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Teaching modern technological concepts in terms of the cultural environment: the case of Botswana

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Abstract

The significant role played by culture in the overall learning process cannot be overemphasised. The learning of technological concepts by an individual child depends by and large on the cultural environment. Despite having a rich cultural educational storehouse in Botswana to facilitate the learning of concepts in technology, Western-style expensive teaching aids (such as Meccano, Lego and many more built from a Western cultural bias) are still imported to our schools at an alarming rate. The school children in Botswana have to learn concepts and procedures using teaching aids originating in an unfamiliar and complex culture. It is with these problems in mind that the author has here attempted to demonstrate that the cultural environment of technology in Botswana remains a rich resource for facilitating the teaching and learning of design and technology concepts. Examples are cited and developed to illustrate cultural translation of teaching basic concepts from expatriate models to local indigenous models.

Introduction: the link between culture and technology

‘Culture’ and ‘technology’ are diverse and complex ideas. Hornby (1989) defines culture as:

Customs, arts, social institutions, etc. of a particular group of people.

while Kretch et al identify culture in problem-solving terms, very relevant to Design and Technology, as:

...the pattern of all those arrangements, materials or behavioural, which have been adopted by a society as the traditional ways of solving the problems of its members. Culture includes all the institutionalised ways and the implicit cultural beliefs, norms, values, and premises which underlie and govern conduct. (Kretch et al, 1962, p.380)

Culture is thus associated with a particular group of people sharing not only a particular geographical location but common sentiments, activities, beliefs and behavioural norms. It is thus impossible to construct a single detailed definition of culture. I like Farrant’s definition:

...all that contribute to the survival of man, such as art, drama, dress, education, literature, music, politics, religion and technology. It is absorbed by living in it and changed by contact with outside cultures or inspirations from within. (Farrant, 1981, p.12)

As we try to associate the concepts of culture and technology we note that Banks defines Technology in Black and Harrison’s words (1985) as simply:

...a disciplined process using resources of materials, energy and natural phenomena to achieve human purpose. (Banks, 1994, p.14)

and quotes Houghton who sees technology as:

...the application of scientific and other knowledge to practical tasks by organisation that involve people and machines. (Banks, 1994, p.12)

Implicit in the above definition is the notion that technology involves people and, as it is indicative that both nature and people are very much linked to culture, we come to realise that the relationship between culture and technology is that of parent and offspring. Technology is a derivative and dependent of culture. However, Technology in schools is perceived differently and according to Peter
Molosi, the Permanent Secretary in the Ministry of Education in Botswana

Technology in schools refers to a problem-solving subject that offers students with the opportunity to be creative, inventive and to analyse and solve problems. (Junior Certificate Syllabus, 1993, p.1)

The basis of the above statement is derived from Piaget and Vygotsky who identify that children gain control of their development of concepts by interaction with their environment, for example through play, that culture presents problem situations which children might want to solve, and that by solving those problem situations, they develop their mental cognition. In this

...children’s everyday experiences are indirectly local, occurring in particular contexts, and the concepts which children thus form are ones linked to situations.
(Saxe, 1991, p.12)

Values, Issues and Appropriateness of Technology in Botswana

We wish to take these ideas of culture and technology and to apply these to the practical issues of curriculum and syllabus content. We must therefore clarify what it is that we wish to achieve. We are dealing here with the part played in Design and Technology of the understanding of values and appropriateness, and this will give us a framework for analysis of the issues.

Our aspirations, our goals, our principles, our politics must be identified and expressed in terms which our people must understand. This means that we must build them on the foundations provided by Botswana’s culture and by Botswana values and traditions. (Sir Seretse Khama oa Bua, 1990)

This brings to question the mechanism whereby school technology can link to culture.

The Batswana (ie. the people of Botswana) have their own traditional ways of transmitting wisdom and skills - knowledge, cultural heritage and technology education. Traditional Botswana education was not formal but it was, according to Crowder (1994), well organised and effective. In the family, education was transmitted from parents to children, while contact with playmates and the community exposed children to other trades and technologies the family could not provide. At the initiation rites skills such as building, care of domestic animals, crop production, animal hunting and other technologies related to these activities were taught. The special skills of iron smelting, blacksmithing, traditional medicine were passed from one generation to the other through father to son life apprenticeship (Crowder, 1994).

Crowder makes two very important illustrations: that this type of education brought not only a sense of belonging, but also respect and patriotism among the native Batswana, and that people discussed ideas, shared ideas, sentiments and duties surrounded by a background they understood better.

Although this type of education may have been lost as a result of foreign interference (Price and Ndaba, 1996), part of it still exists today and might play an important role in technology education. In Crowder’s view this was the education that made people aware of what they were, ‘working directly towards addressing the society’s needs’ in context - true appropriate technology. These traditions are the type of foundation on which we can develop new culturally relevant models of modern Design and Technology education.

Ojo (1994) introduces Wilson who believes that ‘education does not take place in a cultural vacuum’. Educational materials from abroad are not normally culturally neutral. As the product of a different culture, the use of Western teaching aids may bring Western values and cultures with them. This is not then appropriate to local issues. Ojo espouses this view by stating that there is

...a weak fit between models of the technology which originates from the TDCs (Technology Donor Countries) and the recipient African countries organisational, socio-cultural and economic environment...(Ojo, 1994, p.4)
The Translation of Technology from Western to Indigenous Ideas

In this section the aim is to look at how we can translate imported (Western) elements of our school Technology curriculum to a form that will be culturally and practically natural to the children receiving the education. In so doing we will look at specific examples relevant to present Botswana school curricula. Whitehead in Coggin (1991, p.55) contends that ‘education is to be found in gaining the utmost information from the simplest apparatus’. Therefore what follows is a discussion of the way in which four examples from the local cultural environment can replace Westernised teaching aids.

The wire car model

This is a very popular child’s toy made and designed by the children themselves from joining different pieces of wire together. It represents the outline shape of a real car. It has the wheels, chassis, body, axles and a steering mechanism usually with an extended control arm so that the child can propel and steer the car whilst walking and without bending down. The wheels are made from soft drink can bottoms cut and joined together by pressing one into the other. Parts are all from scrap materials. After the designing and all the basic parts have been made, the car is assembled and tested before use. The activities which the maker of this toy car experiences are those of Design and Technology. The work is almost entirely concerned with Structures and Mechanisms which are to be found in the Botswana Design and Technology syllabus.

At present schools in Botswana use imported kits of Meccano or Lego, which comprise of several different components: structural components, wheels, gears, rods - from which technological principles can be taught. These kits are also built on the basic principle of linking play to formal learning - but the play is that of European children, not Batswana. They are, however, also built on principles of assembly that involve aspects of logical thinking and the controlled use of materials and processes which are relevant to Batswana. The culturally relevant alternative examples must not lose any of the important educational gains of the imported systems.

The design process, skills such as cutting, joining and bending can be demonstrated using the wire toy. The use in education of an experience these children have used outside education can form a natural linking from play to formal Design and Technology. For example, the principles of rotation, where motion can be achieved by the application of linear forces - in the principles of steering mechanisms where one lever pushes or pulls another to provide a different direction of motion - can be achieved with the use of the wire car model. Triangulation in producing strength of structures is just as easy an idea to convey through a wire car model as it is with Meccano - and is testable in practice on the competitive car race track! The need for precision of measurement in the manipulation of materials is very important especially when the individual components of the wire car are joined together into a single structure. (Batswana children seem to be good at modular car design from an early age.)

The fact that this wire car model can be made cheaply and is a technology from a familiar environment that is guided by common verbal persuasive measures is just enough to convince even the most critical. Those parents who will complain that children are ‘playing’ in school are no different from the British parents who complain of their primary school children ‘playing’ with Lego.

Hut building

The traditional Setswana hut comprises of a roof made from rafters cut from selected straight branches, thatched with grass and with walls made from a mixture of mud and cattle dung. The rafters (dithhomaso) are supported by a main pillar (pinagare) at the middle of the hut with additional pillars surrounding at intervals (maotwana), and by the mud and cattle dung wall. Building such a hut requires an understanding of structures, materials, and thermal conductivity. It is good and appropriate local technology. School children, as members of a family and if old enough, would be expected to play a full part in helping with the production of a new home. The scientific and technological concepts involved can be taught in school, supporting not only the children’s part in the home, but
their general educational development as well. A study of these traditional approaches will not only make students aware that their traditional huts have a lot in common with modern (Western) building structural systems, but will also provide the design experiences using a variety of appropriate building materials and building systems which can be combined with new techniques to advance the traditional building techniques available in the rural areas. Even traditional technology is not static - it is appropriate.

The new Junior Secondary Curriculum seeks to provide education in Design and Technology in its second year through involvement with projects based on community needs. Some of these will be, for example, in the provision of small public buildings (bus shelters, clinic waiting rooms, etc.) in rural areas. This will be more appropriate than teaching only Western building techniques, not greatly used in some rural regions.

A study of these approaches will not only make students aware that their traditional huts have a lot in common with modern structural building designs (beam strength, triangulation, surveying and layout) but will also provide students with design experiences using a variety of appropriate building materials and building systems. These will be combined with new techniques to advance the cultural building techniques with new wall and roofing systems produced from local materials available in rural areas. Design and Technology thus link to historical appropriate technology.

Solar energy
The use of solar energy is yet another example. Facts on Botswana (1990), an official guide book compiled by the Department of Information and Broadcasting states that:

The rainy season in Botswana begins in the month of November, peaks in January and declines in March, coming virtually to an end by April. During this period, average daily maximum temperature is around 33 degrees Celsius in January, but can go as high as 45 degrees Celsius, and average daily minimum is around 18 degrees Celsius...In winter, average daily maximum temperature is around 22 degrees Celsius, especially in July, but can rise to 32 degrees Celsius. Average daily minimum is around 5 degrees Celsius, but has been known to drop as low as -10 degrees Celsius over the desert. (Department of Information and Broadcasting, 1990, p.5)

This geographical feature offers the opportunity to demonstrate how science and technology can complement one another in, for instance, the design of a solar powered device which can transfer knowledge acquired in Science lessons to the Design and Technology workshop. We need to reconsider how such opportunities can be translated into the school content to give a better understanding of technology concepts from a local perspective.

Equipment imported from, say, the UK for teaching energy ignores our great advantage of almost continuous daytime sunshine throughout the year. This is understandable in terms of British weather. Equipment for the teaching of solar power would be culturally irrelevant to British children, except for the very low solar power requirements of such things as calculators. The fact that solar power systems are relatively new and do not have a long term traditional use in Botswana should not exclude them from culturally relevant Technology teaching.

The Design Process
At an even more fundamental level the copying of Western teaching curricula in Design and Technology is not culturally sensitive. Botswana has had major influences on its teaching styles in schools and further education from the USA, UK, and other countries.

In Botswana, the kgotla system, where people meet to discuss, in a democratic way, societal issues concerning the community's immediate needs and to discuss how to find ways of satisfying such needs is an example of a natural, culturally relevant basis for identifying Design and Technology needs. It particularly provides a starting point of identifying and outlining solutions that are geared toward satisfying the community's needs.
We need to replace Western stylised models of a design process, especially the early stages of identifying needs and seeking alternative solutions, and the evaluation element, with a process that uses the great community strength of Batswana children. They expect to discuss and solve problems as a normal part of living in a strongly mutually-dependent culture. They are good at this, and to devise a teaching strategy in Design and Technology which replaces their natural great strength in this area, with an alien alternative, can only lead to poorer performance. The new Junior Secondary curriculum is, hopefully, a start in this direction.

Conclusion

Despite their recognisable potential to galvanise students to grasp concepts in Design and Technology, the education systems in Botswana do little to incorporate cultural activities in the syllabi.

Importing educational materials from foreign countries, while there are local materials which can serve the same educational purpose, is an area that should be revisited by our educational experts. What can be emphasised is the need for more research work and discussions to identify local cultural aspects that can be incorporated into the school curriculum.

Technology, however, is an international activity. Examples such as the above can be used in cross-cultural terms to benefit other educational systems. For example they could be used for orientation purposes for people going to work in Botswana or elsewhere, as developing country cultural activities in European schools, and as a way of encouraging cultural diversity within other countries.

Clearly no country can survive as a static culture. One has to look at the different educational technologies and materials available in modern schools. So long as our wish is to keep abreast with international developments, cultural diversity will always be a thing to consider. Admittedly different educational materials and technologies available in developed countries, are envied by developing countries such as Botswana. However a clearer recognition of the strengths of our own culture in education is necessary. If such action is not undertaken, then we might in the end fail to deliver education 'with the most simple apparatus', and consequently fall far short from providing the best and relevant technology education.

References


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