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Metadata Record: https://dspace.lboro.ac.uk/2134/3394

Publisher: © DATA

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Scientific and Technological Literacy and UNESCO Project 2000+ : An Agenda for Curriculum and Professional Development in Nigeria

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Keywords:
Curriculum
Technological literacy
ICASE
UNESCO
Nigeria Primary

Abstract
This paper explores some of the issues facing both teacher and curriculum development and delivery in an environment of considerable poverty facing a legacy of past political upheaval. The current place of primary design and technology is explored, and questions asked regarding the relationship this currently shares with science education, particularly in the light of recent political changes which include a return to democracy and a return to the Commonwealth and international fold. A return to democracy will have implications for all levels of society, not least in primary teaching where scientific and technological literacy ‘of the people, by the people, for the people’ will need to take a key role in the raising of standards in education, in health, in individual wealth and in long-term safeguards for a sustainable environment.

On the 29th May 1999 a new era began for Nigeria with the swearing-in of Olusegun Obasanjo to preside over a democratically elected government. New doors will undoubtedly open as Nigeria takes its place within the international fold and new accompanying opportunities and choices will follow. This paper explores some of choices that will need to be made in curriculum and professional terms in the fields of technological and scientific literacy. In particular, the paper explores the measures being undertaken to develop teacher expertise and the consequent enhancement of the science-technology experience for children. It also explores models of science-technology curriculum delivery and how these depend on factors such as context, needs and evolution from past frameworks.

Scientific and technological literacy (STL) are key strands in Project 2000+, which is co-ordinated by UNESCO. A declaration of intent (UNESCO, 1994) pronounces that “sound basic education is fundamental to the strengthening of higher levels of education and of scientific and technological literacy and capacity and thus to self-reliant development” (p.7).

This notion of “self-reliant development” is of central importance, for it is through measures such as STL that people can begin to make informed choices about their future. Informed choices will indeed need to be made as environmental issues gain a higher profile in people’s lives. UNESCO (1983) recognised this almost 20 years ago by registering a concern that education could and should contribute to solving problems which arise within the environment, adding that many of the problems were generated by human behaviour.

Project 2000+ provides an overarching structure for a global array of regional organisations which support local projects within the promotional theme of STL.

Early ELSSA activity
In western and southern Africa, one such project is ELSSA, the Early Learning Science Series for Africa. ELSSA was initially concerned with publications to promote health education, and booklets such as Stop Malaria Stop (Bajah, 1997) provide vivid accounts of the effects and prevention of various tropical illnesses. In these works, the use of storytelling and participant engagement through related songs is dramatic. Many of the words of Stop Malaria Stop for example, have a chilling ring to them and can be likened to some of the texts of Roald Dahl, so often designed to make children squirm. And indeed, just like works by Dahl, the books have impact on children since they reach further into our consciousness than we might think – or indeed want!

“Better for you when awake than asleep
As nightmares and daymares will harass you
You will climb steep slopes
and fall into deep valleys
You will cross wide bridgeless rivers
And be chased by ferocious lions on the other side
To be welcomed by monstrous creatures where you flee...”
(Bajah, 1997, p.12)

This focus on health education is a powerful indicator of the importance of context in determining what is relevant and important in the lives of ordinary people. It follows thus that the impact of local circumstance on curriculum content is profound. Avoiding malaria in much of Africa is central to life itself.

ELSSA is not a static project with a narrow focus. It is alive to educational trends and the needs of teachers and children (Bajah, 1999). Most recently it has become concerned with upgrading teacher skills and the associated production of low-cost science equipment. With the generous support of the British Council, ELSSA has been able to host workshops at which teachers can explore teaching methodology and produce simple equipment.

These workshops have had a number of effects. One effect is that, within the professional setting of workshops, teachers have been able to informally review and discuss the contents and expectations of the State curriculum. One of the features of the core curriculum for primary science is that it embraces areas of design and technology. This lack of a distinction between these subjects is important since in many ways, design and technology activity is seen as a contributor to the overall experience of science, rather than a subject in its own right.

Science and technology - dual delivery
The inclusion of elements of design and technology into the Nigerian primary science curriculum stems from a curriculum review in 1989 in which objectives for the National Policy on Education were integrated into the Core Curriculum for Primary Science. The Core Curriculum for Primary Science (Federal Ministry of Education, 1991) states that the curriculum should be “giving the child opportunities for developing manipulation skills that will enable him to function effectively in the society within the limits of his capacity” and “providing basic tools for further educational advancement including preparation for trades and crafts of the locality” (p.9).

This picture of technological capability is one of four themes which are seen to permeate and give contextual meaning to the science curriculum, the other themes being environment, energy and health.

Technological activity in the formal curriculum can be fleshed-out with further reference to the detailed specification in the Core Curriculum for Primary Science. Modelling with pliable materials such as clay is a feature of Year 1. Children are required to make models of knives and forks, a football, baby human and other animals. In Year 2 modelling is revisited with a wider range of materials, including straw, cork, broomsticks, raffia and leaves. Printing with leaves and leaving impressions on sand and plasticene are also introduced. In Year 3 the emphasis shifts to embrace engagements with mechanism and simple tools. Year 4 sees the introduction of experiences with materials, with such activities as sorting. Year 5 involves children making and using simple objects that can float in air, such as kites and gliders, and Year 6 provides further activities with mechanism. Incidentally, comparison with some curricula from other developing countries shows a remarkably similar pattern. The primary science curriculum in Jamaica (General Education Unit, 1980) for example, has an identical technology delivery pattern featuring the modelling of living things and work on mechanism.

This ‘stranding’ of the Nigerian science curriculum which isthreaded with aspects of technology is not that remote from the Science 5-16 policy statement for England and Wales (DES/WO, 1985) which noted that “science and technology in the primary school should form, and be experienced as a continuum” (p.9). This publication acknowledged that primary practice in science teaching in the UK already embraced technology – often as a hybrid creature “science-with-craft” (Geary, 1974) in which scientific ideas could be explored through children making appropriate artefacts. Forces and motion for example were explored through children making simple vehicles to roll down ramps. Electric
circuits were explored by wired systems to control lights in the ‘room-in-a-shoebox’ – complete with miniature furniture and curtains!

Naïve as these early approaches to science-with-technology may seem set against the subject separation and specification of the National Curriculum for Key Stages 1 and 2 of the National Curriculum (DfE, 1995), this concept is not without merit. It is through this strong association that that ‘technology’ and indeed ‘design and technology’ can provide a range of exciting and child-centred contexts, often through modelled situations, from which ‘play’ activity can become focused, purposeful and set at a scale which is readily accessible to children.

Johnsey (1999) throws this into greater focus with his alternative model for curriculum delivery which involves “the integration of science and design and technology so that learning in each subject enhances the other. It is proposed that that this might be achieved by enabling skills and knowledge gained in science to be used in pursuing the goals of design and technology” (p.115).

Holbrook and Rannikmäe (1997) echo the ideas of Johnsey in terms of the transfer of knowledge from science in a focused STL setting where they suggest that “STL is usually taken to mean developing the ability to creatively utilise science knowledge in everyday life to solve problems, make decisions and hence improve the quality of life” (p.15).

Perhaps there is something of an evolutionary process going on here, and that part of the pattern of subject niche creation involves the heart-searching act of deciding what makes a subject different from something else, and then perhaps, after a number of years, with later subject maturity, the links to the wider world are more readily acknowledged.

**Developing technological capability and awareness in teachers**

A second effect of ELSSA workshop activity for participants engaged in equipment manufacture has involved the use of simple skills to master construction techniques. Even ‘simple’ low cost equipment requires some skills for purposes of manufacture. Hand drills, junior hacksaws and assembly with screws were encountered by some teachers in ELSSA workshops for the first time. For some this has been a moment of technological awakening. These participants have recognised a ‘need’ for technological capability in themselves and this in turn has prompted wider debate about the place and purpose of the technological strands within the primary science curriculum.

**Professional and curriculum issues**

Nigeria faces the new millennium with perhaps a greater sense of responsibility than many nations, for the prospect of democratic activity acting on decisions may be considerable. For teachers, the shaping of the curriculum itself will need close examination. Questions raised at ELSSA workshops have begun to expose some of the uncertainties about the technology strand in the primary science curriculum. Is this strand sufficiently bonded to real life experiences? Does it address not just technological actions, but technological consequences? Are the links between strands exploited sufficiently for effective learning to take place? Finally from the viewpoint of democracy, to what extent will teachers play a active part in shaping the curriculum of the new millennium?

From a professional perspective, the ELSSA workshops have opened up new horizons and accompanying questions. Through practical experience, teachers have gained new skills and insights into what practical technology (as opposed to ICT) might be and might do. In evolutionary terms, the ideas of Black and Harrison (1985) can be seen to be recapitulated. Workshop participants have been exposed to resources of knowledge, skill and experience. The have developed their capability - for example to ‘get things done’ and they have started to extend their awareness through the need to make balanced and effective value judgements. Enhanced personal technological capability has both an impact at a practical level (such as making equipment in workshops) and at theoretical level which has served to direct attention to the appropriateness of the relationship between science and technology that currently exists in the primary curriculum.

**Towards the future - scientific and technological literacy for all?**

The ELSSA contributions to scientific and technological literacy for all are in many ways just starting points. Nigeria has many poor people and practical workshops, although eminently desirable as means of professional development, will not be available to all who need or want them. Furthermore, Nigeria
is a big country in which travel can be difficult, relatively expensive and not untouched by considerable danger. This acts as another limiting factor on professional development activities which are travel-dependent.

One way of developing access to STL ideas is the employment of open and distance learning modes in order to widen the experience of continuing professional development. In some developing countries this route has become increasingly popular as a non-formal delivery mode, since it can provide learning at a pace and in places determined by learner.

In curriculum terms, the future direction of school technology is perhaps at a crossroads. Will design and technology develop as a separate subject? Will it be seen as a cross-curricular subject or will it become more closely integrated with science? Layton (1993) offers this timely comment on the choices being faced. He points out that attempts to clone specific models of technology education - offerings which have been developed in the (relatively) resource rich North - have been sensibly resisted in developing countries. He offers the caution that "...we should be careful not to write off alternative models from the South as necessarily inferior versions. The North has often so much to learn from the South, not least in the areas of informal and non-formal education, if only it will allow its eyes to see.” (p.64)

ELSSA, alongside its collaborators as part of the UNESCO Project 2000+ thrust, is assured of a key role in whatever developments may begin to unfold.

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Biographical notes
Eric Parkinson MSc BSc is a Senior Lecturer in Education at Canterbury Christ Church University College. Professional experience includes teaching at primary and secondary levels in the UK and abroad, deputy headteacher, and consultancy activity in southern and western Africa and the Caribbean. Member of the UNESCO/ ICASE (International Council of Associations for Science Education) Standing Committee on Scientific and Technological Literacy For All (Project 2000+). Principal areas of research interest are: construction activities in primary schools; the history and development of construction kits; the development of distance learning text and Internet based resources for INSET in design and technology for primary teachers; identification and development of aspects of technological literacy. Published in areas of science education (knowledge and understanding background for primary teachers) and technology education.