Post-Fordism? Technology and New Forms of Control: the case of technology in the curriculum

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ABSTRACT *Technology is changing not only our material reality, but also our social roles and power positions within the social structure. Whilst its increasingly widespread applications in industry, on the one hand, facilitate production processes they also contribute to the marginalisation and displacement of particular groups of people within the labour force (Sivanandan, 1989; Pollert, 1988). Thus, technology can "embody specific forms of power and authority" (Winner, 1986, p. 19). This article considers the view that Technology as a reconstituted subject in the National Curriculum in England and Wales functions to a large extent as a means of naturalising evolving work practices and specific worker awarenesses required within the technological production process. It also serves to legitimate real and symbolic differences created between the new 'technical' knowledge elites and the functionaries within the production process. The accommodation in the technology curriculum of new structural changes occurring within society can then be regarded as an attempt by the state to rationalise, in pupils' consciousness, the basis of a reformulated capitalist economic order.*

Introduction

During the past decade, there has been increasing evidence of policy shifts taking place in England and Wales towards providing pupils with an education more overtly geared to develop the qualities, skills and knowledge required for work within the technological age (DES, 1985). Indeed, technology, vocational preparation, problem solving, attitudes and entrepreneurism were to become linked during the 1980s, in a powerful discourse ensemble developed simultaneously in the FEU (Further Education Unit), APU (Assessment and Performance Unit), MSC (Manpower Services Commission) and the TVEI (Technical and Vocational Education Initiative) and, thence, became incorporated into *Technology in the National Curriculum 5–16*. Although within the whole policy ensemble the commitment to these goals is somewhat equivocal and often contradictory, the vocational and economic meanings constructed in successive government policy guidelines such as *Training for Jobs* (1984) and *Working Together* (DES, 1986) do, nevertheless, feature prominently in the current technological curriculum framework.

This paper explores the social construction of the 'new worker' in the knowledge

content of the technology curriculum during the past decade. In case-studies of the Further Education Unit (FEU) policy discourse during the 1980s and the DES/National Curriculum Council (NCC) documents *Technology in the National Curriculum 5–16* (1989, 1990), it examines the economic and cultural meanings embedded in the notions of 'technological capability' and skills/worker 'flexibility' in the technology curriculum. It is argued here that the shifts in meaning that have occurred within the reformulated technology curriculum (an amalgamation of Art, Craft & Technology, Business Studies and Home Economics) cannot realistically be analysed outside the broader framework of the accumulation crisis that has beset capitalism since the late 1970s. The emphasis provided here relates specifically to the effects of the reconstituted production process on the re-organisation of labour and the emergence of new social relations (Aglietta, 1979) within the technological production process. Thus, it is argued that the technology curriculum provides the context *par excellence* in which the ideological restructuring of social relations is to take place with regard to (a) the redefinition of work, (b) the division of labour and (c) the restructuring of class relations. In adopting this position, the paper seeks to explore and extend theoretical issues raised by Apple (1988) concerned with the political economy of technology as a subject in the curriculum and the effects of technology on the teaching process. Methodologically, it seeks to take on board some of the paradigmatic concerns for educational technology research discussed by Beynon (1989) and Beynon & Mackay (1989). Overall, the analysis represents an attempt to move away from the functionalism of the liberal pluralist framework that has informed much of technology research, and aims towards identifying some of the analytical and critical concepts needed to theorise the 'sociology of technology' in education (Beynon & Mackay, 1989, p. 246).

I focus exclusively on the policy meanings legitimised in key curriculum documents and address these in relation to wider social practices. In doing so, my analysis excludes an overt consideration of the struggles for control over meaning between different interest groups within the policy-formulation arena. This is not to diminish the importance of these struggles—rather, it constitutes an attempt to deconstruct the technology curriculum in order to lay bare the concrete meanings in which knowledge and learning have been grounded. My adoption of a textual/content/contextual analysis is further underscored by the principle that curriculum policy documents (henceforth, referred to as curriculum documents) provide the 'official' categories and frames of reference in which dominant ideas are made available for consideration in mainstream educational discourse. By thus defining the parameters of curriculum debate, they serve to limit what can and should be said about 'knowledge and knowing' (Young, 1971). Moreover, curriculum documents not only provide concrete indications of ideological shifts taking place in policy, but are as Apple (1986) suggests, themselves part of wider cultural production and thus "need to be seen as constitutive elements of a particular hegemonic project"(Apple, 1986, p. 174). In this paper I posit the view that the vocational meanings and worker awarenesses constructed in the technology curriculum constitute an attempt to fulfil the ideological and economic 'mission' (Bates, 1989, p. 217) of neo-liberalism. Curriculum content as a cultural terrain in which sociopolitical, economic and ideological meanings are produced and reproduced thus locates itself within the arena of 'sign' discourse; "it is itself part of an active process of signification in which meaning is produced" (Hill, 1979, quoted in Apple, 1982, p. 158).

Whilst I focus primarily on the relationship between the technology curriculum and the accumulation process, I also locate the shaping of cultural hegemony—and the gaps and mismatches that exist between policy meanings and social reality. It is with this

awareness of 'power-struggle', the 'inner dialectic' of policy meanings, that the correspondences or 'power knowledge' discourses (Foucault, 1980) constructed between education and the economy, between education and the re-organization of the labour force—as well as the structuring of cultural 'truths' within curriculum policy texts—are to be viewed. My own analysis of meaning production in the technology curriculum takes into account that textual meaning obtains a degree of malleability also in interpretation since readers bring to it their own subjective understandings—and, in doing so, create possibilities and opportunities for the fracturing of existing dominant meanings (Street, 1984; Whitty, 1985; Bowe *et al.*, 1992).

Because of the centrality of production meanings in the technology curriculum, I preface my overall analysis with a brief outline of the concepts of labour and production 'flexibility' as have been presented in the debate about capitalist crisis management and the projected societal transition from 'Fordism' to 'post-Fordist' relations of production. Within the context of this paper, these concepts serve primarily as analytical categories, alongside those derived from the 'new vocationalism', to explore the nature of the work practices and worker consciousness embedded in the technology curriculum.

Shifting Paradigms?

It has been argued that new production regimes and capital accumulation strategies have been emerging in response to the crisis that has beset capitalism since the early 1970s (Bonefeld, 1987; Jessop 1988; Harvey, 1989). The emergence of 'post-Fordist' production regimes during the past decade have been heralded as the 'new historical bloc' which signifies a definitive end to the Fordist crisis of regulation (Bonefeld, 1987, p. 97; Harvey, 1989). The 'post-Fordist' production process, it is argued, relies on 'flexible' workers and technology producing differentiated, low cost, quality commodities in order to cater for increasingly competitive and more discerning markets. The new micro-electronics technology occupies a central position in the reorganized production process. Computer aided design and manufacture (CAD/CAM) are seen to play a key role in integrating the flexible forms of labour required to increase productivity by allowing workers to co-operate in design and production. This particular concept of team work, it is suggested, decentralizes power controls within the production process and is seen also having contributed to an increasing pluralisation of the process of control within the work context, as opposed to the top-down, strong controls inherent in Fordist production. The notion of *flexible specialisation* grounded in this model of production, implies closer co-operation between designers and craft workers (often working in different geographical contexts) in the production of commodities, which allows an interactive sharing of expertise to take place (Piore & Sabel, 1984; Murray, 1987; Tomaney, 1990). *Flexible specialisation* also carries with it the promise of craft labour and small scale 'cottage' industry using the new technology to produce commodities for differentiated consumer tastes within an international market (Piore & Sabel, 1984). This notion of *flexible specialisation* has been viewed by many on the 'left' as being, intrinsically, individually liberating to craft workers—enabling labour to free itself from capital. However, this assumption has been subjected to critique by writers such as Pollert (1988), Murray (1987) and Tomaney (1990), in terms of the concrete social relations evolving within the work context. Of these, Tomaney (1990) and Murray (1987) have argued that in reality, the notions of *flexible specialisation* and 'skills/worker flexibility' have, certainly in some industries, contributed to an increase in the individualisation and intensification of work, intermittent employment amongst periphery workers and a steady rise in non-unionised,

low-wage labour. Indeed, the fact that the new micro-electronics technology can be programmed to produce a variety of products to be used for a range of purposes—having minimal requirements for labour, effectively allows capital to use labour only when it is necessary (Sivanandan, 1989). The use of the new technology in the re-organised production process not only plays a functional role in the social division of labour, but has the capacity to replace living labour (Wolf, 1984; Pollert 1988) within some industries.

Moreover, as a social practice the new technology is also infused with symbolic meanings, which, in turn, derive from the values attached to it within the life of the society and, more importantly, the uses to which it is put. Collectively, these 'cultural' variables shape and influence dominant definitions of 'social progress' as well as 'what we all should know and possess' in order to be 'effective' workers and citizens. I consider some of these arguments in the case-studies below. The following case-study of the FEU technology curriculum discourse provides an overview of the context in which dominant meanings about technology were legitimated in the educational policy arena during the 1980s. It focuses, particularly, on key moments when meanings changed in technology discourse in education. It also highlights the dual meanings inscribed into the integrated problem solving model which provides the basis of knowledge and learning in the technology curriculum. This discussion then informs the analysis of the concrete meanings inscribed into *Technology in the National Curriculum.*

Case-study 1: Constructing Technology in the FEU Curriculum

The use of computers in education, on the whole, remained disparate until their use-potential became clarified in the vocational training ethos of the educational reforms during the mid-1980s. Prior to this, computers operated, largely, at the periphery of mainstream education despite the many individual libertarian claims made during the 1970s about their intrinsic 'value' in the learning process (Postman, 1978; Vaizey, 1971, 1972). Teaching 'computer literacy' at the time depended mostly on decontextualised, linear software which were geared to improve writing and 'thinking' skills. In reality though, this particular use of computers in classrooms served primarily as a way of keeping low ability pupils 'busy' in remedial withdrawal groups. Yet a decade later, computers were to feature centrally in the neo-liberal vision of 'education for the 1990s and beyond'.

The concept of 'computer literacy' first entered the FEU policy discourse during the early 1980s as an "entitlement", a "basic skill" and "an opportunity that should be made available to all" (FEU, 1983a). Levels of computer literacy, at the time, were to be developed according to criteria which required students on FE courses to be taught a wide and "not necessarily in-depth" range of computer skills which formed part of the "common core of basic skills" (FEU, 1983a, p. 5) in vocational education. For 'less able' students on vocational training programmes, being computer literate became a "life skill" as essential to individual development as "are other forms of literacy" (FEU, 1983b, p. 46). This view was to alter radically during the mid-1980s when the new technology became increasingly presented as a 'panacea' to diverse economic problems. Already by 1978 UK firms had been warned by Kenneth Baker, then Minister for Information Technology, to "automate or liquidate!" (quoted in Bessant, 1987, p. 163). The DOI, in turn, declared that

> If British firms do not seize the opportunities which micro-electronics offer, the effects will not fall on them alone: inevitably Britain's capability as an exporting

> nation will also be affected. Therefore, the UK cannot afford to let its manufacturing industries miss the microelectronics boat. (Department of Industry, 1978, quoted in Bessant, 1987, p. 163.)

The parallel scene for curricular change was set by the Council for Education and Training (CET) publication, *Microelectronics: Their Implications for Education and Training* (1978). The CET report highlighted the following set of questions to be addressed in education: "What can we do to help people to prepare themselves for a rapidly changing society? What can we do to help people fit themselves for employment in new and technologically advanced occupations? What can we do to help people fill their leisure hours whether the result of a reduced working week or the enforced leisure of unemployment? What can we do to help people to maintain their self-esteem when there are no jobs for them?" (CET, 1978, p. 5). This gives some indication of the way in which the new technology was coming to occupy a pivotal position in the reconstituted view of production—and the need for education to fill the gaps and mismatches created between the world of work and popular expectations.

A major change in perspective took place in 1989 when the concept of 'key' technologies entered the FEU curriculum discourse. The 'key' technologies were defined as "newly emerging topics in science and engineering which are likely to have a major evolutionary effect on an existing product or process or (which) may lead to a revolutionary new product or process" (FEU, 1989, p. 7 information in brackets added). Computers, having been dissociated from their prior link with 'lifeskills' and literacy skills acquisition, were now becoming tied to a new discourse emphasising technical innovation and enterprise in the production process—within the broader context of Science, Technology and Engineering. In an overall sense, educational concerns started to shift away completely from "knowledge about computers" towards "a new approach to the development of technological skills rather than the technology itself" (FEU, 1989, p. vii). Organic links were being established between the technology curriculum, commodity production and the market. The Engineering Council/Society of Education Officers (1988), for example, recommended that "(the key technologies) should be considered in relation to the activities of research, design, development, production, finance, quality, marketing, sales and service" (EC/SEO, 1988, p. 2, information in brackets added). Specific work practices and worker awarenesses, incorporated into an integrated problem solving approach, were now coming to occupy a central position within FEU curriculum discourse. Students were, for example, now to be provided with a broad base of knowledge and generic skills with a sharp emphasis on the basic principles of design (incorporating CAD/CAM), marketing, management, economic awareness and business skills (FEU, 1989, pp. 8–9) as well as co-operative team work. The importance of team-work already featured in the White Paper, *Better Schools* (DES, 1985) which had highlighted employers' support for a broadly-based education and "the development of personal qualities and skills, including motivation and commitment, self-discipline and reliability, confidence, enthusiasm and initiative, flexibility and the ability to work both individually and as part of a team" (DES, 1985, p. 9).

The educational rationale for a shift to practical pedagogies was principally informed by the findings of the APU report *Design and Technological Activity: A Framework for Assessment* (1987b). The findings published in the report were based on the Unit's monitoring of project work done in Craft, Design and Technology (CDT) in schools, and particularly considered the problems involved in understanding design and technological activity.

The APU inquiry into the teaching of Science (1980–84) had already highlighted the positive educational value that inheres within a process-orientated teaching approach, that is, an integrated teaching approach which provided pupils with concrete learning opportunities and the experience of practical problem solving within their learning contexts. Overall, the findings underscored in the APU reports were progressive in their orientation in that they signified an important move away from the prior emphasis in education, generally, on more formal teaching approaches. However, the pedagogical meanings underscored here and the historical role of the APU as definer of successful classroom practice deserve more critical appraisal—especially since the APU was to have a formative influence on the problem solving model incorporated into the technology curriculum. Of special significance is the fact that the 'progressivist' educational ideals underscored in the APU reports on the teaching of Science (1987a) and Design and Technology (1987b), deviated considerably from those that prevailed in the right-wing discourse of the Black Papers during the 1960s and early 1970s—the context in which the Unit had initially been set up with the task of monitoring 'standards' in education. In this prior role the APU had served principally to legitimate state intervention in education during a period of sustained right-wing attacks on educational 'progressivism'—much of which revolved around concepts of holistic, thematic, child-centred education and which supported an integrated, developmental model of learning. Some of these teaching and learning approaches also incorporated problem solving rooted in a critique of everyday social experience (Walkerdine, 1984; Avis, 1991; Rassool, 1986).

Taking into account the nature of the historical relationship that has existed between the APU and education, the defining role that the APU reports now played in providing educational legitimacy to the redefined technology curriculum is, therefore, significant. This can be interpreted in two ways. On the one hand, it could be argued that the new technology curriculum borrowed eclectically from the past to insert specific economic/educational meanings into technology as a reformulated subject in the curriculum and by doing so, provided educational legitimacy to the neo-liberal, market-orientated ideals of the 'new right'. On the other hand, however, the APU's adoption of educational 'progressivist' meanings as its terms of reference can also be seen as reflecting how successful classroom practice had impacted itself on policy frameworks during the preceding decade. If so, the change in focus of the APU can then be seen as having been mediated by the educationalist 'capture' of defining sites such as the APU. However, whichever the influence, what *is* clear is that two key aspects of the technology curriculum, namely, computer literacy and integrated problem solving, having had their origins in a previous phase of educational policy and discourse, had now been reworked, repositioned and given different meanings. With the emergence of new forms of labour process and production they had become tied to a different discursive ensemble within the 'new right' policy framework. A new discourse shaped around technology, problem solving and integrated learning approaches was now coming together as an ensemble of meaning 'practices' articulated in a variety of influential sites including the APU, MSC and FEU.

Following the APU recommendations on the organisation of the context in which learning was to take place, cross-curricular and inter-disciplinary work became a central feature in FE curriculum planning. Within an educational context in which individual work and centralised monitoring have historically been accorded great value, the change in emphasis towards team effort and, similarly, self-monitoring and self-motivation to work was a key development in overall curriculum organisation. As stated earlier, the shift towards team work and cross-curricular learning was clearly a 'progressive' move

towards allowing pupils to work in a more open-ended way that could, potentially, be individually empowering. At a deeper level, however, the integrated methods of work advocated in the new technology curriculum were now also, more realistically, beginning to reflect the skills, qualities and areas of experience intrinsic to evolving work practices. For instance, the need for students to have a broad base of computer knowledge and flexible skills integrated into co-operative team work, could be seen also in relation to the technological production process in which CAD/CAM play an important role in achieving labour flexibility. Here the cross-curricular learning and inter-disciplinary work practices can be seen in parallel with the increasing reliance in the production process on multiple task performance, the elimination of job demarcation and the horizontal integration of labour which places emphasis on workers' co-responsibility (Swyngedouw, quoted in Harvey, 1989, pp. 177–178). These and other meanings linking production to market processes were consolidated in the Engineering Council/Society of Education Officers document *16–19 Education and Training: A Statement* (1988) which advised that "(w)hatever new system comes into being should build on the problem solving approach used in primary schools and progress from a core-curriculum and technical and vocational initiatives pre-16" (EC/SOE, 1988, p. 29). The latter included MSC and industry sponsored mini-enterprises in schools which were geared to develop pupils' motivation, self-sufficiency, literacy and numeracy, communication skills, ability to work in teams, skills for problem solving, decision-making, knowledge and accounts of book-keeping, planning and forecasting skills, a 'yearning' to research, skills in the design process, understanding of quality control issues, marketing instincts and social responsibility (EC/SOE, 1988, p. 29). The links established thus between the principles of a problem-solving pedagogical approach, and the skills and attributes of commodity production and business enterprise, effectively served to incorporate the ideals of educational progressivism into the mores and values of the technological production process, the market economy and 'basic skills' education. This was to be a powerful ideological compromise within the technology curriculum framework. New meanings were being ascribed to the 'progressivist' notion of integrated problem solving which now became located within specific production tasks orientated largely towards commodity production and marketing. The problem-solving model adopted by the FEU outlined the following categories: the planning process (context/task analysis or needs identification), work process (task performance), product (artifact/environment), evaluation (on-task assessment) and presentation (media sales and marketing), and working within this framework, students needed to develop the 'right attitude' towards change.

The emphasis placed on 'worker attitude' was an important hegemonic variable inserted into the FEU curriculum. The prospects of sporadic or long-term unemployment created by the replacement of human labour with technology meant that students would now have to learn to adjust to job-uncertainty as a necessary part of life in the future (see Wolf, 1984, below). Some of these meanings also derived from the MSC funded Youth Training Schemes which were geared fundamentally to develop individuals who, as suggested by Nigel Lawson, then Chancellor of the Exchequer, "would have the right skills and would be adaptable, reliable, motivated and prepared to work at wages that employers can afford to pay" (quoted in Jones, 1989, p. 107). Similar meanings were reflected in the FEU curriculum where training 'needs' were increasingly to be orientated towards the structuring of a neutral, adjustable individual consciousness as a means of ensuring school leavers' unproblematic acceptance of their uncertain futures as workers "within a constantly changing job-market" (FEU, 1983b). Young people would thus require a broad base of skills common to many occupations by

acquiring a "range of generic skills to improve their adaptability and potential for progression" (FEU, 1983b, p. 8). Job insecurity could then be countered if students were to develop generic 'transferable' skills and a 'flexible' approach to changing market-demands for particular forms of labour. Furthermore, high motivation and a 'work-prepared' consciousness would alleviate uncertainties created particularly for low-skilled workers functioning at the periphery of the production process. Again, these meanings had already been legitimised elsewhere in educational discourse. The White Paper, *Working Together: Education and Training* (DES, 1986) had consolidated the basis of the 'learning society' envisaged for 'the 1990s and beyond' stating that "motivation is all important so that attitudes change and people acquire the desire to learn, the habit of learning, and the skills learning brings" (DES, 1986, 1.4). In reality though, students were to be taught positive attitudes of motivation which go beyond the immediate competences needed in contemporary employment to be able to adjust to evolving needs within the production process. Within a context of permanent job insecurity the assumption was that "employees (would) need to want to learn, so that training becomes almost a reflex reaction to changing technologies and employment patterns" (Jones, 1989, p. 86), effectively, becoming a workforce constantly in the process of being constituted.

As is the case with the emergence of flexible skills and knowledge in the technology curriculum, highlighted above, the affective aspects of experiential problem solving now coming to occupy a pivotal position within the technology curriculum bring into focus the double-edged nature of the notion of motivation being constructed. Whilst motivation and positive attitudes clearly do have the potential to facilitate pupils' learning they, implicitly, also reflect some of the worker behaviour patterns/awarenesses inherent in the social relations of the re-organised production process. According to Ball (1990), "motivation by reward—intrinsic and extrinsic—and a continued positive orientation to learning is essential to the 'post-Fordist bargain which offers security in turn for flexibility'" (Murray, 1988, quoted in Ball, 1990 p. 126). Whether such employment 'guarantees' are borne out in reality is, however, a debatable question. This is especially pertinent if we take into account the capacity of the new technology to replace vast sections of workers in the production process as has been, notably, the case in the car industry. Wolf (1984), for example, argues that the second generation of robots (post-1979) used in the production process can effectively assemble complete cars, including body-work painting. The only jobs reserved for human labour include those of, *inter alia*, electrical wiring and cooling systems. Wolf (1984) maintains that since 1983 hundreds of these robots have been installed in car assembly plants in West Germany (as it was then) and that on average "every robot now replaces four to ten workers . . . " (ibid., p. 22). The subsequent reduction in labour costs contribute an increase of at least 40% in profits. Added to this, the increasing introduction of short-term labour contracts and the selling of 'yearly work-time' effectively enable capital to use labour when it is required. This, in turn, depends on market demand, thus leading to seasonal work, an increase in overtime for some workers and sporadic part-time work for others. These factors systematically erode the demands for living labour (Wolf, 1984; Pollert, 1988; Tomaney, 1990) thus allowing the distance between the work experiences of those employed at the core of the production process and those employed at the periphery to widen. Moreover, the geographic dispersal of work contexts, implicit in the notion of *flexible specialisation*, would diminish the possibility of collective struggle against oppressive working practices (see also National Curriculum below).

These real social effects and impacts of the re-organised (technological) production

process, highlight the fact that the notions of 'motivation' and task-orientated team work embedded in the problem-solving model as featured in the FEU technology curriculum, in reality, serve a powerful hegemonic function. Here they would mediate not only the mores of task performance within the work place, but also the beliefs and value system of a profit-orientated, technocratic social reality. The social construction of everyday thinking and expectations of what it means to be technologically 'capable' and 'competent' and, therefore, 'employable', serves to refract key aspects of prevailing social reality—in this instance, high levels of unemployment. It offers a new societal alternative in which only 'positive attitudes' to change, worker and skills flexibility, the 'motivation' to work and 'rational self-management' strategies would, theoretically, enable workers to secure individual 'choice' in the job-market. That is to say, only those with the 'right' skills (transferable/flexible), the 'right attitude' and the 'motivation' to adapt to evolving changes would be guaranteed employment in a fluctuating and contracting labour market. By thus attaching neutral meanings to the variables of unemployment and job insecurity, the responsibility for future employment would (theoretically) be transferred to the individual and, of course, the exigencies of the market (see also NC below). This, in effect, lends credence to the view that the notion of labour flexibility has been appropriated strategically as a market and managerial concept (Pollert, 1988) and, as such, functions as a powerful hegemonic variable in the re-organisation of both the production process and labour relations during a period of sustained economic crisis. Certainly, the notions of competent performance, personal accountability and individual skills-ownership (FEU, 1984), inscribed into the integrated 'technological' problem solving model would, at least theoretically, have vast hegemonic potential in relation to maintaining the social equilibrium necessary for an unimpeded process of capital accumulation (Bonefeld, 1987). However, these distinct forms of labour domination in the restructuring of capital are by no means uncontested; they provide an arena of ongoing struggle between capital and labour. Although the steady rise in unemployment during the 1980s would have indicated that the latter is losing out, we are now beginning to witness the emergence, in the social terrain, of some of the contradictions inherent in neo-liberal economic policy. This formulaic market-driven approach to economic and labour policy is in the process of being fractured in the reality of dwindling markets and increasingly high levels of unemployment during a period of sustained economic crisis. In the deepening recession of the early 1990s the collective voices of workers are again beginning to be audible in protest against job insecurity and unemployment.

Conclusions

At least three major modifications to the organisation of curriculum learning during the past decade can be identified within the FEU policy framework. These can be termed:

(a) *the conceptual:* areas of generic skills, knowledge and experience that place high priority on commodity production, enterprise and marketing skills;
(b) *the systemic:* integrated teaching and learning approaches—which seemingly replicate aspects of the social relations of the post-Fordist production process;
(c) *the hegemonic*: the foregrounding in curriculum discourse of the affective variables of 'motivation', 'attitude' and 'personal efficacy'.

Thus, although progressive teaching and learning approaches placing the learner at the centre of the education process are being advanced, the form in which the curriculum

knowledge has been organised in the FEU curriculum framework, also serves to legitimate concrete production meanings as well as the ideological principles of neo-liberal market-forces policy. The meanings constructed could thus be interpreted as serving to legitimate the restructuring of production and the re-organisation of labour relations during the perceived societal transition to the technological mode of production. Curriculum changes, in this instance, can therefore also be seen as the state's response to the potential threat to social order implicit in an uncertain employment market. They could also be seen as helping to maintain social consensus during a period of sustained social dislocation by serving to re-constitute the 'social character' (Williams, 1961) in terms of the anticipated 'needs' of the technological production process.

Case Study 2: Technology in the National Curriculum

In the following case study I use a set of categories derived, largely, from the 'post-Fordist' production process as alternatives to those defined in *Technology in the National Curriculum 5–16*. It is intended for these to bring into focus the specific production skills and worker awarenesses legitimated in the technology curriculum, and also, to highlight the inherent contradictions and the tension in which these meanings exist. Although I focus mainly on textual/content meanings I also take account of the fact that curriculum meanings are mediated not only through the visible policy content, but also in its 'silences'; 'that which it does not say' (Eagleton, 1976; Williams, 1980). Drawing on the economic and ideological meanings constructed in the FEU curriculum policy discourse, I want to examine how and why a particular selection of 'technological' knowledges has been incorporated into the curriculum at this historical moment and which areas, by that omission, are excluded. In the first section I concentrate on curriculum *content* in order to highlight some of the correspondences that may exist between technological knowledge in the National Curriculum and new cultural awarenesses, and the tensions in which these meanings exist. In the second section I examine the *process* through which learning will take place and juxtapose the awarenesses, thus developed, with the redefinition of work and the reorganisation of labour relations in the technological production process. The analysis is by no means extensive and, because of limited space, excludes consideration of how meanings change in the implementation process—this forms part of my ongoing research. The analysis provided here will, hopefully, be substantive enough to establish essential points.

Curriculum Content

The technological production process itself is credited as being more flexible than the rigidity inherent in the semi-automated assembly-line Fordist production process (Aglietta, 1979; Pollert, 1988). This relates, in part, to the fact that the new technology can be programmed to produce a variety of products to be used for a range of different purposes, with minimal labour requirements. Labour and technological flexibility, it is argued, enhance the scope of product diversity and can, therefore, cater for increasingly more discerning consumer markets. The relative ease with which a diversity of products can be manufactured with the help of the new technology has increased pressure for ever-evolving new markets - and, *de facto*, the dynamic re-construction of consumer 'needs' and 'wants' aimed at fulfilling market demands. Advertising and product presentation using different forms of media imagery assume important positions in the social construction, the media 'packaging' of, largely, ephemeral consumer needs. The

mediation of a fragmented, kaleidoscopic reality evident in the differentiated and, largely, transient tastes, desires and choices reflected in ever-present, ever-changing media images, art and design serves "to integrate the production of commodities into cultural production" (Jameson, quoted in Harvey, 1989). I explore below the construction of new cultural meanings in the knowledge content of Technology as a National Curriculum subject.

Differentiated production. Pupils are already at key stage 1 taught to consider the importance of consumer 'choice' in the manufacture of artifacts: they are to be taught, for example, to "recognise a variety of forms resulting from people's different values, cultures, beliefs and needs" and to "recognise aesthetic qualities in things around them and use them in their work". Pupils are to be taught the centrality of consumer choice in the production process in that they are to learn to "recognise that people like certain objects, but not others, (to) find the reason why and use this knowledge in their designing and making". Similarly, they are to learn to "take account of people's reactions to aesthetic characteristics", to "make the connections between aesthetic characteristics of natural and manufactured objects and (to) relate these to their own work" and to "recognise the importance of consumer choice and hence the importance of product quality and cost". They should also be taught to "consider the needs and values of individuals and groups from a variety of backgrounds and cultures". There is a natural progression in the levels of skills to be developed at key stage 2 in order to allow pupils to establish the connection between products and consumer choice: pupils have, therefore, to be taught to "know that the needs and preferences of consumers influence the design and production of goods and services". At key stages 3 and 4 these meanings become integrated with quality production and product presentation: pupils have to learn, *inter alia* to "aim for high quality of accuracy and presentation" and to "work together to establish criteria for appraisal of design and technological ability". Pupils are to be encouraged to exploit the design aspects, the customs, surface images and representations of different cultures, and the variety of consumer choices that they generate, and then to incorporate these awarenesses into the production process. This knowledge mediates the importance of production to cater for a range of consumer 'needs' and 'choices' within a variety of sociocultural contexts. The surface elements of cultural exotica thus become highlighted and pupils are required to explore design possibilities in order to gear commodity production to the needs of particular, specialised, international markets. Subliminally, it serves to mediate an image of a 'classless','global' society in which patterns of consumption define the range of categories in which consumers can aspire to the fetishism of international designer living. Commodity production would, therefore, rely on a preferential reconstruction of past styles that echo past forms (Harvey, 1989) and, having the sole concern of product marketability, product research would centre on selected cultural and historical images. A deeper understanding of the unequal relations between the 'developed' and 'under-developed' world set up in international trade agreements, the role of trans-national companies in securing a monopoly in the production of particular commodities— and the negative effect of these on Third World economies (Sivanandan, 1989)—lie outside this knowledge framework. By virtue of this exclusion, the knowledge constructed here divorces itself from society and politics, and by denying the opportunity to explore inner-, intra- and inter-contextual meaning it assumes the status of a 'neutral', 'technical' and 'rational' knowledge. 'Inner' contextual meaning here refers to the development of pupils' subjective awareness

of their roles as both producers and consumers. 'Intra' contextual meaning refers to their understanding of the relationship between themselves as consumers and the processes of the market, for example, how consumer 'needs' and 'wants' are shaped in media advertising based on consumer stereotypes of age, gender, 'ethnicity' and 'classlessness'. 'Inter' contextual meaning refers to their knowledge of the function of the consumer-market within the broader framework of international capitalism. In other words, why consumer choice has become a 'democratic right' within the free-market economy of advanced capitalist countries and a privilege to a small elite in the 'developing' and 'under-developed' world. Knowledge that is intrinsically political is, instead, presented as neutral and unproblematic technical 'know-how'.

Enterprise and initiative. These categories derive from the context specified for learning at key stage 2. This states that "(w)ithin the general requirements of design and technology, activities should encourage the appraisal of artifacts, systems and environments made by others as well as the application of enterprise and initiative" (DES, 1989). Pupils are to be taught to "organise and plan their work carefully, introducing new ideas, so that their work improves", to "propose modifications to improve the performance and appeal of existing products" and to "investigate artifacts, systems and environments to find new ideas for designs". They are also to learn to "break design tasks into sub-tasks and focus on each in turn as a way of developing ideas", and to "generate ideas and develop them further using a variety of techniques and media". These entrepreneurial awarenesses draw on the meanings constructed in the FEU curriculum framework during the early 1980s, as well as the MSC funded TVEI mini-enterprise projects in schools during the mid-1980s. Although learning is located here within a task analysis framework which is grounded in problem-solving approaches, the need for production to generate innovation, entrepreneurship and enterprise in order to maintain a dynamic market is, nevertheless, foregrounded in these technical tasks. These market-centred meanings follow through progressively at key stages 3 and 4.

Quality control, cost effective production and worker efficiency. As seen above, meanings re-inforcing quality production are evident already at key stages 1 and 2. In addition, at key stage 1 pupils have to "consider how well their products were designed and made, propose simple modifications to improve the effectiveness of designs and to overcome difficulties when making them", as well as to "reflect, individually and in groups, on how they went about their work, and whether changes might be needed". Pupils are encouraged to 'analyse', 'evaluate', 'justify', 'identify', 'use judgement' and 'consider', and would thus be developing a range of higher order thinking skills. Educationally, these are sound ideals to strive for in that they would involve pupils in making concrete evaluations, informed decisions and also provide pupils the opportunity to explore alternative ways of solving problems—individually and as members of a group. At the same time, however, the skills and awarenesses developed here also serve, implicitly, to encourage self-monitoring and appraisal as an integral part of practical 'on-task' behaviours in production-orientated problem solving. Equally, the notion of group appraisal that features here emphasises workers' co-responsibility, learning-by-doing integrated into long-term planning and quality control as part of the work process. If viewed in relation to new forms of labour control emerging within the work context, these 'flexible' work practices raise key questions regarding the quality of workers' real life experiences. Tomaney (1990), for example, maintains that the notion of flexible workers within an integrated, self-monitor-

ing production process, in practice serves to intensify labour. Learning-by-doing integrated into production, essentially involves the detection of defective parts of the commodities produced (Swyngedouw in Harvey, 1989). At key stage 2, these on-task monitoring skills are extended to also incorporate time and resource management: pupils are then to be taught to "allocate time and other resources effectively throughout the activity", "use knowledge and judgement to make decisions in the light of priorities and constraints", "avoid wastage of materials" and to "know that costs include time, people, skills, equipment and materials". They are also to be taught to "know that, in the production and distribution of goods the control of stock is important". At key stage 4 efficient production is approached as a whole process, and combines the knowledge and skills acquired at the previous key stages—at a higher level of production. The worker controls operating here start at the planning stage and include costs, resources, time, quality and evaluation of the final product—and, eventually, an overview of the whole production process. Pupils should, for example, be taught to "prepare a flow-chart and a detailed work plan to achieve the objectives of the design", "estimate the operating costs of a system, its dependency on other systems, and evaluate its efficiency", "develop test procedures, including those of quality control" and to "use techniques for planning effective cash flow and budgeting systems, including computer modelling, where appropriate, to evaluate options". The work process is, therefore, labour intensive and, again, although pupils are given the opportunity to make practical judgements and estimates, the meanings of cost-effective production, nevertheless, feature centrally. This emphasis on task-orientation serves to legitimate the idea of the production process as a rational, neutral process in which workers 'naturally' participate—unquestioningly. It excludes a consideration of workers' subjectivities and experiences—their needs, rights and working conditions within the work place. The concept of worker democracy to negotiate on levels of stress, job satisfaction, exploitation, discrimination and wages are, therefore, not taken into account in developing pupils' understanding and awarenesses of the realities of the work place.

Marketing, presentation, sales and profit income. Selected aspects of marketing feature at key stages 1 and 2. Pupils are to be taught, *inter alia*, to "consider the influence of advertising on consumers", to "identify markets for goods and services and (to) recognise local variations in demand", "plan and structure their communication of ideas and proposals" and to "develop styles of visual communication which take account of what is to be conveyed, the audience and the medium to be used". Again, although educationally, these meanings re-inforce higher order thinking skills as well as pupils' awareness of audience and communication skills, ideologically, they also serve to naturalise market-awareness in pupils' consciousness. Marketing skills feature prominently at key stage 3 when pupils are required to "understand how market research can be used to measure consumer needs and market potential", to "recognise the relationship between price, cost, income and competition in the market for goods and services" and to "collate, sort, analyse, interpret and present information in a form appropriate to the purpose and the intended audience". Cumulatively, these learning opportunities would serve to induct pupils into the primacy of the profit-motive in the production of commodities. At key stage 4 the marketing techniques become more complex and technically sophisticated, and are directed at international markets: pupils are then to be taught to "present their proposals to an audience, using a range of methods and media", "use modelling techniques to communicate design proposals", to "use symbols and conventions that

have a meaning for an international audience" and to "develop specialist vocabulary, symbols and formulae in communicating ideas". The focus thus shifts to the transactional and the presentational, centring on the projection of images in the marketing of products. That is, advertising and product presentation within the broader social terrain where the use of different forms of media imagery assume an important position in the social construction of consumer needs. These images ultimately serve to shape and influence the aspirations, desires, subjectivities, life styles and values of larger groups of people, and, in this way, play an important role in the construction of a 'consumerist' cultural knowledge.

Curriculum Process

The cultural and production meanings constructed in the programmes of study are consolidated in the attainment targets which assess levels of 'technological capability'. The attainment targets follow a problem-solving process which assesses pupils' levels of skills and knowledge in 'identifying needs and opportunities', 'generating a design', 'planning and making' and 'evaluating' and primarily derive from the APU Report *Design and Technology Activity* (1987b). Attainment Target 1 assesses pupils' abilities to evaluate/assess market demands, initiative and enterprise awareness, as necessary prerequisites to the production of commodities. Particular importance is attached to the product's practical use or applicability and, more importantly, its saleability. Levels of skill are assessed in criteria which also evaluate pupils' abilities to use market research techniques, as well as their abilities to produce production rationales based on information gathered. This is re-inforced in Attainment Target 2 'generating a design' which describes the skills and knowledge needed to compile a feasability study with the view to product design. In the world of work, this task performance describes the job responsibilities of the project manager within the production team who has to establish the financial and technical viability of the production enterprise by ensuring that the product meets the market requirements specification. Attainment Target 3 'planning and making' assesses pupils' abilities to work efficiently in the management of production including time and resource management as well as task performance. Pupils need to show evidence of flexibility, innovation and enterprise in their work process, as well as the ability to produce quality products. Collectively, these meanings describe key aspects of the worker awarenesses required in the technological production process, including an understanding of the market. Attainment Target 4 'evaluating' centres on the complete production process. This describes pupils' ability to monitor their efficiency as members of a production team, task appraisal (including resource and time management, as well as the control of work programmes) and product quality. Translated to the work context, these on-task awarenesses would obviate the need for overt centralised control since a range of worker controls have already been built into the task. Although the controls are horizontally dispersed in co-operative team work, they encompass the whole production process—and are, in effect, more totalising. This surveillance of both task and process in production contrast sharply with the learner-emancipatory ethos inherent in the notion of collaborative/co-operative team-effort that featured within the 'progressivist' integrated learning approach advanced in the APU recommendations. It also contrasts with the worker-liberatory meanings attached to the 'post-Fordist' notion of *flexible specialisation*. In terms of this, the realities of *flexible specialisation* need to be interrogated more closely in order to understand the nature of the correspondences which might exist between the classroom practices of Technology as a National Curriculum subject and prevailing work

practices in the technological production process. Tomaney (1990), for example, maintains that whereas in Sweden and West Germany *flexible specialisation* does appear to have improved the experience of craft workers in the production process, in Britain, certainly in the car manufacturing industry, "... the principles of scientific management underlie the introduction of information technology, not emancipatory craft work" (Tomaney, 1990, p. 49). Indeed, Tomaney argues that sections of industry such as car manufacturing plants and coal mining in the UK, have, in fact, become more labour intensive in order to increase capital profits, and unprofitable coal pits are closed down and workers made redundant. Similarly, Murray (1987) cites the centrality of racial and gender divisions in the 'flexible' work practices advanced in the factories of the 'Third Italy' where immigrants from North Africa do the heavy manual labour tasks and women provide a major source for unskilled labour. Murray (1987) argues further that "(t)he geographical fragmentation of distinct phases of a product's labour process works to create maximum wage differentials between different groups of workers" (p. 88). 'Periphery' workers are, for instance, also to be located within the wider context of international capitalism in which transnational corporate business interests (working in concert with national governments) play a pivotal role (Sivanandan, 1989). This international 'export' of production tasks suited to specific forms of labour, in reality, globalises production and, in the process, enables unequal class relations to be structured within a broader terrain. The notion of 'worker flexibility' in UK production processes is further problematical if considered in the light of workers' everyday experiences. A Ford worker, for example, described flexibility in the production process thus:

> Flexibility means that every 102 seconds a car comes by, and not only do you have to screw something into the car, but in between you have to tidy up, check your tools, repair things and check you've got enough parts. You do not have a single job anymore. If there is no work on the line, they move you to where there is work. You are working the whole time. (*The Financial Times*, 8.2.88, quoted in Tomaney, 1990, p. 48.)

In reality then, where flexible work practices have been incorporated into the production process they have not necessarily improved the quality of workers' experiences. As Aglietta (1979) suggests, "widened work is just as empty as before, and as completely reduced to pure duration as was earlier fragmented work (Fordist assembly-line production)" (p. 129, information in brackets added). It could then be argued that, as was the case with the transition to assembly-line Fordism, the emerging technological production processes within some industries have, seemingly, also taken up "the principles of Taylorism and put them more effectively into practice, to obtain an ever greater intensification of labour" (Aglietta, 1979 p. 117).

Similar 'mixed' meanings are also reflected in the technology curriculum where, despite the emphasis on integrated problem solving, based on collaborative and process-learning approaches, the notion of self-monitoring grounded in quality control and task appraisal in the evaluation process signifies an increase in labour intensive work. Attainment Target 4, 'evaluation' can also be interpreted as legitimising the self-monitoring used in, for example, time economies such as the 'quality circles' used in the Japanese 'just-in-time' (JIT) production system. JIT strategies are fundamentally geared to maximise worker production by "reducing wasted labour, materials and imbalances in the (production) line—and lead to a new emphasis on total quality control" (Tomaney, 1990, p. 49). Thus, whilst on the surface, the work practices that feature in the technology curriculum do approximate some of the organisational aspects of the 'post-Fordist'

production model, affectively, they can also be seen as emphasising key aspects of Japanese production strategies.

Curriculum changes then, as is the case with the restructuring of production processes and labour relations during a period of sustained social and economic crisis, can then be seen as a process in flux, signifying an incompleteness and partiality of degrees of shifts taking place rather than a definitive ideological break. In terms of this, we can identify trends, but cannot present definitive points of closure.

Nevertheless, whichever specific work practices are ultimately to be adopted generally in UK production processes, what *is* evident here is the fact that key elements of the technocracy are being constructed in the sub-text of the existing technology curriculum. These meanings serve to legitimate the importance of, *inter alia*, production and worker efficiency, cost-effectiveness and quality production, well-motivated and flexible workers; the 'inevitability' of low employment levels and permanent job-insecurity as 'natural' outcomes of the technological production process, as well as the centrality of the market as a 'rational', 'neutral' and 'technical' control mechanism. The new technology curriculum can then be seen as performing a regulatory function in its legitimation of selected forms of curricular learning. The skills and awarenesses to be developed would, therefore, serve to reconstitute the 'social character' according to the evolving needs of the technological production process (Williams, 1961). Moreover, the framework in which 'technological' knowledge has been organised, subliminally, also provides pupils with a predefined frame of reference in which to interpret selected aspects of the world-as-lived—and in this construction, excludes those skills and awarenesses necessary to function as active participants in a democratic society.

However, these meanings do not translate unproblematically within the teaching situation. It is perhaps in the logistics of their implementation by teachers working in under-resourced classrooms, and already overloaded by the teaching and assessment demands of the National Curriculum, that the struggle for control over meaning in the technology curriculum will finally take place. The debate about technology in the curriculum still needs to be politicized.

Conclusions

The continuing neutral treatment of technology as a subject within the National Curriculum framework neatly avoids addressing those impacts of technology that include dominant power interests. It also neglects to address the pivotal role of technology in the continuing struggle to secure the basis of advanced capitalism and its accompanying unequal social relations within a global context. Moreover, in the absence of a coherent critique, the centrality of worker/skills 'flexibility' and positive worker attitudes within the technology curriculum discourse, have allowed the crisis of capitalism to be constructed as being, primarily, a problem of labour management " . . . and (that) its solution lies in the flexibility of adaptability of labour, both in the work place, and in the labour market" (Pollert, 1988, p. 43). Emphasis on the need to have adaptable and motivated workers deflect from the material base of contemporary capitalist crisis involving not only production, but also capital investment, exchange, trade agreements and labour control—within the wider context of international market competition.

The significance of these 'silences' in educational discourse is that they present an ahistorical, de-ideologised and de-politicised view of technology as a curriculum subject, as well as technology in society. We need to examine technology as a cultural phenomenon which has evolved within the historical relationship that has existed

between producers and consumers, and those who control the means of production. We need to deconstruct the dominant paradigm.

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