

COMMONWEALTH EDUCATION BRIEFING NOTES

Prepared by the Commonwealth Consortium for Education

A grouping of voluntary and professional bodies committed to education development in the Commonwealth

No 9 SCIENCE TECHNOLOGY AND MATHEMATICS EDUCATION IN THE COMMONWEALTH

Introduction

Science and technology are universally important factors for development and economic growth. Science, technology and mathematics education (STME) is also universal in the sense that the underlying principles of science, technology and mathematics are the same throughout the world, even though the social context and local relevance may vary.

The teaching of STM at basic levels is important for every child. The local environment should be a starting point for such teaching. No sophisticated equipment or apparatus is required, but teachers need adequate initial training and, as necessary, in-service training. This is where access to quality education is so important.

The Commonwealth Secretariat has initiated many programmes over the years to assist the development of STME mainly in the field of supply and training of science teachers. Over much of the period since the Secretariat was founded there have been specialist officers for STME on the staff, but a combination of staff cuts and the present focus on other areas of education have caused the excision of these positions. A similar fate has caused the demise of the Commonwealth Science Council which, although mainly focusing on the higher levels of science and science education did have some impact from time to time on the STME scene in Commonwealth countries.

The Secretariat organised the original significant conferences on science and mathematics education as long ago as 1963 (Peradeniya, Sri Lanka for science), 1966 (Huddersfield UK for technical education) and 1968 (Trinidad and Tobago for mathematics).

The Secretariat, in collaboration with CASTME (see below), also arranged a number of specialist regional meetings on gender and STME and, in collaboration with the British Council, the use of locally available materials for science equipment. At

Box 1: 53 Member States of the Commonwealth

Antigua/Barbuda	Ca	1981	Mozambique	Af	1995
Australia	Pa	1931	Namibia	Af	1990
Bahamas	Ca	1973	Nauru	Pa	1968
Bangladesh	As	1972	New Zealand	Pa	1931
Barbados	Ca	1966	Nigeria	Af	1960
Belize	Ca	1981	Pakistan	As	1947
Botswana	Af	1966	Papua New Guinea	Pa	1975
Brunei Darussalam	As	1984	St. Kitts Nevis	Ca	1983
Cameroon	Af	1995	St. Lucia	Ca	1979
Canada	Ca	1931	St. Vincent	Ca	1979
Cyprus	Eu	1961	Samoa	Pa	1970
Dominica	Ca	1978	Seychelles	Af	1976
Fiji	Pa	1970	Sierra Leone	Af	1961
Gambia	Af	1965	Singapore	As	1965
Ghana	Af	1957	Solomon Is.	Pa	1978
Grenada	Ca	1974	South Africa	Af	1931
Guyana	Ca	1966	Sri Lanka	As	1948
India	As	1947	Swaziland	Af	1968
Jamaica	Ca	1962	Tanzania	Af	1961
Kenya	Af	1963	Tonga	Pa	1970
Kiribati	Pa	1979	Trinidad/Tobago	Ca	1962
Lesotho	Af	1966	Tuvalu	Pa	1978
Malawi	Af	1964	Uganda	Af	1962
Maldives	As	1982	United Kingdom	Eu	-
Malaysia	As	1957	Vanuatu	Pa	1980
Malta	Eu	1964	Zambia	Af	1964
Mauritius	Af	1968			

Af — Africa (18) As — Asia (8) Eu — Europe (3)
Pa — Pacific (11) Ca — Canada/Caribbean (13)

one time in the 1970s there were a number of specialist officers of the British Council in African, (13) Asian and Caribbean countries appointed under a scheme (Aid to the Commonwealth Teaching of Science – ACTS) financed by the British Government's Overseas Development Administration (ODA) to assist in the development of new curricula and assessment in STME. The Commonwealth Fund for Technical Cooperation (CFTC) was utilised to support the training of local leaders in these fields. The wave of curriculum development projects, including integrated science for junior secondary schools and the establishment of indigenous science and mathematics teachers' associations, were part of the Commonwealth

Secretariat's activities in the last decades of the 20th century, often in collaboration with other international agencies or organisations, including UNESCO.

As a result of these initiatives several Commonwealth countries have introduced new approaches to STME but many require more help. Students all over the world respond well to the teaching of socially-relevant STM, but teachers need assistance with specifically-focused courses. This is how ministries of education throughout the Commonwealth (see Box 1 for a list of Commonwealth countries) can provide support through a network for sharing of best practices in curricula and assessment.

The Problem

The declining quality of STME at the basic education level is a cause for concern in several regions of the Commonwealth. In many countries, STM teachers have received little or no training. An estimated 80% of science teachers in some countries are either unqualified or under-qualified. To break this 'cycle of mediocrity' requires intervention that acknowledges the deficiencies of existing teacher education programmes. It must be recognised that many STM teachers at this level find it very difficult to translate the STM content into suitable learning experiences for the students. Moreover, given a fixed curriculum in many countries, teachers find it difficult to make STM teaching relevant and interesting, especially to girls, since little is drawn in terms of learning experiences from the everyday lives of the students. So, poor quality of STM teaching at the basic level is a major barrier to the popularisation of STM and to the recognition of STM as part of local culture and indigenous technologies.

Gender and Science Technology and Mathematics Education

Various studies have indicated poor enrolment and achievement of girls in STM courses in many Commonwealth countries. (Table 1 gives some general figures for girls' enrolment in Africa: the proportion taking STM courses is much lower).

This issue was raised at the 13th Conference of Commonwealth Ministers of Education Conference in 1997 in Botswana and recommendations were made. Since then, many countries claim to have integrated gender issues into their STM curricula. Experience shows, however, that in most cases a "window dressing" treatment has been given by including female faces in illustrations and by replacing 'he' with 'he/she' in the text. Very little effort has been made to draw content from the lives

of girls or relating it to their lives. Women in developing countries are a repository of indigenous technologies because of the nature of the activities in which they are traditionally involved. This knowledge possessed by women should be used to relate local learning experiences to science and technology in the school curricula.

Table1 Females as percentage of males in primary and secondary schools in selected African countries 2004

Country	Primary	Secondary
Cameroon	85	70
Kenya	94	93
Lesotho	100	127
Malawi	102	81
Mozambique	83	70
Nigeria	85	81
Tanzania	96	n.a
Uganda	100	79
Zambia	96	79

Source: UNESCO Institute for Statistics. Global Education Digest 2006, Tables 3 and 5.

There are, however, some encouraging signs. In Ghana, for example, the Government has adopted the Science and Technology Clinic for Girls programme aimed at giving girls more access to science and technology education and targeted at girls in secondary schools. In Botswana, also, there is a Science and Technology Roadshow for Girls. Both these initiatives were launched in collaboration with the Commonwealth Secretariat and non-government organisations such as GASAT (Gender in Science and Technology).

Science education and development education

Globalisation impacts upon people of all ages and backgrounds but it can be interpreted in many different ways. It may just refer to the economics of the market place and to international communications. But it may be about something more fundamental linked to social and political changes in the world. If STM education is to be relevant to all, then global perspectives need to be at the heart of STM teaching. This is increasingly being recognised by governments and a range of initiatives and projects have been developed by non-government organisations (NGOs) and professional bodies demonstrating how to integrate the global dimension into STM lesson plans.

Development education may not be a well-known term to the majority of STM teachers; those who are aware of it have probably linked it to geography and possibly now to citizenship education. Yet, no study of STM can ignore the implications of STM

education for people around the world, whether it is climate change, water and diseases, genetically modified food, nutrition and diet, food and farming, pandemics (e.g. the threat of bird flu) or HIV/AIDS.

STM education without a global perspective will prevent young people from seeing the full social relevance of STM and give a very narrow and parochial view of the subjects.

Partnerships and Links across the Commonwealth

Because science, technology and mathematics are universal subjects with curriculum content that is similar in many countries, one potentially valuable way of using STME for development and for meeting the Millennium Development Goals is to establish links and partnerships among individual schools throughout the Commonwealth. Several such links have been established on a north-south, as well as south-south and north-north, basis.

One such project is *Science across the World* which is an international education programme developed and managed by the Association for Science Education (ASE) in the UK in partnership with an industrial sponsor. It aims to link individual schools worldwide with each other directly. Box 2 shows how *Science across the World* works:

Box 2. How Science across the World Works

1. Join the project through www.scienceacross.org
2. Go to 'My Zone' to register e-mail addresses, passwords, receive exchange forms
3. Choose and sign up a chosen topic
4. Study the topic
5. Complete the exchange form
6. Select schools to exchange with
7. Carry out the exchange
8. Discuss and report findings.

Students normally work through the pages of their topic in small groups. There are always some activities in the form of research or enquiry as well as traditional practical work – but with a minimum of specialist equipment. There is always discussion and debate after the activities have been completed.

A list of topics currently available is given in Box 3.

The website and topics are in six languages – English, French, German, Italian, Portuguese and Spanish. Some topics are also in additional European languages and in Japanese. This aspect has been shown to be of considerable value in language teaching especially in those schools working in a bilingual context. Foreign language

teachers are working with colleagues teaching science.

Box 3: Science across the World: list of topics by age range

Topic	Age Range					
	8	10	12	14	16	18
Acid Rain			xxxxxxx			
Biodiversity			xxxxx			
Chemistry in Life			xxxxxxx			
Wetlands			xxxxxxx			
Domestic waste			xxxxxxx			
Drinking water			xxxxx			
Dwellings			xxxxx			
Eating/drinking	xxxxxxx					
Global warming				xxxxxxx		
Keeping healthy			xxxxx			
Plants in life			xxxxx			
Renewable energy	xxxxxxxxxxxxx					
Road safety			xxxxxxxxx			
Genetics			xxxxxxx			
Tropical forests			xxxxxxx			
What do you eat			xxxxxx			

The impact of Science Technology and Mathematics Education on peace, poverty, citizenship, health.

There are strong arguments for increasing the direct and indirect impact of Science, Technology and Mathematics education on peace, poverty, health and citizenship. There have been pilot workshops covering all of these issues, organised by CASTME Africa.

The outstanding outcome was the confirmation of the need to adopt a strategic approach across the Commonwealth, enabling pupils, schools, cities and states to benefit from better informed citizens who understand their responsibilities and are more able to use science in particular for the benefits of local societies and communities.

Workshops, organised by CASTME (see below) on behalf of the Consortium, in January 2005 as a follow-up to the 15th CCEM highlighted the problems of education in difficult circumstances and the impact of HIV/AIDS on education. The role of relevant STME in both these areas of concern was identified.

CASTME recommends that all those involved in the formulation of educational policy undertake a review of:

- where these vital areas are being met within education
- where there are gaps

- what training would enable teachers to integrate these areas into the existing curriculum.

Commonwealth Association for Science, Technology and Mathematics Educators

The Commonwealth Association for Science, Technology and Mathematics Educators (CASTME) was established in 1974 as a non-government organisation recognised by the Commonwealth Secretariat. It now has members throughout the Commonwealth and has regional branches in Africa, Asia and Europe.

The aims of CASTME are to share best practices in STME and to demonstrate the relevance of STM to local environments as well as the relationship between science, technology and mathematics especially at school level.

The Commonwealth Association of Science Technology and Mathematics Educators (CASTME) mission in the Commonwealth is to promote the teaching of STM in a social and locally relevant context and to ensure that access to such teaching is universally available. Some modest progress has been made in this direction through, for example, the preparation of basic teaching aids and guides for teachers and parents in a very few selected areas of West Africa on the subject of HIV/AIDS.

From the very beginning of CASTME it has offered annual awards for STM teachers who submit an account of a project or activity carried out in their own local environment related to local social or environmental issues. These awards are now well-established and prestigious. The professional assessment of the entries is carried out by CASTME. The Awards are supported, in part, by grants from the Commonwealth Foundation, as indeed is most of CASTME's work.

Also, CASTME has arranged triennial conferences, usually on a regional basis, to bring together local teachers and educators to discuss topical and local issues in STME. The reports of such conferences and the winning CASTME Awards entries are published in the CASTME Journal, which is sent three times a year to all individual members of CASTME and to libraries and educational institutional members of CASTME. One such conference held in Barbados gave rise to a major regional three-year project – supported financially by the Commonwealth Foundation – on the training of technicians for education establishments by satellite and correspondence courses. This project was linked to the University of the West Indies Distance Education Programme (UWIDITE), which is one of many fine examples of distance education

stimulated and supported by the Commonwealth of Learning (COL).

Information about CASTME, including its current activities and projects, some of which are described above, may be found at the CASTME website <www.castme.org>.

Conclusion

Although there are major problems facing STME in the Commonwealth, there are many signs of optimism especially in developing a Commonwealth perspective in STME. The traditions of common syllabuses and assessment techniques; the tackling of common problems such as teacher education, with the use of ICT wherever possible, and approaches to gender issues; and the sharing of ideas through partnerships and linking schemes – all these present challenges which the STME community with support from the Secretariat, the Foundation and COL, may be able to meet in the years ahead.

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or CCEM website: www.16CCEM.com

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