The Biological Technologies

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In her paper, Glenda Prime sees the current debate and re-thinking about the nature of technology and the form of school curricula as something positive which is ensuring the survival of technology education. She builds her own contribution on the premise that the purpose of technology is to enhance the quality of human relationships at the personal, community, national and international levels. This is not the usual emphasis and it should challenge all of us to reflect on the image and picture of technology we bring to the discussion.

It would not be surprising if the picture is of machines, computers and tools which utilise so-called hard materials for this is the usual picture of technology. Some readers will no doubt think of so-called soft material technologies which are frequently linked with food and textiles. This separation is regrettable for soft has connotations of weakness, vulnerability, malleability and of something which does not endure and cannot stand up to powerful forces. It is also frequently a separation which cannot be justified. Both hard and soft materials are used in the construction of a car and without biologically produced petrol and oil, the conventional car will be useless. Similarly an artificial heart valve is made of 'hard' metal or ceramic, with 'soft' polymer or animal membrane.

Suppose instead of the words hard and soft, the terms 'physical science' technologies and 'biological science' technologies are used, what picture of technology is now presented? The proposed National Curriculum Technology Orders imply that technology in school is to be seen basically as physical science technology with the exception of some biological materials, namely food and some textiles. Given that whichever adjectives are used, the separation between hard and soft or physical and biological will often be spurious, this article pleads for the wider representation of biological technologies, often referred to as biotechnology, in school technology. The word biotechnology is included in the proposed new orders (p.50) where it is stated that 'there was lack of agreement on whether the study of specific technologies, such as biotechnology, should be included in the revised D&T curriculum'. But biotechnology is not a specific technology: the biotechnologies are a vast, complex series of technologies and the term biological technologies would seem appropriate to set alongside the term physical science technologies. In any case it would be interesting to know on what grounds the decision was taken to exclude biological concepts, processes, knowledge and materials with the exception of food (always biologically produced) and non-synthetic textiles.

When acknowledging the concern of industrialists for a skilled work force, we should surely include those industrialists who are concerned with health care, waste treatment, water purification and supply, detergents, pharmaceuticals, agriculture, food production and processing, tourism, environmental management, new materials and many other biologically based industries.

Industries such as these are at the forefront of present and possible wealth creation and are, without doubt, major factors in 'society's need to respond dynamically to forces within and without itself'. These forces are likely to include environmental issues, health care, genetic manipulation of animals and humans, recycling, biodiversity and future energy needs. The biological technologies have produced, and will continue to produce, developments which are controversial. This is nothing new, for all aspects of technology involve making decisions based on value judgements. What is new is the scope and potential for considerable damage as well as great benefit.

The only comparable controversial technology is that concerned with atomic energy. The citizens of tomorrow will need to be technologically literate about the biotechnologies.

David Layton writes that 'values and value judgements are 'the engine' of design and technology' and also notes that 'the kind of values brought into play are wide-ranging' (1992, p.36). Thus, technology education should not only involve a wide range of technologies, which draw on biological as well as physical science knowledge, but also acknowledge a wide range of values.

Many of the points raised in this paper can be further illustrated and given relevance by reference to an exciting, innovative, technological project — Biosphere II, a structure which looks like a massive greenhouse in the Arizona desert. Inside the structure are five different habitats — desert, marshland, an ocean, grassland and a rainforest. Four women and four men are now

Values	Examples	Values	Examples
Technical	Right materials for the job	Social	Equality of the sexes
	Improved performance of an artefact		Regard for the disadvantaged and handicapped
	'Neat' solution		
Economic	Thrifty use of resources	Environmental	Ecological benignity
	Maximising added value of a product		Sustainable development
Aesthetic	Pleasing to handle	Moral	Sanctity of life
	Attractive to look at	Spiritual/ religious	Commitment to a conception of humans and their relationship to nature

sealed in the biosphere living in a completely self-sufficient manner. This project can be seen as the ultimate in technological problem-solving, concerned as it is with all the basic processes for human survival, and requiring a wide range of technologies. Such a project may be viewed holistically since it is concerned with the problem of survival in an artificial world. But within the project are 'subprojects' such as: How will the temperature be controlled inside a glass dome in the desert? How will drinking water be obtained? At the overarching project level and at the level of practical problems decisions have to be made based on values. Layton (1992, p.36) sets out the wide range of values involved in technology in the accompanying table.

At the major project level, all aspects will need to be addressed. The environmental, technical and economic are perhaps the most obvious. But the experience of living in the Biosphere will also be enhanced or diminished by aesthetic features of its design and by ergonomic considerations. Will everyone be able to operate the systems? Can some equipment only be operated by physically strong people thus giving them power over others? Given that men and women are participating it may be expected that moral values are involved in decisions about the use and availability of contraceptive technologies.

Living in a confined space, without direct access to family and friends, with limited space to be alone, separated from the world are, spiritual and religious matters. In addressing the whole Biosphere project pupils can discuss these examples along with many other value judgements.

Although constructing a Biosphere is beyond the possibilities in school, it is possible to produce an enclosed, self-maintaining and life-supporting system such as an aquarium. Also within the overall project are numerous problems which might be considered in school practical work. For instance a major problem will be monitoring the quality of the air and ensuring circulation of the air. A mechanical pump is available in the actual Biosphere. In producing the pump decisions will have been made with reference to technical, economic and aesthetic value judgements. Air purity is essential for sustaining life. One can imagine that moral decisions might have to be made regarding which species would have to be sacrificed and which nurtured if the quality of the air deteriorates. Social decisions might also have to be made which restrict human activity to conserve oxygen.

Biosphere II is one example of a modern technological project which brings together areas of knowledge, which raises many value issues about present-day and future ways of living, and which has commercial and industrial potential. The decisions being made and the problems being experienced and investigated in the Arizona desert may be very similar to those which will be experienced by space dwellers of the future. One might argue that if this is so the need for a technologically literate population is even more important and urgent.

References

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