Investigating the interface between technological practice and technological education

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Introduction
Against a background of instability and change in the technology curriculum, there is an urgent need for some fundamental research on the relationship between the practice of technology and frameworks for educating about the subject.

As there is no generally accepted definition of technology, describing and categorising the 'practice of technology' is difficult.

"The undertaking of technological enterprises is crucially determined not by advances in knowledge nor simply by the identification of needs but by social interests. Of the potential new technologies available at any time, only some get developed and widely implemented."1

Pacey (1983) sees technology as having three aspects: the "technical" aspect, which is concerned with the associated knowledge and skills; the "cultural" aspect, which focuses on the underlying values; the "organisational" aspect, which relates to the economics and sociology of the conduct of technology and employment of its outcomes.2

One definition may assist categorisation, whilst another may be contradictory. As Schon observes, "It is as though the practitioner says to his colleague, 'while I do not accept your view of knowledge, I cannot describe my own'. Sometimes, indeed, the practitioner appears to say, 'my kind of knowledge is indescribable'."3 It follows that a generally accepted specification for technological education is similarly elusive.

"Abstract, academic learning, 'knowing that', needs complementing by technological knowledge, 'knowing how', which empowers its holders in the realms of practical action."4

"Although men and women have been engaged in the practice of technology since the beginning of history, our understanding of the nature of technology is very recent."5

"Practising technologists, and successful school technology students, tend to acquire the formal knowledge they need in ways other than conventional academic transmission"6

Is there a generalisable body of knowledge and set of processes and skills which characterise the practice of technology? How should technological education reflect the practice of technology in industry? What is the nature of the existing links between industry and educational institutions? How should these links be developed to the benefit of technological education? Answers to these questions are sought through the research project described below.

A note on terminology: 'educational sites' are schools and colleges in the statutory system; 'industry' is used in a generic sense and includes the extractive, manufacturing or service sectors; 'partnerships' are schools-industry links and education-business partnerships and the range of activities associated with them.

The Research Programme
The programme of research will be conducted in five stages.

The first stage will involve fieldwork, through "practitioner" case studies in selected sectors of industry and commerce, to establish models for the practice of technology.

In the second stage, also involving fieldwork, a series of comparative "educational" case studies will be undertaken on programmes of technological education in schools and colleges to establish frameworks for technological education.

The third stage will involve an analysis of the data from the practitioner and educational case studies.
From this a generalised model for the relationship between the practice of technology and technological education in England and Wales will be proposed. The model will include an organisational framework and context and content descriptors.

The fourth stage is a series of 'partnership' case studies, involving further fieldwork. As part of these case studies, the model from stage three will be compared against a series of school-industry links. The analysis arising from the comparative work between stages one and two, and four, will provide a framework for effective “partnership” schemes such as work experience and mini-enterprise. This framework will then be evaluated in the fifth and final stages.

The relationship between the five stages of the research is shown in figure 1.

The Research Methodology

The case study approach will allow generalisations to be made about instances, the instances being 'the practice of technology', 'technological education' and 'partnerships'. Data will be collected through a 'triangulation between method' technique using questionnaires, non-participant observation and social surveys. Triangulation is a term borrowed from land surveying, and means simply that the researcher gets a better view of a situation by looking at it in more than one way.

Stage One & Two - Educational and Practitioner case studies

Questionnaires will be distributed to approximately 250-300 educational and industrial sites to gather information about the sites. Educational sites will be chosen randomly within the counties of England and Wales, which will also be chosen at random. The industrial sites will be selected randomly within different sectors of industry. The sectors of industry will be selected purposefully to ensure that the sample is representative of a broad spectrum of industrially practised technology, for example textiles, agriculture, graphics.

The questionnaire will be accompanied by an explanation of the research, its purpose and methodology. This will allow recipients to decide whether or not they wish their site to be involved in the project, and, if they do, at what stage they wish to participate.

There will be separate questionnaires for educational sites and industrial sites. The questionnaires will consist of open and closed questions in a structured format. The questionnaires will be used to elicit information on the site; school-industry links; views on the relationship between school-industry links, the practice of technology, technological education and the National Curriculum.

As a precursor to a pilot social survey, two sites from the educational and industrial sample will be selected from those who wish to take part. Two weeks will be spent at each site and information will be collected through informal discussion (which will be recorded on tape), observation (with analytical note taking), and filming (to provide a visual record).

Research indicates that 'strangers' in schools do not gain a true impression of classroom life; the same is probably true of industrial environments. For this reason an acclimatisation period will be allowed prior to data collection.

The precursor will be an empirical study which aims to establish key issues for subsequent exploration. This will be used in conjunction with a literature review to formulate a number of hypotheses for investigation through the social survey. Provisional hypotheses are:

- the practice of technology in industry is far removed from that which is practised in schools;
- the National Curriculum is pressurising teachers away from school-industry initiatives;
- “partnership” schemes are poorly formulated and implemented, thus creating unrealistic experiences.

Four more sites from both the industrial sample and the educational sample will be selected to pilot and refine the social survey interview schedule. Data, using the refined interview schedules and the questionnaires, will be collected at ten sites from each sample. The hypotheses will be tested by analysing the data obtained through the interview schedules.

A critical path analysis for the research is given in figure 2; figure 3 is the data collection framework.

Stage Three & Four - Partnership case studies

Partnership is integral to the research as questions concerning “partnership” schemes will be asked throughout educational and practitioner case studies. There will also be a separate investigation into school-industry, education-business initiatives, and their corresponding agencies, such as industrial liaison bureaus. Data will be obtained through...
relevant literature, informal taped discussions and telephone interviews. Stage three will include an analysis of “partnership” material of a generic nature, as opposed to an in depth study. The data gathered will be used in conjunction with the results and conclusions from the educational and practitioner case studies to generate a framework for an effective “partnership”. This framework will then be compared against a series of school-industry links which are already in operation.

As well as the comparative study a questionnaire will be administered to those effected by “partnership” schemes, and those in a position to formulate and implement such schemes. Analysis of the responses will evaluate the proposed framework.

Discussion

It is anticipated that the research will contribute not only to the debate about the technology curriculum nationally, but also to the wider international movements concerned with technological literacy.

Specifically, the models of the practice of technology will:

- clarify the relationship between practical processes, skills deployment and technological understanding;
- address the matter of continuity in technological practice through an exploration of any associated "technological tradition" and how this is maintained;
- address the matter of turnover in technological practice through an examination of redundancy and replacement of key processes, skills and the changing knowledge base;
- outline the legislative and voluntary framework of responsibility and public accountability in terms of any social and environmental costs arising from practice.

Through the frameworks of technological education it will be possible to establish the extent to which:

- the practice of technology in industry and commerce is reflected, in terms of processes, skills and understanding, in the technology curriculum;
- the technology curriculum is based on a technological tradition which has its origins in industry and commerce;
- the technology curriculum is responsive to changes in key processes and skills and the knowledge base associated with the practice of technology;
- perspectives from other disciplines on the social and environmental costs arising from technological developments can be accommodated in the curriculum.

The "partnership" case studies will be concerned with:

- the perceptions of the practice of technology and its relation to technological education held by practitioners in industry and commerce;
- the agencies concerned with schools-industry links and the resources they offer;
- the nature of schools-industry partnerships and their impact on the curriculum.

The 'partnership' schemes will:

- address the ramifications of the present schools-industry links systems;
- address the matter of vocational education and the repercussions it will have on our present educational and industrial structure.
- clarify the significance of schools-industry links with regard to wider socio-economic and environmental concerns.

Questionnaires will be distributed in September 1994 and fieldwork will be undertaken in the autumn term 1994. It is expected that sufficient data will have been collected and analysed to allow provision outcomes to be reported in the summer of 1995.

References


Case studies 1 & 2

Partnerships

Generation

Conclusions

Evaluation
Figure 2. Critical Path Analysis for Research
CASE STUDY ONE

QUESTIONNAIRE: FOR SAMPLING AND BACKGROUND DATA

INDUSTRIES

ANALYZE RESPONSES AND SELECT A SAMPLE BY CRITERION REFERENCE

SCHOOLS

SELECT TWO SITES FROM THE SAMPLE

PRE-CURSOR TO PILOT SURVEY TO BE CONDUCTED:

OBSERVATION PERIOD

ANALYZE DATA

DRAFT INTERVIEW SCHEDULE FROM THE RESULTS OBTAINED

PILOT SURVEY OF INTERVIEW SCHEDULES

CONDUCT SOCIAL SURVEY

QUESTIONNAIRE PRODUCING QUANTITATIVE DATA

INTERVIEW SCHEDULES PRODUCING QUALITATIVE DATA

PARTNERSHIP STUDY

REVIEW LITERATURE

CONTACT AGENCIES

CONDUCT INTERVIEWS

ANALYZE DATA

DRAW CONCLUSIONS

GENERATE "PARTNERSHIP" FRAMEWORK

QUESTIONNAIRE TO EVALUATE THE "PARTNERSHIP" FRAMEWORK GENERATED

ANALYZE DATA

DRAW CONCLUSIONS

CONCLUSIONS

Figure 3. Data Collection Framework