The Universities of Liège (Belgium) and Maastricht (Netherlands) have jointly launched a Masters in Business Management (MBA) in Life Sciences. The rationale for this initiative is that "bio-industries" have specificities that need specialized training. The programme consists of four parts: Basic course in business management; Advanced management course oriented to biotechnologies; Specialised course in the selected sector; and Practical work. For more information contact: *D. Schmetz, Centre de recherché en gestion des bio-industries, Université de Liège, Belgium. E-mail :d.schmetz@ulg.ac.be or Sonja Zaar,Graduate School of Internaitonal Management, Universiteit Maastricht, Netherlands. E-mail:s.zaar@gsim.unimaas.nl*

18th International Conference on Chemical Education, Istanbul, Turkey from **3 – 8 August 2004**. Contact: *Prof. Dr Mustafa L. Berkem, Chairman, Marmara University, Ataturk Faculty of Education, TR-81040 Goztepe-Istanbul, Turkey. Fax:+90-2163388060 E-mail:haleb@ttnet.net.tr or icce2004@marmara.edu.tr*

33rd International Symposium IGIP/IEEE/ASEE: ***Local Identity - Global Awareness: Engineering Education Today,*** Fribourg, Switzerland, **27 September – 1 October 2004.** Contact: *EIA-FR, Sigrid Frey, Symposium 2004, Bd de Pérolles 80, CH-1705 Fribourg, Switzerland. Fax:++41-26-429.65.03. E-mail:symposium04@eif.ch http://www.eif.ch/symposium04*

XXVI es Journées Internationales *sur la communication, l'éducation et la culture scientifiques, techniques et industrielles* (26th International Forum on Scientific, Techological and Industrial Communication, Education and Culture.), Chamonix, France, **30 November – 4 December 2004.** Further information from : *D. Raichvarg, UMR STEF, Bât. Cournot, ENS Cachan, 61 Av. Du Président Wilson, F-94235 Cachan, France. FaxL33-1)47.40.24.59 E-mail:Daniel.raichvarg@u-bourgogne.fr*

epiSTEME – 1: International Conference to review research on Science, TEchnology and Mathematics Education, organised by the Homi Bhabha Centre for Science Education, a National Centre of the Tata Institute of Fundamental Research, will be held in Goa, India, **13-17 December 2004.** For further information contact: *Conference epiSTEME-1,Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research, V. N. Purav Marg, Mankhurd, Mumbai 400 088, India. fax: (91-22)-25566803,25585660. email: episteme@hbcse.tifr.res.in http://www.hbcse.tifr.res.in/episteme*

The **13th Conference and Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education (SAARMSTE),** supported financially and technically by UNESCO/Windhoek, will take place in Windhoek, Namibia, from **11 - 15 January 2005.**

Around 400 participants from the SADC (Southern African Development Community) region comprising educators at all levels, ranging from primary schools teachers to universities professors, are expected to attend.
SAARMSTE aims to promote research in mathematics, science and technology education (MSTE) and to foster a sense of community amongst researchers by:
1. Promoting research in MSTE programmes
2. Seeking representation in National policy making bodies
3. Liaising with similar and other MSTE bodies
4. Providing for publications
5. Enabling access to research to policy makers and practitioners
6. Assisting in developing research skills

The Ministry of Higher Education, Vocational Training, Science and Technology will organize the first workshop for the coordination of the stakeholders for the organization of the conference between 8 - 12 March 2004, in Windhoek, Namibia.

Further information from: *Alexandros Makarigakis, Science Assistant Programme Specialist, Windhoek Cluster Office, 5 Brahms Street, West Windhoek, Namibia. tel.: + 264 - 61 - 2917222 fax.: + 264 - 61 – 2917220.*

4th Science Centre World Congress - *Science Centres: Breaking Barriers, Engaging Citizens,* organised by the Museu da Vida – FIOCRUZ, Rio de Janeiro, Brazil, **10-14 April 2005.** For further information contact: *GAUCHE EVENTOS, Av. Rio Branco, 181- gr. 501, 20040-007 Rio de Janeiro RJ Brazil. Tel/fax: + 55 21 2532.2577. E-mail:4scwc@gauche-eventos.com.br http://www.museu-davida.fiocruz.br/4scwc*

Publications

Módulo 1: Desarrollo en armonía con la Naturaleza *(Harmonious Development with Nature) (2003, 102 p.);* ***Módulo 2: Intervención Humano en el Entorno*** (Human intervention in the environment)(2003, 122 p.). The first two of a series of four, these modules for EE teachers of the primary and lower secondary levels have been developed by the Costa Rican Ministry of Education in collaboration with UNESCO´s Science and Technology Education Section. They have been designed specifically for distance learning and deal with the environment in a holistic manner including issues of current interest. Module No. 1 treats EE, Ecology, Biodiversity and Sustainable Development, whereas No. 2 deals with Environmental issues and Water. **Spanish only.** For copies contact: *Ministerio de Educación Publica, División de Desarrollo Curricular, Oficina de Educación ambiental, San José, Costa Rica.*

Enseñar las ciencias experimentales: *didáctica y formación* (Teaching experimental sciences: theory and practice) (2003, 132 p.) by G. Soussan. This publication is the result of over 10 years of research by the author in collaboration with secondary level teachers at the Paris-sud Orsay University, France. It is divided into an analysis of the training process; the bases for pedagogical theory and practice; conceptual networks; methodology; appropriation of theory through concrete situations and presentation of results. Published by UNESCO/OREALC in **Spanish only**. For copies contact: *UNESCO/OREALC, Enrique Del piano 2058, Providencia, Santiago, Chile. E-mail: UNESCO@unesco.cl www.unesco.cl*

Retos y perspectivas de las ciencias naturales en la escuela secundaria *(Natural sciences at secondary level: perspectives and challenges)* (2003, 166 p.) G. Waldegg, A. Barahona, B. Macedo, A. Sánchez (ed.). A publication of the Mexican Secretariat of Public Education (SEP), this book is the fruit of the joint UNESCO/OREALC and SEP meeting on Secondary level Science Education as part of Basic Education: Challenges and Perspectives, Puebla, Mexico, 27-30 June 2001. The authors of the articles included in the book deal with the six major themes of the meeting: basic education curriculum; pre-service teacher training and practice; continuing teacher training; teaching in a technological environment; educational materials and media; and participation of higher education and science institutions. **Spanish only**. For further information contact: *Secretaría de Educación Publica, Argentina 28, Centro, 06020 Mexico D.F.México.*

State of the World 2004 - *Special Focus: The Consumer Society*(2003, 245 p.)This special edition examines how we consume, why we consume and what impact our consumption choices have on the planet and our fellow human beings. Many of the things we buy support destructive industries. But businesses, governments and concerned citizens can harness this same purchasing power to build markets for less-hazardous products. Profusely illustrated with charts, graphs and case studies, it contains chapters on food, water, energy, the politics of consumption and redefining good life. Price US$16.95 (+ s&h). Order from: *Worldwatch Institute, 1776 Massachussetts Avenue, NW, Washington, DC 20036, USA. Fax: 570.320.2079. E-mail: wpub@worldwatch.org http://www.worlwatch.org/pubs/sow/2004/*

Investigación en Educación Matemática *(Research in Mathematics Education)* (2003, 358p.) is the Proceedings of the 7th Symposium of the Sociedad Española de Investigación en Educación Matemática (SEIEM), Granada, Spain, 2003. The book contains presentations of specialists on a variety of aspects of mathematics education as well as those made on the themes of the discussion groups: *Management, quality and evaluation of research in mathematics education; Mathematics education in higher education in Europe; and History of research in Mathematics education.* **Spanish only.** For copies contact: *Departamento de Didáctica de la Matemática, Facultad de Ciencias de la Educación, Universidad de Granada, Granada, Spain. Fax: 958 24 29 46.*

Purchasing Power: *Harnessing institutional procurement for people and the planet*. (2003, 72 p.).This Worldwatch Paper 166, by L. Masny, highlights how forward thinking institutions around the world are changing their purchasing habits to incorporate environmental concerns into all stages of their procurements. Harnessing institutional purchasing may be one of the most powerful tools available for shifting patterns of production and consumption toward sustainability. Price US$5 (+s&h). For copies contact: *(see address above).*

Wisdom of the Trees; Only one Earth; A Jungle in need of a King; A Tale of Two Bags (2004, 40 p. each) by D. Salwi form a set of four books targeting children of 8-13. Written in simple language with a colourful presentation, these story books are meant to make children environment conscious. Through the various facts and figures as well as puzzles and quizzes they mean to amuse and inform children at the same time on specific aspects of the environment. Price: +/- US$.80 each. For copies contact: *Sultan Chand & Sons, 4859/24, Darya Ganj, New Delhi 110 002, India. Fax: 91-011-325.4295 E-mail:scs@del2.vsnl.net.in http://www.sultan-chand.com*

Notions de culture scientifique et technologique: *Concepts de base, percées historiques et conceptions fréquentes* (Elements of Scientific and Technological Culture: Basic concepts, historic breakthroughs and widespread notions). (2001, 480 p., $39,95). This work aims to facilitate the acquisition of basic scientific and technological knowledge - without formulas or equations – in physics, chemistry, astronomy, earth sciences, biology, technology and maths. Its distinguishing feature is that it tries to make science accessible to the non specialist reader, notably by presenting the nature of the scientific/technological activity as well as the historical perspective which permits the reader to understand the reasons for the significant breakthrough marked by certain fundamental laws and theories at the time of their formulation. The author also uses constant comparison between the main scientific and technological concepts and widespread public notions about the same to bring home his point. **French only.** Order from: *Éditions MultiMondes, 930, rue Pouliot, Sainte-Foy (Québec), G1V 3N9 CANADA. Fax: (418) 651-6822 E-mail: multimondes@multim.com*

Inside Science Education Reform (2003, 192 p.) by J.M. Atkin and P. Black, focuses on developments in science education from the end of World War II to the present day. The 7 main themes addressed in this book are:aims and politics; curriculum development; subject-matter boundaries; pedagogy and learning; assessment; educational research and the teaching profession. Each theme is introduced in its historical and philosophical context but so as highlight current issues. Price (p.b.): £22.99 (+ s&h). Order from: *Marketing Dept, Open University Press, McGraw Hill House, Shoppenhangers Road, Maidenhead, Berkshire, SL6 2QL, U.K. E-mail:enquiries@openup.co.uk*

Climate Change and Human Health: *Risks and Responses* (2003, 250 p.) by A.J. McMichael, D.H. Campbell-Lendrum, et al. Like other large natural systems, the global climate system is increasingly subject to pressure from human activities. Since climate has always had an important role to play on human health, global climate change represents a new challenge for humanity. This book describes the context and process of global climate change, its actual or likely impacts on health and how societies and governments should respond with particular focus on the health sector. Price: US$20 (Sw. Fr.14 for developing countries). Order from: *WHO, Marketing and Dissemination, 1211 Geneva 27, Switzerland. Fax:+41-22-791.48.57 E-mail:publications@who.int*

Sipatsi:Cestaria e Geometria na Cultura Tonga de Inhambane (Sipatsi: Basketry and Geometry in the Tonga culture of Inhambane) (2003, 176 p.) by Dr Paulus Gerdes. The book explains how artisans produce beautiful hand bags, called sipatsi in Gitonga, a language spoken in the Mozambican province of Inhambane. The activity of weaving sipatsi is originally a female activity. The book presents a catalogue of decorative strip patterns plaited into the sipatsi, resulting from collecting sipatsi for more than twenty-five years. It also includes suggestions for the mathematical-educational use of sipatsi, varying from the study of composition and symmetries to the study of progressions and pentagons. The book concludes with the presentation of some new phenomena in the production of sipatsi, underlining the geometric-artistic creativity of the basket weavers and the comparison of sipatsi-patterns with some woven strip patterns from other cultures (Northeast of Mozambique, Mexico and Brazil). **Portuguese only**. Price 14€ or US$17.50). For copies contact: *Moçambique Editora, E-mail: rrocha@ME.co.mz ; comercial@ME.co.mz (www.ME.co.mz) or Texto Editora, E-malL: ppegado@textoeditora.pt (www.TE.pt*

Guidelines for the constitution of ecological river networks (Nature and Environment No. 129) (2002, 42p.). The setting-up of the Pan-European Network is one of the main objectives of the Pan-European Biological and Landscape Diversity Strategy. The Pan-European Biological Network is intended to ensure that ecosystems, habitats, populations of species and landscapes of European importance are maintained in a good state of conservation. It aims to restore the biodiversity which is seriously endangered in Europe. Water-courses and the environments associated with them are natural corridors used by both animal species and humans. With their great natural wealth, connecting numerous elements within the corridor, both longitudinally and laterally, they are essential elements in the constitution of the

Pan-European Ecological Network. Price : 8€ / US$12 Available from: *Council of Europe Publishing - 67075 Strasbourg Cedex, France. Fax: +33 (0)3 88 41 27 80* E-mail: *publishing@coe.int http://book.coe.int*

Handbook of Physics (2002, 1181 p.) W. Benenson, J.W. Harris, H. Stocker, H. Lutz (ed.). This book is meant to be a toolbox for rapid access to a wealth of physics information for everyday use in problem solving, homework and examinations. It includes not only the fundamental formulae of physics but also experimental methods used in practice. Compiled by professional scientists, engineers and lecturers, it covers practical physics from classical mechanics to elementary particles, electric circuits to error analysis. Price: 49,95€ (+ VAT, s&h) . Order from: *Springer Customer Service, Haberstr. 7, 69126 Heidelberg, Germany. E-mail: orders@springer.de http://www.springer.de*

The Handbook of Environmental Chemistry, Vol. 2: *Biodegradation and Persistence* (2001, 327 p.) B. Beek (ed). This volume contains the newest results of research in biodegradation and persistence of potential environmentally harmful substances and complex processes involved. The main focus is on the microbial degradation, evolution and predictability of the respective pathways and their impact on bioremediation. Other chapters include sewage treatment plants, impact of toxicants on impaired biodegradation and the need for a more realistic view of the fate and behaviour of chemicals in the environment. Price: 144€ (+ VAT, s&h.). Order from: *Springer Customer Service (address above).*

Recueil sur la renaturation d'espaces (Greening degraded landspaces: Case studies)(2003, 200 p.). This collection of case-studies has been edited by the Conservatoire des Sites Naturels du Nord et du Pas-de-Calais(France) in response to the increasing degradation of natural sites and the flora and fauna dependent on them and the need to address this issue. Over and above the activities of a number of associations related to environment conservation and management, this collection of case studies addresses a new concept that consists of greening landspaces often degraded by human activity thus fostering a source of a rich biodiversity. **French only.** Price: 20€ (+3.50€ s&h). Order from: *Conservatoire des Sites Naturels du Nord et du Pas-de-Calais,4 allée saint-Eloi, 59118 Wambrechies, France.*

ICT and Primary Mathematics (2003, 160 p.) by J. Way; T. Beardon (ed.s).This book provides teachers with insights into how other teachers and researchers have discovered ways to create powerful learning experiences for children. Each chapter helps the reader to understand why certain teaching approaches with technology are more effective than others, as well as providing many practical ideas for activities and projects for children with various ability levels and learning styles. Price: (p.b.) £16.99 (+ s&h). Order from: *Open University (address above).*

Solar Cooker Review is published by the Solar Cookers International (SCI) 2/3 times/year with the purpose of presenting solar cooking information from around the world. SCI is a non-profit organisation assisting communities to use solar energy for cooking and pasteurising water. The Review includes topics such as solar cooker technology, dissemination strategies, educational materials and cultural and social adaptations. Related topics to be covered periodically are women's issues, wood shortages, health, nutrition, air pollution, climatic changes and environment. Reports and commentaries related to solar cooking are welcomed for possible inclusion. It is available online at: *http://solarcooking.org/docs.htm#newsletters.* For paper copies contact: *Solar Cookers International (SCI), 1919 21st Street, Suite 101, Sacramento, California 95814-6827, USA*.

VIEWPOINT

Dear Sir,

Although the concept of sustainability as related to life, development and future, but also tourism, traffic, production, consumption... is well-known to a minority of interested citizens, it is almost unknown to a big majority of less informed citizens. This concept consists, as generally defined, of three pillars: economic, social and environmental. But, to be safe, a chair nevertheless needs four legs or pillars. So, what is the fourth pillar that is not mentioned? Undoubtedly, it is the political, if we are to have an impact.

The political pillar of the concept might be - or better, must be - an important criterion for voters to choose the right, wise and responsible candidates at any election. Thus, voters can expect and demand not only elimination of obstacles, but also understanding, support and encouragement for anybody engaged in promoting sustainability and DESD as a programme for all in the third millennium.

All elected policy makers and decision making authorities - regardless of the kind of political party they belong to - have then a duty to be at the forefront of a common effort. We all want to achieve a better, safer, healthy, clean and well-balanced world free of poverty, conflicts and crises. That is the vital sense and dominant aim of the DESD which must be accepted and introduced globally.

And, allow me finally to recommend the re-introduction of a logo - three triangles within a circle - designed for the World Conservation Strategy originally.

This logo with an explanation of its message would accompany all programmes, activities and attitudes relevant to the DESD everywhere.

With best wishes and sincere greetings,

Yours truly,

Dr.Jan Kleinert, Action group EKOTREND, Chabenecka 7, SK-97411 Banska Bystrica, Slovakia

If you have something concerning STEE to communicate to us - information, suggestions, opinions, ideas - on events or even the articles in Connect, write to us - briefly. The most interesting letter(s) will be published, in substance, with the sender's name. Send your letters to Viewpoint, address below.

International Conference BioEd 2004:

Biological Education, Sustainable Development, Ethics and Citizenship

Rio de Janeiro, Brazil, 13 - 18 September 2004

BioEd 2004, the International Conference on "Biological Education, Sustainable Development, Ethics and Citizenship", will be cosponsored by the International Union of Biological Sciences (IUBS), the Oswaldo Cruz Foundation of Brazil, the International Union of Nutritional Sciences (IUNS), UNESCO and the LDES, University of Geneva. The conference aims to:

- explore linkages among biological sciences, the environment, sustainable development and society;
- promote bio-literacy and biology education reforms that integrate biology, sustainability, health, well-being, ethics and citizenship;
- make recommendations for improving biology education worldwide in support of the UN Decade of Education for Sustainability, adopted for 2005-2015.

Its major objectives are to:

- prepare an agenda for biological education in sustainable development, ethics and citizenship and develop guidelines for its implementation in developed and developing countries;
- involve leaders in science and society in the full range of the educational enterprise, formal and informal, including public education and training;
- address the question of identifying essential knowledge about the environment, sustainability, health and well-being as well as the roles of science and values in education;
- explore and evaluate the diversity of approaches and themes;
- make recommendations on how to develop bio-literacy with special reference to sustainability, ethics and citizenship and disseminate the results of the conference to policy and decision-makers at national and international levels.

Organized in plenary and parallel sessions, there will be poster and educational material exhibits as well as symposia and workshops on:

- Biological education, health and well-being
- Biological education, environment and sustainability
- Biological education, agriculture, nutrition and food security
- Biological education in the modern age of information and communication technologies
- Biological education, ethics and citizenship.

Information and Registration forms can be obtained from: www.iubs.org

www.unige.ch/fapse/SSE/teachers/giordan/LDES.

For further details, please contact: *Faqir Vohra, Secretary-General, CBE-IUBS, <efcie.vohra@wanadoo.fr>*

CONNECT is also available on the Science and Technology Education homepage:
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