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Values in Technology Education

RUTH CONWAY

Coordinator, Special Interest Group: Values in Technology Education, Selly Oak Colleges, Birmingham, UK.

Within the current debate on the nature of technology and the appropriate form and content of school curricula for technology education, there is a recognition that values are a central component:

> There is a sense in which technology, both its products and its processes, represents the embodiment of the culture. We create the things we value, the things we think beautiful or useful. We devise tools, machines and systems to accomplish the ends we value. . . . Our beliefs, our values, our philosophies, our experiences, in short our culture, is made manifest, in part in the artefacts and systems we create. (Prime, 1993, p. 30)

> technology practice entails . . the organisational aspect . . the technical aspect . . and the cultural aspects . . . (where) culture refers to values, ideas and creative activity. (Pacey, 1983, p. 5)

> one way of viewing this area of educational experience is as a progressive refinement in the art of making (value) judgments which are characteristic of the world of practical action. . . . What is regarded as optimal is determined by the ways in which constraints are defined and values are assigned priority. (National Curriculum Design and Technology Working Group, 1988, p. 13)

The centrality of value judgments in the practice of technology has important educational implications. The *Special Interest Group: Values in Technology Education* is a forum where these implications can be explored. Its aims are:

> To initiate a discourse about values and valuing in design and technology recognising that
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> – we shape our community by technological activity
>
> – conversely, technology is shaped by our personal and communal values and beliefs.
>
> If people are to understand and have some control over their own and other people's design and technological activity, the assumptions underlying their value judgments need to be made explicit and debated.
>
> – an important aspect of capability is the readiness to address the pertinent, sometimes implicit, often conflicting values with confidence, autonomy and responsibility.

Each of the aspects needs careful consideration in the process of curriculum development.

SHAPING OUR COMMUNITY BY TECHNOLOGICAL DEVELOPMENT

In his assessment of the entire English National Curriculum, Ron Dearing presents the 'Educational Challenge' in these terms:

> Education is not concerned only with equipping students with the knowledge and skills they need to earn a living. It must help our young people to: use leisure time creatively; have respect for other people, other cultures and other beliefs; become good citizens; think things out for themselves; pursue a healthy life-style; and, not least, value themselves and their achievements. It should develop an appreciation of the richness of our cultural heritage and of the spiritual and moral dimensions to life. It must, moreover, be concerned to serve all our children well, whatever their background, sex, creed, ethnicity or talent. (Dearing, 1994, p. 18)

Education which has these basic aims is rooted in the realities of young people's lives and relationships, which in the modern world are deeply affected by technology. This effect is powerful because 'Technology is not the sum of the artifacts, of the wheels and gears, of the rails and electronic transmitters. Technology is a *system*. . . . It involves organization, procedures, symbols, new words, and, most of all, a mindset' (Franklin, 1992, p. 12). But the effect goes deeper:

> Borgmann argues that our pattern of life is crucially affected by the nature of technological devices. These are developed in order to make commodities available to as many people as possible easily and safely. This is achieved by hiding the machinery of the device so that it makes little demand on the user's skill or attention, nor does it require any depth of relationship with other people. . . . So technological devices encourage people to become consumers of individual commodities which have lost their connection with the creativity and skill that have made them available and with the social relationships that were previously needed and engendered. . . .
>
> Borgmann believes that human freedom is grounded in capacity for significance and it is this which is being undermined by a pattern of living that reduces freedom to the exercise of individual choice in a consumer market. . . .
>
> Any attempt to consider values is itself trivialised by the pattern of living promoted. . . . Discussion centres on the comparative value of commodities, which are highly reduced entities, sharply defined and easily measured, rather than on 'focal things' which have the power to move us and to engage us in relationships. Prominence is given to value for the consumer with no account taken of who shares the profits and costs, including any environmental damage, of producing the hidden machinery. . . . Values are also open to distortion: by concentrating on consumer value and economic profitability, vices such as greed, envy and self-centredness become the virtues of a hard-driving competitiveness. (Conway, 1992, p. 183)

> The influence of technology on human values is not just indirect (as in machines) but also direct. . . . The use of various medical and biotechnological techniques is forcing us to redefine what such common terms as birth, parenthood, quality of life, and death now mean. Our expectations concerning survival, longevity, suffering, and the duties we owe to each other in these processes are rapidly changing . . ."The coming to be of technology has required changes in what we think is good, what we think good is, how we conceive sanity and madness, justice and injustice, rationality and irrationality, beauty and ugliness (Grant, 1986, p. 32)." (Waters, 1991, p. 15)

If this analysis is taken together with the educational challenge set out by Dearing, then technology education should at the least include:

1. opportunities for the young people themselves to be creative and co-operative, in a process that develops sensitivity to other people's needs and cultures.
2. designing and making tasks set within a wide range of different contexts

relevant to the lives and relationships of the young people, not only in the context of producing consumer products.

3. strategies that help young people explore the interaction of technological projects with their surroundings so that constraints and evaluation criteria take account of the environmental, social, moral and spiritual implications.
4. time given to modifying and repairing existing products so that users can become actively involved and resources conserved.
5. consideration of technology practice in society as 'it is only an informed and technologically literate citizen who would be able to make decisions about technology and assess its broad social impact on family structure, inter and cross-cultural relations, national and international functioning, its economic impact on business, commerce and government, as well as its environmental impact on agriculture, food production, and waste disposal, in both the short and long term.' (Prime, 1993, p. 32)

TECHNOLOGY SHAPED BY PERSONAL AND COMMUNAL VALUES AND BELIEFS

The interaction between technology and culture is a two-way process. Pacey starts his analysis of the values that guide technological decision-making by looking at differing world views regarding natural resources:

> the values of people who worry about environmental problems . . include a concept of nature in which living things have an intrinsic worth and the goal of material development is regarded as, ideally, to find ways of living in harmony with nature. By contrast, the confidence of many economists and engineers in human ability to overcome every problem may often reflect a moral judgement that the proper role of man is mastery over nature. . . .
>
> A concept of technology as the management of process . . . offers a philosophical basis for the emphasis on maintenance and prevention . . . and calls for some reassessment of the conventional view of technology as being primarily concerned with the engineering of inorganic matter . . . most of the processes that take place in the world are actually biological ones. (Pacey, 1983, p. 67–68)

Pacey then examines in detail three sets of values: one based on rational, materialistic and economic goals, one concerned with the adventure of exploiting the frontiers of capability and pursuing virtuosity for its own sake, and the other representing the attitudes and needs of users, closely allied to the values embodied in work traditionally done by women:

> Nearly all women's (traditional) work falls within the usual definition of technology. What excludes it from recognition . . . is the fact that it implies a different concept of what technology is about. Construction and the conquest of nature are not glorified, and there is little to notice in the way of technological virtuosity. Instead, technique is applied to the management of natural processes of both growth and decay. . . . Appreciation of process in this sense partly depends on accepting and working with nature rather than trying to conquer it, and is a neglected concept in conventional technology. (Pacey, 1983, p. 104)

Ursula Franklin also stresses the influence that this third set of values could have on the shape of technology:

> One may want to contrast the notion of productivity – churning something out at the lowest cost whether anyone needs that something or not – with the notion of 'copeability', the ability to deal and cope adequately with a variety of circumstances, a quality much valued and respected in the women's world.
>
> The technological order is geared to maximising gain; the strategies of the women's world are more often than not aimed at minimising disaster. . . .
>
> *But change there must be.* Humanity will simply not survive the current technological order with its escalating human oppression, ecological destructiveness and global militarism. (Franklin, 1985, pp. 8, 11)

> I (have) outlined the nature of prescriptive technologies and . . . contrasted this mode of working to women's historical experience of situational and holistic work. The success of such work depends strongly on personal judgement, on knowledge of the total work process, and on the ability to discern what the essential variables are at any one time. None of these attributes of knowledge and judgement are required in modern industrial production and in fact, they're usually not appreciated in workers. . . . The great contribution of women to technology lies precisely in their potential to change the technostructures by understanding, critiquing, and changing the very parameters that have kept women *away* from technology. (Franklin, 1992, p. 104)

The development of any technological project is guided by these (often hidden) perspectives and by the dominant 'framework of meaning':

> What is necessary is a statement of purpose of technology that is extrinsic to the solution of the problem. I would like to suggest . . . "the enhancement of the quality of human life and relationships on the personal, community, national and international level". The emphasis here on relationships is deliberate for it is the quality of relationships, not the possession of wealth that determines the quality of human life. (Prime, 1993, p. 33)

> Technology based on the simplistic change-equals-growth-equals-progress paradigm constituted "a reckless incursion into the future" . . . To continue to place mankind's narrow understandings and vested interests in manipulating the world at the top of the value scale is to ensure the end of our species. . . . It must be a spur to a different way of using knowledge as wisdom and to seeing our sojourn here as a trusteeship – a cooperative and constructive endeavour rather than a competitive struggle. It goes to the heart of how we see ourselves and, therefore, of how we should educate our children. (Tomlinson, 1990, p. 16)

> Science and technology servicing a global economy rooted in free-market competition and consumption would seem to have very different priorities to those that would exist in a global economy based on cooperation and conservation. Do we really want to educate young people so that they can deploy their . . . technological skills on the trivia of affluence? . . . Or do we want to educate them for a world in which, if they do become . . technologists, their science and technology will be directed to . . . attempting to ensure the survival of Planet Earth? (Chapman, 1991, p. 58)

This suggests that technology education should include:

1. exploration of the implicit purpose and values in the technology that is taught/learnt through the content and pedagogy of the curriculum and the attitudes of the teachers.
2. biological technologies used in domestic, neighbourhood and industrial settings, recognising that there are '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 that society faces questions related to) environmental issues, health care, genetic manipulation, recycling, biodiversity and future energy needs' (Riggs, 1993, p. 37)

3. some technological activities approached via a particular issue or situation, possibly with the help of colleagues from other subject areas.
4. design and make tasks that are aimed at encouraging good relationships at home or in the community; they do not all need to be directed towards marketable products.
5. tasks that draw on the experience and interests of an individual student or group of students, giving them a personal sense of achievement and encouraging them to work together.
6. use of the term 'problem-centred' rather than 'problem-solving'. The latter encourages a 'technical-fix' approach, whereas the former suggests a complex situation requiring sensitivity, wide sympathies and the need to judge between conflicting values.

ADDRESSING VALUES WITH CONFIDENCE, AUTONOMY AND RESPONSIBILITY

It is not easy to develop 'the capacity to interpret meaning and to evaluate the consequences of technological choices' (Olson, 1993, p. 1). John Olson acknowledges that 'technical ways of knowing and acting do not provide the tools for analysing the moral value of technical systems', a point echoed by the Leeds Education for Capability Research Group: "(for teacher training in technology education), aspects of the school curriculum traditionally addressed in the training of humanities teachers – ethical, moral and social issues – will also have to be included." (Anning *et al.*, 1992, p. 10)

Some pointers as to how this can be done have already been given. It is crucial that technological activities are not pursued in isolation from their human and environmental setting and that real life experience is taken seriously. Pacey recounts how a group of women working as research scientists in Cambridge in 1934 concerned themselves with social issues such as malnutrition among the unemployed, and opposition to the militarization of science, and thereby alerted others to the question of social responsibility in science and leading him to remark: "What lies behind this, I suggest, is a particular sense of responsibility arising from the immediacy with which (women) experience human need. Values are rooted in experience." (Pacey, 1983, p. 108)

It is in paying attention to the context and the experience of all those involved – users, suppliers of resources and skills, designers, manufacturers, workers – that the range of values can be made explicit and that confidence in handling value-judgments can be encouraged. This can be a

far-reaching exercise, questioning the very values encouraged by so much of the technology that is part of our lives:

> Today the values of technology have so permeated the public mind that all too frequently what is efficient is seen as the right thing to do. Conversely, when something is perceived to be wrong, it tends to be critiqued in practical terms as being inefficient or counterproductive (a significant term in its own right). The public discourse I am urging here needs to break away from the technological mindset to focus on justice, fairness, and equality in the global sense. Once technological practices are questioned on a principled basis . . . new practical ways of doing what needs to be done will evolve. (Franklin, 1992, p. 123)

The examples she gave could be addressed even in school technology:

> One needs to ask, "Who has given anyone the right to cut down trees and destroy habitat for the sake of a double-page advertisement for cars? . . . Who has given the right to publishers to suddenly dish out their newspapers in individual plastic bags that just add to the already unmanageable waste? Who gives the right to owners of large office buildings to keep wasting electricity by leaving lights on all night in their empty buildings?" These are not questions of economics; they are questions of justice – and we have to address them as such. (p. 121)

David Layton calls this component of technology education *critic competence*:

> the ability to judge the worth of a technological development in the light of personal values and to step outside the 'mental set' to evaluate what it is doing to us (e.g. it might be encouraging a view of social problems in terms of a succession of 'technical fixes' rather than more fundamental considerations). (Layton, 1993, p. 61)

Again there are implications for technology education:

1. Teachers in training should have the opportunity to explore underlying assumptions in their teaching:

   > 'Good' teacher education necessarily implies enabling future teachers to think about and justify what they will be doing as teachers in terms of fundamental beliefs about humans, society, nature, knowledge and ethics. This is essential if they are to be autonomous in the sense of being able to take responsibility for their actions as teachers. (Bearlin, 1987, p. 2)

   Within the teaching of technology

   > teachers need models that help them to approach technology together with its social and scientific context. They need encouragement to include reflection on moral values and social relations reified in technical objects. . . . It needs a teacher education based on technological understanding beyond specialised expertise. (Hansen/Olson, 1993, p. 7)

2. The aims that a school formulates for its technology curriculum should be explicit about underlying values, and about the meaning attached to purpose and quality, in addition to technical aims. For example, a local authority in England includes in its aims for technology education:

> . . . Ensure activities and learning experiences are drawn from the whole curriculum . . . Enable equal opportunities for all pupils. . . . Develop a responsible and caring attitude towards the effects of technological change in society . . . Stimulate, encourage and develop personal qualities including self esteem, cooperation and positive appraisal . . . (Design and Technology in Sandwell, 1989)

Another school in England, after listing in its aims the development of capability in each part of the design process, states that 'pupils should be enabled and encouraged to:
deepen their concern for the poor and those at the margins of society (both locally and internationally),
deepen their awareness of the need to look after the earth's resources and ecosystem,
challenge racial and gender stereotyping, and to work for genuine equality of opportunity,
develop respect for others, and the skills necessary to work in groups (including the ability to be self-critical and to accept criticism from others). (Pitt, 1991, p. 35)

3. Teachers can be ready to let the history or social context of a particular technology lead on to consideration of issues that will demand their attention as responsible citizens. For example, a report of a Crafts Council exhibition of Quilting concluded: "All of this demands creativity, design skills, hand and machine stitching skills, and the ability to adapt old skills to new products", but the report had also included historic examples such as: "Women in the mining communities developed the traditional patterns and sewed them for their own families and when, as so often happened, their men were killed in the pit, it was only the making and selling quilts for a pittance that allowed them to survive. There was no compensation or insurance" (Thomas, 1993, p. 3) This would be an ideal example with which to take up Paul Gardner's challenge: "I am not aware of any school curricula which have examined the history of an artefact from the vantage point of how people have interacted to produce it." (Gardner, 1993, p. 6)

PRODUCTS AND APPLICATIONS – A CONFERENCE TO EXPLORE VALUE-JUDGMENTS IN DESIGN AND TECHNOLOGY

More research and curriculum development are needed if technology education is to respond adequately to the challenges posed by the 'values and valuing in design and technology'. As a contribution to the pool of possible learning strategies, The Special Interest Group: Values in Technology Education is planning a conference in the Autumn of 1994 to test out one approach. Small groups of teachers will be invited to evaluate the design, manufacture, promotion, use and disposal of products on the basis of researched information tracing the interaction of the product with its 'surroundings'. They will be asked to summarise the values that they

judge to have been influential and then reflect on their personal response to each product, on how their decision might affect other people, and what for them are the most important considerations. This will then be the basis for the development of similar learning strategies they could use with their pupils.

Our hope is that this conference will prove a worthwhile initiative that can make a contribution to the understanding and teaching of technology, with a view to helping today's young people think sensitively and responsibly about the goals they are pursuing, and which in turn are pushing them, into tomorrow's technologically shaped society.

REFERENCES

Anning, A., Driver, R., Jenkins, E., Kent, D., Layton, D. & Medway, P.: 1992, *Towards an Agenda for Research in Technology Education*, Education for Capability Research Group, Leeds.

Bearlin, M. L.: 1987, *Feminist Critiques of Science: Implications for Teacher Education*, GASAT 4 International conference.

Chapman, B.: 1991, 'The Overselling of Science Education in the Eighties', *School Science Review* **72**(260), pp. 47–63.

Conway, R: 1992, Book Review of Borgmann, A., 'Technology and the Character of Contemporary Life: A Philosophical Inquiry', in *British Journal of Religious Education* **14**(4), pp. 183–4.

Dearing, R.: 1994, *The National Curriculum and its Assessment: Final Report*, School Curriculum and Assessment Authority, London.

Franklin, U. M.: 1985, *Will Women Change Technology or Will Technology Change Women?* Canadian Research Institute for the Advancement of Women, Ottawa.

Franklin, U. M.: 1992, *The Real World of Technology*, Anansi Press, Ontario.

Gardner, P. L.: 1993, *Science and Technology: Rethinking the relationship*, Paper presented at International Conference on Science Education in Developing Countries, Jerusalem.

Grant, G.: 1986, *Technology and Justice*, Anansi Press, Ontario.

Hansen, H-H. & Olson, J.: 1993, *Rethinking Technology in Education: An Action Research Approach*, Research Proposal, IPN/MSTE.

Layton, D.: 1993, *Technology's Challenge to Science Education*, Open University Press, Milton Keynes.

Department of Education and Science: 1988, *National Curriculum Design and Technology Working Group: Interim Report*, DES, London.

Olson, J.: 1993, *Technology as Social Context*, Notes for presentation at workshop: Exploring the Relationship of Science, Technology and Society in Education, IPN, Kiel.

Pacey, A.: 1983, *The Culture of Technology*, MIT Press, Massachusetts.

Pitt, J.: 1991, 'Design and Technology and Social Responsibility', *Design & Technology Teaching* **24**(1), pp. 34–36.

Prime, G. M.: 1993, 'Values in Technology: Approaches to Learning', *Design & Technology Teaching* **25**(3), pp. 30–36.

Riggs, A.: 1993, 'The Biological Technologies', *Design & Technology Teaching* **25**(3), pp. 37–41.

Thomas, S.: 1993, 'More Than a Patch on the Past', *The Times Educational Supplement*, 5 November, p. 3.

Tomlinson, J.: 1990, 'New Visions for Old', *The Times Educational Supplement*, 5 January, p. 16.

Waters, B.: 1990, 'Pilgrims and Progress: Technology and Christian Ethics', *The Center for Theology and the Natural Sciences Bulletin* **10**(4). pp. 13–21.