The technological aspects of the Secondary School Curriculum

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What schools must provide — what "entitlement", to use current terminology — in technology and design is becoming clearer. It is also obvious that the new will differ greatly from the old. However, alongside clarifications are confusions, confusions that range across a number of school curriculum issues. Although the distinctive separate subject design of the National Curriculum will inevitably dominate the thoughts of all subject teachers, some subjects, particularly Technology and Design, will require very careful study. Implementing it appropriately will require ensuring that learners benefit from the experiences provided perhaps via a range of school subjects. These benefits will need to be demonstrated as appropriate to life in the twenty first century. The curriculum is required both to serve the individual in adapting to contemporary life and to facilitate the aadaption of commercial social systems.

It was ever so, but the present situation demands massive re-appraisal of what schools must provide: assuming that what is now provided is generally inappropriate, out of date and out of step. That a subject-based curriculum design will best serve the new expectations, however, begs many questions. Certainly the thinking implicit in the programmes already provided under the Technical Vocational and Educational Initiatives (TVEI) requires subject matter in Mathematics, English, Science etc to be associated, as they manifest themselves in situations outside school.

The incorporation of all the statements of attainment and programmes of study in NCC documentation into the existing pattern of school subjects is also still unclear. A crude strategy will be to carve up the NCC documentation and spread it across existing school subjects by the tactic of 'curriculum auditing'. Whilst this will have the politically advantageous effect of retaining the confidence of teachers of CDT, Home Economics, Business Studies etc as well as allowing co-operation, it could provide tension and conflict if the coherence of technological and design thinking does not emerge in the minds of both the teachers and the learners. Secondary Schools need subtle management to achieve coherence of thought and action in technology and design. Some schools may try to develop coherence by making one department out of the contributing group of Business Studies, CDT, Home Economics responsible for the monitoring of programmes. In large schools one department may possibly take on the whole teaching job. A faculty structure may facilitate a potentially successful approach here. Whatever plan is adopted, the skills of individual teachers will have to be fully reappraised and re-aligned.

Addressing this dilemma involves consideration of what counts as a school subject and what aspect of subjects meet common knowledge requirements and of ways of relating knowledge. Educational philosophers have debated all this at length, and, in the UK, so have HMI, the DES, SCSST and the Schools Council.[1, 2, 3] The National Curriculum proposals (variously Design and Technology, Technology and recently, Technology including Design) and TVEI, have been superimposed on the school subjects with little regard to their influences on coherence.

Coherence via Integration of Technological Subject Matter

It is easy to claim that thinking about a concept that straddles subjects will become coherent merely because each subject considers it. But "the ability to grasp what is meant by applying theory to practice" is often generalised in one pupil's school report as "able to use theory to good effect" for one subject and as "unable to relate to theory" for another. It may be assumed that there exists an abstract ability "to relate theories to practice" that is subject free. Some teachers may doubt this. We will need to clarify our commitments school by school, if attainment targets are to spread across established subjects. A less contentious unifying principle might be the "significance of energy in society" but even this is a potent source of confusion and duplication of effort in school. Writers such as Gagné[4] have argued that the higher order and unifying principles emergent from analysis of social and individual needs ought to contribute to systematic determination of learning experiences intended to develop coherent thinking.

It is difficult to recognise how such a policy can be easily superimposed on what are thought to be preordinate principles contributing to aims in disparate subjects, especially in the minds of teachers whose subject allegiance predominates over inter-subject relationships.

As an entitlement curriculum, the National Curriculum is to direct attention to broad ends rather than specific means. Consequently the anticipated outcomes to be measured by SATs, will greatly occupy senior school management and school governors, who will feel bound to develop curriculum means via management strategies which serve tangible ends. Tangible to them that is.

This is further complicated by a public examination policy at 16+ which is associated more with established and disparate subjects, especially if option schemes are to continue to be encouraged.

All in all, delivery of the technological aspects of the school curriculum, based on a divisive subject pattern between the ages of eleven and sixteen, is bound to be highly complex if accommodation to existing and new demands is to be accomplished satisfactorily, that is with ten Statutory Curriculum subjects and more than ten school subjects.

If we add to this the anticipated higher/further education and other post-school destinations of late adolescents and the orientations of eleven year olds, the problem of providing a coherent route through technological and design principles is further complicated. In reconciling general cultural needs with the special opportunities to be gained from the technological/design aspects of

the curriculum, planning must become a major focus of attention. Developing the eleven to sixteen technological and design curriculum (building on prior learning), requires anticipations of all pupils' destinations in a post-sixteen curriculum, which has however not yet become clear. Can all this be done by "integrating" and cross-referencing existing school subjects at all stages?

The transition between primary, secondary and tertiary phases raises many more issues. So what actually goes on (and is to go on) at each of these three stages? The variations of teaching styles, the significance of choice, the vocational implications of subject choices and the combinations of subjects contributing to technology and design, post-sixteen in particular, are some issues emerging from the implementation planning for the National Curriculum and TVEI Extension.

The primary school orientation is unifying, smoothing the edges between, say, economic, biological, social, domestic, scientific "subject matter". However the post-sixteen curriculum, with the exception of Certificate of Pre-Vocational Education (CPVE) courses and TVEI, is divisive within technological and design areas. The eleven to sixteen curriculum must reconcile these differences. The National Council for Vocational Qualifications (NCVQ has made noteworthy efforts to emphasise unification and thematic patterns within vocational families).

The secondary school teacher is faced also with the matter of subject validity and subject allegiance. How, in practical terms can "integration" from contributing subjects of art, business studies, CDT, home economics and science etc, be achieved effectively? Team teaching is a possible strategy. Although attractive, the planning and delivery implications are daunting. As Taylor observes:[6]

"It may not be profound or original thought, but I think it worth concluding by stating that team teaching must begin with teamed staff if it is going to be presented to the children."(pp 149)

and ...

"One immediate need is for staffs of team-teaching schools within each area to get together and compare their organisation and methods." (pp 132)

Consecutive teams and teams operating concurrently are needed. It may be that team development of teaching materials will be undertaken, with individual teachers delivering them.

Coherence via a new subject?

One possible alternative would be to develop a new 11-16 school subject from established ones, similar perhaps to the emergence of secondary school mathematics from established algebra, geometry and arithmetic (for which there were specific and unrelated examination papers in School Certificate examinations) and later 'modern maths'. It was never clear why the contributing and related elements of mathematical thought had ever become separate school subjects, except perhaps for reasons of convenience of delivery. Likewise, if we finally determine what the distinctive elements of school technology and design are, school management might recognise that cohesiveness of the commonness of technology and design across what are at present distinctive subjects of CDT, business education, home economics, some aspects of science and art education etc, is a more unifying principle than previously recognised. If society requires schools to develop unifying technological and design concepts, including their implications for contributing to economic development, serious problems in long term curriculum planning arise, such as the training and re-training of teachers. If this is envisaged now, the more acute the problems. Significantly, the National Curriculum *does* regard the unifying principles as paramount, certainly up to age sixteen. Consequently students will be bound to expect school to demonstrate unity rather than diversity in spite of difficulties in delivery.

Broad, balanced and relevant

Breadth and balance is evident in National Curriculum planning, even in technology. Relevance, though, is another matter. It is seldom judged objectively. However broad and balanced the proposers intended course content to be, the crucial issue is how pupils/students identify with it. How, for example will longitudinal relevance be assured? How will one stage build on previous stages? Will explicit and overt planning between primary, secondary and tertiary stages monitor the gradual increase in sophistication of concepts "visited" at several stages? The machinery for such monitoring will need to be in place for every pyramid (even allowing cross-pyramid pupil transfer) to make this appropriate, effective and coherent. The maintenance of lateral relevance relates to the monitoring of educational experience, either across disparate subjects or within an integrated provision as outlined above. The emphasis will need to be on 'experience; and the perceived relevance by the learner. Hence effective profile management will be crucial with the related feedback into formative evaluation processes with the schools. The two distinctive dimensions — *general cultural awareness* and judgement concepts, and *particular and enhanced experience* of the use of these in designing, developing and testing of artifacts, systems and environmental factors — will need to be the points of focus, especially in determining continuity and the potential for vocational and career choice.

A daunting prospect or an exciting opportunity?

In 1979 J B Ingram wrote:[9]

"Viewed from a life long perspective curriculum integration makes an important contribution to educational progress, personality development and the fostering of community. In these roles it serves not just to improve teaching but to enhance living. Far from being simply a teaching technique, it is an essential feature of any curriculum that prepares children for life." (pp 101)

To what degree Ingram's assertion is both true and a feasible principle, either as a directing theme for pupils to identify (with help) the integrative aspect of disparate school subjects contributing to technological thought or as an organising principle justifying a more central focus — a new subject — remains to be seen. The associated integration across other aspects of the school curriculum has led some to argue for general education through technological concepts. This seems to be the motivation for the development of City Technological Colleges (CTCs).

Ingram stresses the importance of planning if curriculum integration is to succeed: "teachers must learn to formulate their intentions and design their curricula in ways that will ensure educational validity and operational effectiveness". (pp 61)

This is easier said than done. What of design and technological education which cannot be contained within school or college departments of CDT, Home Economics, Science, Business Studies, Art etc but requires attention by the whole school and even associated schools to determine how departments/faculties can work together or create new departments? Orientation towards the new perspectives already available for

consideration and to developing a receptiveness to the continuing reaction to needs and opportunities in life-long education has vast implications for educators.

Educators in technology and design especially would do well to follow Glegg in designing educational programmes:[10]

"The third realm of activity is the rational, which represents disciplined thinking applied over the entire field of design from theoretical analysis to economic realities." (pp 21)

Although Glegg does not spell out what should be done, he marks out the value position that design involves much more than the properties and uses of materials for functional and decorative intentions. NCC documentation is fairly explicit about some aspects of intellectualism and business principles. Is this enough?

For Glegg the other two realms of design are the "inventive" and the "artistic". These two realms will no doubt be significant in the design of school curricula.

In a text directed principally at education for Architects — *Educreation and Feedback* — Ritter asserts that:[11]

"The crying need is for a scientific method that not only combines the subjective with the dispassionate or systematic approach. More than that, we need a scientific approach that can systematically take the wonders of science and research that are sprouting pretty aimlessly in a thousand corners and give them more meaning, more worth, greater effectiveness and criteria with a matrix for combining them into a comprehensive whole." (pp 40)

No statement could better express what seems to be expected of Technology with Design 5-16 as a part of the school curriculum.

Means to ends

Clearly the emerging contexts outlined above, especially of technological and design education, require much more debate.[12, 13, 14, 15] Discussions are needed about curriculum arrangements established for a range of purposes elsewhere and now being developed to deliver the new demands via newer curriculum initiatives. The foundation of the National Design and Technology Association should facilitate the exchange of ideas and ultimately clarify some of the issues. Also helpful would be school-based research into the problems of implementing new curriculum initiatives along lines proposed by Stenhouse.[16]

"... research that either issues in hypotheses that can be tested in classrooms or that illuminates particular cases that can be judged against experience."

We are certainly at this time greatly in need of illuminated experience.

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