

**CASTME – UNESCO – HBCSE**

**SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION  
FOR HUMAN DEVELOPMENT**

**FRAMEWORK FOR ACTION**

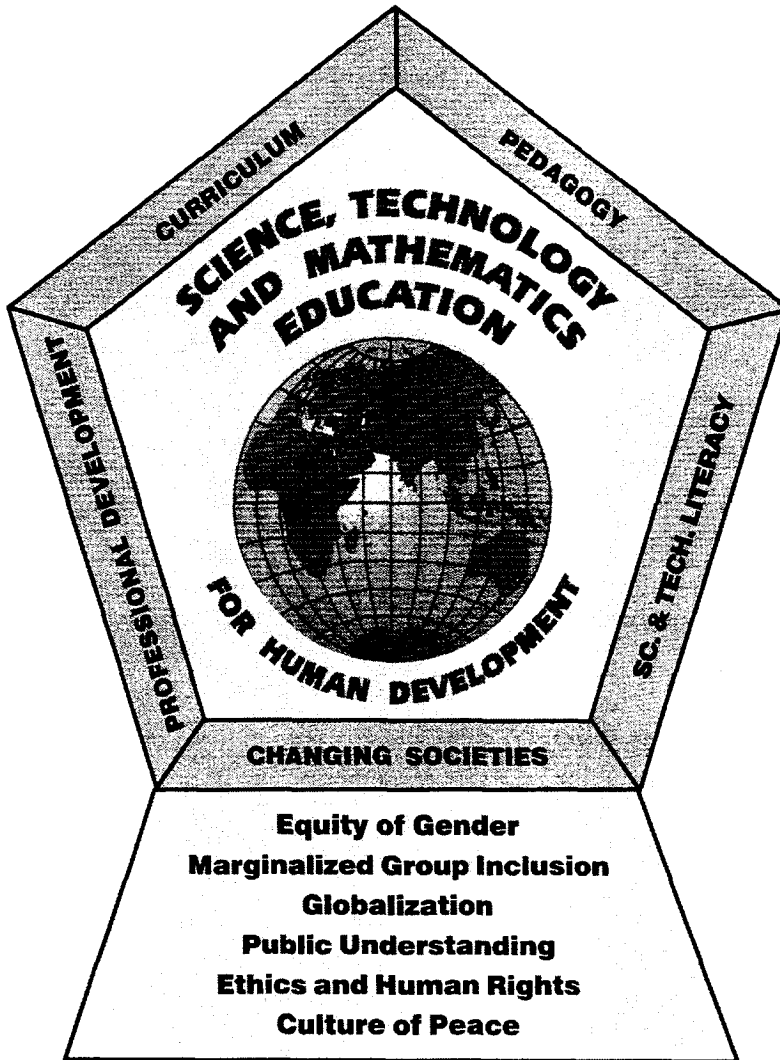
Adopted at

**The International Experts Conference On Science, Technology  
And Mathematics Education For Human Development**

**(Goa, India, 20 – 23 February 2001)**

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## FOREWORD

The start of a new century and a new millennium inevitably encourages considerations of reflection and prediction. For science, technology and mathematics (STM) educators it is a time to consider what has been achieved in the last century and to decide what should be our goals and how we can achieve them in the years ahead.

Three hundred and sixty experts in science, technology and mathematics education from 39 countries met in Goa, India, from 20 -23 February 2001 to review the current status of science, technology and mathematics education (STME) worldwide and to make recommendations for future developments.

The Experts Meeting was convened by the **United Nations Educational, Scientific and Cultural Organisation** (UNESCO) and the **Commonwealth Association of Science, Technology and Mathematics Educators** (CASTME), supported by the partner organisations in *Project 2000+* and organised by the **Homi Bhabha Centre for Science Education** (HBCSE), Tata Institute of Fundamental Research, Mumbai, India. It provided an opportunity for an in-depth analysis of the strengths and weaknesses of STME and to make recommendations to governments as well as local and international non-governmental organisations (NGOs).

The distinctive feature of STME, in its attempts to encourage scientific and technological literacy (STL), is the emphasis on societal needs and the importance of developing an ethos of social responsibility in the development and application of science and technology (S&T).

Advances in S&T continue at an ever-increasing rate. STME is aiming at a moving target. The groundwork for change in STME has been laid in a number of international fora over the past twenty years. Inevitably changes in education are slow to come into effect and lag behind developments in S&T. Capacity to deal with the rapidly changing world of S&T must be a central concern of STME.

## ACKNOWLEDGEMENTS

This international conference was organised jointly by UNESCO, CASTME and HBCSE but other members of the *Project 2000+* consortium played an active part. In particular, the organisers would like to acknowledge the assistance and contributions of **Gender and Science and Technology** (GASAT), **International Council of Associations for Science Education** (ICASE) and the **World Council of Associations for Technology Education** (WOCATE).

# INTERNATIONAL CONFERENCE ON SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION (ICSTME 2001)

This meeting brought together the knowledge and experience of 360 internationally renowned educationists who had as their mission the furtherance of **science, technology and mathematics education for human development**. As shown on the conference logo, the following six major issues gave a societal focus to the meeting and were central to all discussions:

- **Gender equity:** It is recognised that in many societies males and females do not have equal opportunities of access and achievement in education in general and particularly in STME. This is not only a violation of a basic human right but also constitutes a waste of human potential and capital.
- **Inclusion of marginalized groups:** This not only includes minorities within societies, but can be extended to societies and nations, which feel marginalized in the World Order. An important example is the inequality, among countries, of access to the new information technologies, leading to what has been called “the digital divide”. This has major implications for human development.
- **Globalisation:** Advances in communication technologies and developments in inter-continental travel have done much to heighten awareness of living and working conditions in all countries of the world. The consequences of activities in one country may be felt far beyond its borders.
- **Public understanding of science, technology and mathematics:** Unrealistically high expectations of the ability of S&T to solve the world’s problems together with an increasing fear and distrust that it seems to inspire, have greatly increased the importance of developing an STME that provides a realistic representation of the power and potential of STM.
- **Ethics and human rights:** The enormous advances in S&T accomplished by humanity in the past few decades have brought it to the core of all human activity. Increasingly, STM educators are aware that STME provides a platform for issues that extend far beyond narrow subject boundaries.
- **Culture of peace:** Notwithstanding a number of serious conflicts, the past half-century has to a great extent been a time of peace and stability. However, it has become increasingly evident that S&T plays a vital role not only in ensuring equitable development – a major factor in avoiding conflicts – but also in the development and use of arms. STME has thus a major part to play in ensuring that peace and stability are the norm for the 21<sup>st</sup> Century.

The prime concern of this international meeting of experts was bringing about **change in societies**. The role of teachers is to bring about change in students and through them in the wider society. The aim of STM educators is to produce **scientifically and technologically literate** citizens who can more effectively engage with the democratic decision-making process. Nations

have evolved mechanisms and structures for the delivery of the educational process. The knowledge, skills, attitudes and values that are to be passed on are included in the **curriculum**. The methods to be used in the transmission process are defined by the **pedagogy**. However, how something is taught is as important as what is taught. Education is a dynamic process and the effective **professional development** of those entrusted with the education of those who will shape a nation's future is a high priority. This applies to educationists in all sectors of the educational enterprise.

## **RATIONALE**

*There is today an accumulation of discoveries, applications and know-how that constitute an unprecedented source of knowledge, information and power. Never have discoveries and innovations promised a greater increase in material progress than today, but neither has the productive – or destructive – capacity of humankind left unresolved so many uncertainties. The major challenge of the coming century lies in the ground between the power which humankind has at its disposal and the wisdom that it is capable of showing in using it.* (Science for the twenty-first Century – A New Commitment. World Conference on Science, Budapest June/July 1999, p.19, para2.)

## **Challenges for the 21<sup>st</sup> Century**

1. The challenges to STM educators in the 21<sup>st</sup> Century will be to:
  - ensure that there is a sufficient number of qualified people to address the scientific and technological needs of the global society in the 21<sup>st</sup> Century;
  - see that the decision makers in society, and in particular those with political responsibilities, have sufficient scientific, technological and mathematical understanding to make valid decisions on science and technology based issues;
  - aim for a level of education in STME so that all members of society can make sensible decisions and choices in areas of their lives that impinge on scientific discovery and application and ensure that the power bestowed on humankind by S&T is used for the benefit of all and not the few.
  
2. This will involve:
  - broadening of the knowledge base for STME and sensitisation and awareness building of decision and policy makers in STME;
  - developing a greater public awareness and understanding of STM and the need to enhance the popularity of STME at all levels;
  - helping individuals acquire the intellectual skills and attitudes required for their own development through lifelong learning;
  - inculcating the possession of ethical values and a respect for human rights and promoting a culture of peace and tolerance;
  - developing an understanding of globalisation and the need for sustainable development as well as a willingness to acquire the knowledge skills and attitudes required for responsible citizenship;
  - promoting values of equity and empowerment - in particular the need to address issues of gender and marginalisation - so that all can achieve the required level of STME to play their full role within society.

3. STME at both formal and non-formal levels will need to integrate STM into the local culture, emphasising the contribution to open and critical thinking and helping people meet the demands and needs of modern society. In particular, it must seek to meet the needs of those who will not be working in science-based or technology-based careers but for whom grounding in STME is essential if they are to make informed decisions in their lives.
4. In the last decade of the last century, S&T has frequently had bad press leading to a public perception of science and technology out of control. The emotional debate that has surrounded such topics as genetic engineering and nuclear energy has tended to lead to a perception of S&T as a force for ill rather than good. At another level, unduly high and inappropriate expectations of S&T have led to disillusionment and a feeling that when really necessary, S&T cannot supply solutions. There is much work to be done by STM educators to achieve a more informed understanding at all levels- from politicians to the man and woman in the street - about the nature of S&T; the nature of evidence and proof, cause, effect and correlation; and an understanding of the concept of risk. In particular, mathematics has much to offer here.

## BACKGROUND

### Since Jomtien

5. The **World Declaration on Education for All** arising from the international meeting in Jomtien (Thailand, 1990) stressed that sustainable development depends on a scientifically and technologically literate population. Governments and public and private sector interest groups were urged to review educational provision for achieving STL for all.
6. In 1993 UNESCO, in collaboration with a group of international organisations and NGOs convened an international forum to establish a global agenda to encourage governments and all working on reforming science and technology education. The outcome was the setting up of **Project 2000<sup>+</sup>: Scientific and Technological Literacy for All**. Significantly, the 1993 Declaration recommended that by the year 2001, there should be in place appropriate structures and activities to foster STL for all in all countries.
7. The World Conference on Science for the 21st Century: a New Commitment held in Budapest, Hungary in July 1999, negotiated a new social contract for science in the 21st Century establishing what efforts needed to be made in response to social expectations and the challenges posed by human and social development.

The new commitment identified a number of central issues including:

*“The need to improve, strengthen and diversify science education, formal and non-formal, at all levels and for all sectors, and to integrate science into the general culture, emphasising its contribution to the formation of open and critical thinking as well as to the improvement of people’s ability to meet the challenges of modern society. (...) Any discriminatory barrier operating against equitable participation in science must be removed, and positive efforts are needed to fully integrate women into the sciences.”*

The renewal, expansion and diversification of science education for all are seen as a core essential for the participation of the individual in the society of the 21<sup>st</sup> century.

8. The **Dakar World Forum, 2000** regretted that in spite of all the initiatives taken in the framework of Education for All much remained to be done, notably in improving literacy and gender imbalances and that it was essential for all countries to take urgent action in this respect.

## CONFERENCE AIMS

9. The aims of this **International Experts Conference on STME for Human Development** were:

- to provide a forum for the exchange of ideas on the role of STME in human development;
- to review the achievements of *Project 2000*<sup>+</sup> and to provide direction for future action;
- to identify new strategies for narrowing the gap between developed and developing nations in the field of STME;
- to explore ways in which the new technologies - and in particular information and communication technologies - can be used to extend the reach of STME
- to enhance co-operation among the consortium of international organisations working to achieve STL for all;
- to promote the access and participation of girls and women in science, technology and mathematics based careers;
- to adopt a conference statement and framework for action.

10. In order to facilitate discussion and provide adequate time for in-depth discussion of major concerns and issues, the Conference was organised around six strands:

- The need for effective curriculum reform and changes in assessment practices
- The introduction of more appropriate classroom and out-of-school practices and the utilisation of more effective technology
- The need for coherent and effective systems of professional development for STM educators
- The empowerment of women and the inclusion of marginalised groups within the community
- A clearer articulation of what it means to be scientifically and technologically literate and how practices to achieve STL can be evaluated
- What the STME community can learn from research in STME and STL

## **SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION IN CONTEXT**

### **Sustainability, equity and investment**

- 11.** Sustainable development depends on a scientifically and technologically literate population.
- 12.** High quality STME is a strategic necessity to provide for the basic needs of the population. People must learn to solve specific problems and to address the needs of society by utilising scientific, technological and mathematical knowledge and skills.
- 13.** Although there is equal access to STME in many countries, there are however gender imbalances in enrolment and achievement. Any gender discriminatory barriers operating against equitable participation and achievement of boys and girls in STME must be removed to fully integrate women into S&T. Current curriculum, pedagogic practices and classroom organisations must be reviewed to identify any discriminatory practices and steps taken to rectify them.
- 14.** The continuing under-investment and lack of focused policies and follow-up activities are causing shortage of teachers and teaching materials.
- 15.** Access to science and technology education, which contributes to peace and human development, is the right of every child from early age.

### **Science, technology and mathematics education in the 21<sup>st</sup> Century**

- 16.** There is a need to improve, strengthen and diversify science education, formal and non-formal, at all levels and for all sectors and to integrate science into the general culture, emphasising its contribution to the formation of open and critical thinking as well as to the improvement of people's ability to meet the challenges of modern society.
- 17.** STME should build bridges with traditional knowledge systems (especially the large part of traditional knowledge possessed by women) and facilitate the flow of knowledge to and from rural communities
- 18.** Mathematics occupies a central place in children's learning. Mathematics is not just a collection of skills; it is a way of thinking. It lies at the core of scientific understanding and of rational and logical argument. An understanding of mathematics is a pre-requisite for being an active participant in modern society.
- 19.** Science and technology are inextricably linked: technology is not merely applied science. Technology is the human capacity for action. It is the cultural response to problems and opportunities, which affect the way we work and live.
- 20.** The current science curriculum retains its past, mid-twentieth century emphasis, presenting science as a body of knowledge which is value-free, objective and detached – a succession of “facts” to be learnt, with insufficient indication of any overarching coherence. Most current science curricula are an inadequate preparation for the citizens of the 21<sup>st</sup> Century.

## **Curriculum reform and professional development**

- 21.** Curriculum reform is frequently seen as a mechanism for improving the quality of education and there have been many changes in STME. However changes in curricula are not enough. They must be accompanied by changes in delivery, through changes in teaching practice and improvement in teaching and learning resources.
- 22.** Curriculum reform must be accompanied by corresponding changes in assessment procedures. Most educational systems are assessment driven and assessment procedures and practices can either support curriculum renovation or undermine it. Good assessment practices can substantially improve teaching.
- 23.** Many STM teachers and other professionals involved in formal and non-formal education do not have access to regular professional development programmes. Changes in curricula and assessment practices will fail if teachers are not equipped to take those changes forward. Improving professional practice is a long-term process. Professional development must be seen as an extended process with teachers, teacher trainers, inspectors and other key members of the education enterprise given the opportunity to update their skills and knowledge. There are many strategies for professional development but the most effective tend to give the recipients a large measure of responsibility for their own progress and a sense of ownership of the process.
- 24.** Current science teaching does not empower people to understand and respond critically to media reports with a science component and to hold and express a personal point of view on issues with a science component that enter the arena of public debate.
- 25.** The information and communication revolution offers new challenges and opportunities for advancing scientific, technological and mathematical knowledge and education. They offer new directions, methodologies and scenarios for STME.
- 26.** Increasingly, education is being seen as a life-long process. There will be a need within an educational system for individuals to update their knowledge and acquire new skills. This is particularly the case in STME where change and advance is rapid. Access to Information and Communication Technologies (ICTs) opens up enhanced possibilities for lifelong learning and leisure. Individuals and societies without access to appropriate technologies, and in particular ICTs, will become increasingly marginalised.
- 27.** STME can contribute to peace and coexistence and conflict resolution by including teaching of subjects like energy, pollution, environment, water and use of resources that are potential cause of conflicts.
- 28.** STM can contribute to human rights and human dignity in accordance with the Universal Declaration of Human Rights.

## **SOME POLICY GUIDELINES**

### **Science, technology and mathematics education as a core requirement**

- 29.** Science, technology and mathematics (STM) need to be made core subjects at school level for all. For this they need to:
  - meet the needs of all students as future citizens;
  - enable students to make appropriate career choices;
  - appropriate learning for possible future studies in STM.
- 30.** Promoting STME relevant to the cultural environment through STME must be a major priority, where relevance in the teaching approach is viewed from a society's or students' point of view so as to increase public awareness and understanding. Such an approach means giving a wide interpretation of STME in keeping with the goals of education, as a whole, and involving students in participatory teaching activities.
- 31.** STM courses must be based on societal needs, both for the present and the perceived future. STM courses need to be made more popular among students, both girls and boys. For this, STME requires more relevant curricula that cover a full range of goals and lead to greater awareness of the role played by STM in everyday life.
- 32.** The level of complexity of STM is expected to increase for students undertaking further studies and for pursuing professional or skilled employment - not only to function within their careers, but also to enable such persons to play their expected roles within the society.
- 33.** Developing curricula to enable STME to play its role in educating students is a professional skill and many teachers need careful guidance. Forming strong links among curriculum developers, teacher educators and teachers is important at local, national and international levels. International organisations such as UNESCO have a major part to play, working alongside national governments, as well as local and international NGOs.
- 34.** Valid assessment strategies for STME must cover intellectual, personal, communicative and social skills. It is not sufficient to assess content knowledge alone. Attention needs to be given to the assessment of skills in scientific method and social skills, especially those related to problem solving and decision-making.

### **Active learning and student focussed teaching**

- 35.** Teaching approaches must reflect that students:
  - are the focus of classroom activity, helping to define content and activities;
  - are active inquirers involved in resolution of real life problems;
  - are actively involved in their own learning and are encouraged to develop their own meaning for their SMT experiences. Their learning should be judged by what they can do and how they can use information and skills in new contexts.

### **Continuing support for teachers**

36. Distance learning procedures can play a major role in STME. Greater learning opportunities through distance learning need to be developed and utilized by teachers.
37. There is a need for greater recognition that STM teachers are expected to receive ongoing professional support. The professional development of teachers must cover the full range of educational goals. The professional development of teachers is expected to address the integration of the full range of educational goals.
38. It must be recognised that interacting with others in professional subject associations, with practising professionals in the community and an involvement in national and international gatherings such as this conference, are all important sources of professional development.

### **Values, human rights and equity**

39. STM curricula must be constructed so as to promote equity for all and be presented in a manner relevant to both boys and girls. They should focus on knowledge, skills and attitudes appropriate to the needs of both boys and girls.
40. Values education needs to be included as an important component of STME for all. A consideration of ethics and social responsibility must be a part of STM teaching alongside economic, environmental, and political considerations. Teachers should be encouraged to ensure that ethics, human rights and a culture of peace are integral components of their STME teaching with relevant student-centred activities undertaken to promote the ethical issues and values involved with STM in local, national and global arenas.

# A FRAMEWORK FOR ACTION

## Preamble

The following major recommendations – together with associated illustrative actions – were submitted, discussed and agreed upon at the final session of the International Conference on Science, Technology and Mathematics Education for Human Development held in Goa, India from 19 to 23 February 2001, under the auspices of CASTME, UNESCO and the HBCSE.

*(Bulleted points represent typical actions to be taken to address the priority goals. These points are illustrative only. Many others exist for implementation at international, regional, national and local levels.)*

## RECOMMENDATIONS FOR PRIORITY GOALS TO BE ADDRESSED

### **There is a need for policies and guidelines.**

1. The extent to which educators, policy makers, and the public recognize that scientific, technological, and mathematical literacy encompasses the intellectual, personal, social and economic development of the individual should be increased and should be the primary aim of STME.
  - Governments should develop appropriate and context specific policies and guidelines for the development of STME at the formal and non-formal levels of education,
  - Governments should prepare STM trainers to run workshops for teachers of STM on the conceptualization and operationalizing of scientific, technological and mathematical literacy (STML) for all through the development of locally appropriate teaching materials,
  - Governments should work systematically to stimulate teachers to continually evaluate their own performance in terms of their students' learning.

### **Ethical and social issues are the concern of STME.**

2. Ethical values, social issues, health issues, human rights issues and concern for the quality of life and social responsibility should permeate STME.
  - Cooperation between governments, relevant NGOs and training institutions should be developed to conduct periodical revision of the curricula for the training of STM educators in order to develop their skills in relating each topic they teach to relevant issues in society.
  - In cooperation with relevant NGOs, governments should make efforts locally, nationally and internationally to collect and disseminate good practices in STME that incorporate ethical values, social issues, ecological issues, health issues, human rights issues, concern for the quality of life and social responsibility.
  - Governments and training institutions should see to it that STME courses and materials should be oriented towards and have a central role in the understanding of sustainable development.

### **STME must be more relevant to the needs of the learners.**

3. STME should be made more relevant to the needs, interests, and aspirations of the students and their society.
  - Governments and relevant NGOs should stimulate local STM educators to explore the link between STME and indigenous culture and the results forwarded to the STME Network Mechanism.
  - Training institutions should organize workshops regionally and nationally, to produce teaching modules to illustrate the relevance of STME to local environments and societies.
  - Specialized institutions should conduct research at local and national levels to identify the core needs, interests and aspirations that STM education needs to satisfy.
  - Governments and relevant NGOs should stimulate STM teachers to prepare, use and evaluate their own teaching materials based on community issues relevant to the students.
  - At the local level, governments should support STM educators to enable participation by media, industry and social agency representatives in the learning activities.

### **Assessment must be valid.**

4. Valid assessment of STME, as an integral part of teaching, should address the full range of learning outcomes, including cognitive, affective and sensori-motor skills.
  - Governments and specialized institutions should conduct workshops at regional and national levels to develop assessment procedures that cover the full range of STM learning outcomes.
  - UNESCO and governments should ensure that assessment instruments be shared with other regions through the STME network mechanisms.
  - Appropriate technology should be used in the assessment process.
  - Governments and specialized institutions must ensure that assessment will not be biased in terms of race, gender or class.

### **Accountability demands effective monitoring systems.**

5. Continuing STME accountability and monitoring systems should be developed and implemented as a vehicle for quality improvement.
  - UNESCO should promote a continuous evaluation of STME performance in its Member States.
  - UNESCO, in association with relevant NGOs, should conduct an audit to ascertain the extent to which the structure and activities recommended for STME are in place
  - Governments should regularly collect and publish data relevant to the implementation and effectiveness of STME at the national level.

### **STME must promote equity and inclusion.**

6. Every person, including those from the minorities and disadvantaged groups, should have an opportunity to participate in, and benefit from, the full range of STME. Whilst recognising the complexities involved, STME should be seen to promote equity by ensuring inclusiveness across, but not limited to, gender, disability, class, ethnicity, cultures, and sexual orientation.
  - Local NGOs should organize STME awareness activities at school and community levels for the participation of minorities and disadvantaged groups, including out-of-school youths, dropouts and citizens of all ages.

- Governments and NGOs should collect data indicative of inclusiveness in STME and review their policies to ensure promotion of inclusiveness.
- During the next five years, national and local governments should conduct workshops that promote a broad range of equity.
- In cooperation with specialized institutions and NGOs, governments should see to it that research conducted into the content of STM teaching materials to ensure that they reflect a broad inclusive approach and equitable portrayal of all facets of society.
- Textbooks should be seen to be equitable.

### **Diversity of effective practice is to be welcomed.**

7. Recognition and valuing of the diversity of effective practices for STME should be increased.
  - In cooperation with training institutions, governments should take necessary actions to ensure that teacher training and continuing professional development are adapted to encourage teachers to use, accept and reward a multiplicity of practices that lead to desired learning outcomes, rather than rigidly adhering to a restricted range of teaching and learning modalities.
  - NGOs and specialized institutions should develop informal mechanisms for developing STME in order to supplement formal education.
  - Governments should develop strategies to implement education systems that encourage innovation and experimentation in STME.
  - Distance education institutions should take a lead in diversifying STME practices through their delivery systems.

### **STM educators need to feel valued by society.**

8. All societies should have the opportunity and should be encouraged to value the role of STM educators thereby increasing their motivation and creating an optimum learning environment for students.
  - Governments should establish support systems to help motivate and facilitate the work of STM teachers.
  - In cooperation with relevant NGOs, UNESCO should establish working groups of STM educators in each region to work with the public, media and other agencies towards clearer understanding of the positive impact of STM.
  - Governments should collaborate with UNESCO to produce and disseminate through all available channels and media, materials that explain and promote the value of education in STM.
  - UNESCO should seek to increase the allocation of its human and financial resources for STME as a priority.

### **Effective professional development programmes should be a major government priority.**

9. A coherent system of appropriate, effective, and progressive professional development for all STM educators should be established.
  - Governments should establish a programme to work with professional STME associations with the objective of strengthening their systems to enable them to work with teachers on effective development programmes.

- Governments should acknowledge the lack of well-qualified teachers and should establish a programme to work with professional STME associations in order to promote effective professional development through such approaches as action research.
- STME teachers should more actively implement their own personal development programmes.
- Governments should prioritise their policy to attract talented teachers, including female teachers, and retain them through attractive packages of conditions, salaries and career development proposals.
- Teachers should be encouraged to work in a supportive way with each other, where possible, through professional associations.
- Governments should see to it that the areas of curriculum development, assessment and teacher education are harmonised.

**Mechanisms are needed for the sharing of information about effective practice.**

10. Networking at all levels (local, regional and international) should be further developed and strengthened to encourage the sharing of effective practices in STME.
  - UNESCO in association with relevant NGOs should set up a clearinghouse for the dissemination of effective STME practice at different levels.
  - At the regional and national levels, relevant NGOs should hold meetings and conferences to share information on effective practices in STME. Examples of such practices should be submitted to UNESCO and international NGOs for inclusion in their STME network mechanisms. At the international level, UNESCO and relevant NGOs should develop their web sites to include examples of STME.
  - STME NGOs should develop criteria by which effective STME practices can be recognized.

**Research into effective practice must be encouraged.**

11. The extent to which STME engages in, and utilizes research for strengthening its curriculum, practice, equity, policy and assessment should be increased
  - Governments should promote action research at local level.
  - Governments should establish a policy for the revision (or renewal) of curricula every three years.
  - Professional associations in STME should escalate their research efforts and contribute the findings to the UNESCO STME Network.
  - Commercial organisations, donor agencies, and the mass media should be involved in the development and strengthening of effective STME courses.

**NOTE**

*The extent to which these recommendations are implemented should be monitored by the sponsoring organisations of the Conference and their partners through follow-up meetings, at regional and national level, over the next five years. However, it must be appreciated that the reality of life, especially in developing countries, presents many constraints that limit appropriate actions at the upstream levels. At the downstream level, notably in the classroom, class size and resources for teaching STME courses are constant problems for teachers and therefore, these teachers need time and support to work on and develop the ideas in many of these recommendations. Moreover, teachers (and students) need to work collaboratively rather than in isolation.*

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