Bernard Hill
Shoreditch College

A Future for Graphic Communi-cation*

The current state of flux in school curricula brought about by the Debate, the considerations of a common system of examining at 16+ and the implications of the Schools Council 18+ research programme into studies based on N and F proposals can either be seen as an interference with the smooth running of schools, or as opportunities to question some of the assumptions on which the smooth running is based. In either case, and whatever the eventual outcome, 'things will never be the same again' even if there is no change in the system.

I prefer to accept that although there is continuous review of curriculum content and attendant changes, the current opportunities should be grasped with both hands. For example, though the problems of implementing a common system of examining at 16+ have proved to be too major for it to come about, thé pilot schemes already developed and in use by the consortia will doubtless provide evidence and experience of value in reappraising the more entrenched examination systems.

Mechanical Drawing, Engineering Drawing, Technical Drawing and like titles with or without the prefix 'Geometrical and', have not only been used to *describe* an area of study within schools in the post war period, but have also largely *prescribed* the content too. Whatever happened to the vision expressed at the turn of the century by Solomon Barter, organiser and instructor of manual training to the London School Board, in his Introduction to *Manual Instruction – Drawing?* Although one may not now altogether agree with parts of the philosophy in contemporary concepts of education, one can ill afford to be so complacent as to think that what masquerades as education in many school drawing offices, and which is reinforced in some measure by the influence of external examinations, appreciably attains the vision of Barter:

'Drawing of any kind is in itself a form of manual training. A child's hand must acquire dexterity, and his eye must be trained to accurate and intelligent observation, if he is set to draw.

The stimulation of the imagination and the strengthening and directing of the spirit of enquiry in the child mind are of themselves objects which every teacher regards, if not indeed as the goal of his labours, at least as the hardest portion of his work; and all will agree that, when once enthusiastic attention is secured in the pupils, the mere imparting of information is as much a pleasure to the teacher as to the class.

Drawing is, when properly taught, one of the subjects in which this can be most readily achieved; but not, however, by a series of spiritless, flat copies of conventional curves combined into 'nondescript vegetables' which still find a measure of acceptance into our schools.

Drawing itself is essentially a living, interesting subject which is a mode of expression, in one or other of its forms, of any perceptions or emotions of whatsoever kind.

It lends itself with equal ease to the inspiration of the great artist, the humour of the caricaturist, or to the most exact necessities of the map maker or the engineer. It has at once the language of the vaguest suggestion and the utmost precision.

A careful teacher, intelligent, knowing his subject, and unhampered by restrictions, has in his hands, by reason of its very adaptability, one of the strongest means of education'.[1]

Although laden with qualifying phrases, we could do far worse than to take this eighty year old statement as a starting point for any developmental work envisaged in connection with syllabus revision. Peter Booker, in his *History of Engineering Drawing*[2] traces the influences during the evolution of the subject up to the 1960s, amongst which influences are the works of da Vinci, Farish's *Isometric Perspective* of 1820, William Binns' *Elementary Treatise on Orthographic Projection* of 1857 which followed Blanc and Armengaud's *The Engineer & Machinists Drawing Book* of 1855, Barter's aforementioned *Manual Instruction – Drawing* of 1896, through to the universally known Parkinson's *A First Year Engineering Drawing* of 1933. This latter text, written as a National Certificate textbook has probably had the largest single influence on the school syllabus in recent years. In transposing the type of drawing exemplified in Parkinson's work into school textbooks, authors often seem to have failed to answer the question 'Why', concentrating on 'What' instead. That is to say, giving precedence to content regardless of philosophy.

In implying criticism of the current scene, it is easy to lay down oneself equally open to criticism by giving advice rather than by affording help, the former being by far the easier. Earlier, I accused the subject titles of *prescribing* rather than *describing* the area of study. How one communicates intents without falling into the same trap has exercised

Footnote

This paper was initially written early in 1979 whilst the author was following research into design education and Craft, Design and Technology at the Royal College of Art. The views expresssed are not necessarily those of the Royal College of Art, or of Shoreditch College where he is a senior lecturer in the department of design technology.

the minds of education and curriculum researchers considerably. Teachers of Technical Drawing will be hard pressed not to have heard of Bloom's *Taxonomy of Educational Objectives*[3] as it has been used in reference to the subject on many occasions, not least in the Schools Council *Engineering Drawing at GCE 'A' level*.[4] To what extent the Taxonomy has been read and its implications and reservations understood by those who choose to base their work on it must be questioned. Those familiar with the criticisms of Gribble[5], Sockett[6] and Pring[7] *et al* will credit Bloom and his team of researchers with having made a major contribution to the debate on curriculum, particularly in relation to objectives, but at the same time realise the shortcomings of the Taxonomy when one attempts to use it as a basis for measurement of attainment. (Very briefly, it does not seem possible to assess abilities identified in the higher orders of the Taxonomy's hierarchy devoid of lower abilities, or to assess cognitive domain objectives divorced from those of the affective domain, and in the case of drawing, divorced from the psycho-motor skills through which expression takes place).

Rather than add column centimetres to the epistemological issues as to whether objectives are educational, can or cannot be specified *a priori*, must or need not be assessable in specific terms, I prefer to adopt the curriculum process stages as evolved by D.K. Wheeler.[8]

Wheeler defines curriculum as 'the planned experiences offered to the learner under the guidance of the school'.[9] The choice of words is significant as is the omission of specific reference to the teacher, reinforcing the notion that schools are primarily about children and learning through experience.

The five phases accorded to the curriculum process are as follows:

1. The selection of aims, goals and objectives.
2. The selection of learning experiences calculated to help in the attainment of these aims, goals and objectives.
3. The selection of content (subject matter) through which certain types of experience may be offered.
4. The organisation and integration of learning experiences and content with respect to the teaching – learning processes within school and classroom.
5. Evaluation of the effectiveness of all aspects of phases 2, 3 and 4 in attaining the goals detailed in phase 1.[10]

What relationship might exist between teachers and external agencies in bringing about change in the curriculum? Ideally, teachers in concert with colleagues, should determine each of the phases within the overall school structure, using external agencies for guidance and moderating of assessments should such be necessary for societal or other reasons. In recent years, primary school staffs seem to have given the lead to their secondary school counterparts, many of whom are wedded to the influence of examination syllabuses as it has osmotically tainted learning throughout their schools. There is no shortage of staff room comment concerning external examinations, yet it seems that the status quo is accepted, at least if judged by the lack or take up of the Special Paper facility of G.C.E. Boards and the far from universal use of Modes 2 and 3 of the C.S.E. system, although over 5 years from 1972 to 1976 there was an increase in Modes 2 and 3 entries over all subjects from 18% to 26%.

Teachers' Centre development groups, LEA and DES short courses and national projects each act as stimulus, but it remains with school staff to develop the framework within which the content, organisatio and integration of learning experiences can be built.

Before attempting to offer such a framework, I would like to return briefly to the title of the subject. The N & F propposals submitted to School Council by the Technical Drawing syllabus steering group proposed the title 'Technical Graphics'. To me this is little improvement on the earlier 'Technical Drawing', and in the light of other developments seems to be a regression from the more commonly accepted 'Graphic Communication'. It is no longer possible to use requirements of industry as a basis for subject content, and in this context, 'Technical Graphics' has vocational overtones. Figures taken from 'Occupations in Engineering'[11] can be used to show that 0.25% of the working population are classified as draughtsmen, that is, the producers of drawings, and that something under 5% of the working population, from managerial to craftsman level, will have need to read engineering drawings. This is not to say that other occupations are devoid of the need for the ability to produce graphic information by some employees, and the need to read and interpret such information by others, but rather to suggest that whilst the language of graphic communication needs to be universally understood, the essays should not always be about the same subject. Information presented graphically is now an established element in the daily lives of most people, irrespective of vocation. Temperature and blood pressure charts at the foot of a hospital bed convey to the consultant, information about the patient as clearly and unequivocally as do the laundry care labels inside a garment to the launderer. Stylised and symbolic route maps are as essential to the traveller as histograms and pie charts are to the educated man in the street.

The evolution and long association of Technical Drawing with workshop crafts, and in particular the virtual exclusive use of formal drawing in accordance with the biblical BS 308 for orthographic projections of engineering components and geometrical solids has been a major factor in the discrete uses of drawing in schools, and in particular in the polarisation in external examinations of the philosophies of the Art and the Technical Drawing syllabuses. Little wonder that as the evolution of Woodwork and Metalwork via Handicrafts to Craft Design and Technology with a design education

philosophy has so much leeway to make up before those involved can readily articulate design concepts pictorially at a stage in development. Similarly, D. Boardman with reference to research in geography by D.J. Satterly comments:

'Sixty fourth-year pupils were given a battery of tests to assess conceptual, perpetual and spatial variables. The results showed the main variable underlying performance in mapwork appeared to be perceptual reasoning ... He concluded that in order to improve performance in map-work it was necessary to raise pupils' level of spatial concept. He recommended that the pupils should be provided with experiences in which their attention was focused on spatial arrangement of objects within three dimensions and on their own position in relation to them, as in drawing and model making'.[12]

In Junior and Middle schools, drawing offices with rigid walls and similar philosophy thankfully seldom exist. Drawing occurs as a means of recording, communicating and expression throughout the curriculum, parallel to the written word of English and the numerals of Mathematics, but before protagonists of those subjects take to their quills and calculators in protest, let the analogy be further explained. As the development of competence in the use of language and of mathematics needs nurture for progress towards means of dealing with sophisticated concepts, so will the early experiences of children in drawing need to pass through a structured framework of experience, albeit a loose framework initially, if drawing ability, perceptual reasoning and ability to conceptualise are to be developed in concert. Demands and expectations will need to take account of the stages in individual children's development, from concrete example to spatial conceptualisation and abstraction, likely in the later middle years. To this end, modelling may well provide for drawing the reinforcement provided by speech for the written word and the real world of number for mathematics.

That in a secondary school subject-based curriculum, Art, Craft, Design and Technology, Geography, History, Mathematics, Science etc. all employ graphic communication in one form or another is not disputed. The case being made is that if the philosophy of graphic communication as a language is to become a subject with upper case initial letters, Graphic Communication, then in its development, it must not be orientated towards any one 'subject' to the exclusion of others. This is not to say that once interest has been aroused and initial ability developed, the interest afforded by specific areas of the curriculum should not be used as catalyst for further development. Rather the 'living, interesting subject which is a mode of expression ... of any perceptions or emotions of whatsoever kind' of Solomon Barter to which earlier reference was made, than 'a series of spiritless, flat copies of conventional curves combined into 'nondescript vegetables' which still find a measure of acceptance in our schools'. 1896! Where is progress?

The outcome, or ultimate goal, of a Graphic Communication course will be to have educated children by experience in the understanding and use of visual media related to communication and description of products and environment for making, doing and evaluating.

Alone, this gives little other than philosophical guidance as to what the 'planned experiences offered to the learner', cited earlier as Wheeler's definition of curriculum, will constitute. To amplify this goal, sub-divisions will be needed, but care must be exercised to ensure that these are neither prescriptive nor exclusive. As we are primarily concerned with children, these will be expressed in suitable terms:

To develop the ability of children to:

articulate ideas and concepts graphically through pictorial and orthographic presentation

understand the language and conventions of communication and resolution

develop graphicacy as a device of memory and as a tool for the development of ideas

translate between verbal, written, numerical and graphic forms of communication

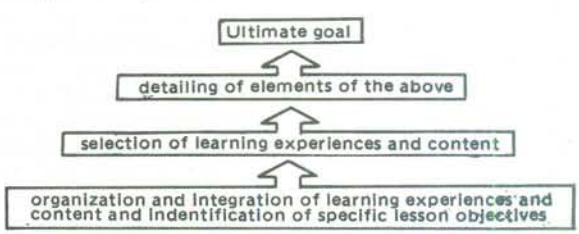
select suitable methods of presenting information and appropriate means of reprography and to prepare work accordingly

resolve numerical and like concepts graphically

respond to stimuli and develop organizational strategies

develop satisfaction from and respect for achievement leading to critical evaluation.

It is tempting at this stage to leave the further development into planned experiences to any teacher who cares to accept them as guidelines. To what extent they can be employed, and to what degree they can be attained will largely be functions of resource available. It should always be remembered that they are sub-divisions of an anticipated outcome of Graphic Communication hence should lead towards the ultimate goal. Similarly, when progressing to the phases of selection of learning experiences and selection of content through which the experiences may be offered, the ultimate goal should be born in mind. A simple, though incomplete model of the process might be expressed thus:



These stages do not align exactly with Wheeler's five stages, for whilst I agree that for purposes of identifying the stages it is useful to separate learning experiences from content, in practice classroom activity is a synthesised experience. It would not be possible to attempt to develop the ability of children

along lines suggested in the earlier paragraph without consideration of content. At the risk of destroying my argument through allowing misunderstanding and narrow interpretation of what follows to be taken as a reason for maintaining the status quo, I will offer some consolation to those who perceive that the baby is in danger of following the bathwater.

At appropriate stages of children's development, and through any area of the curriculum offering relevance, scope and interest, the following topics might be included. They are not hierarchical or necessarily sequencial, and certainly neither prescriptive nor exclusive:

To know of and understand the use of:

pencils, other drawing media and papers – cartridge, detail, tracing, sensitised (sizes, proportions, supply and care)

priority and relevance in graphic statements

graphic symbols in lieu of language – trans-curricular and taking account of conventions, specifications and codes of practice

methods of pictorial representation – informal freehand, formal perspective, oblique and isometric

orthographic drawing including sections and auxiliary views.

Provided that the ultimate goal is kept in sight when structuring a syllabus, it is of little consequence that articulation of concepts through drawing, using appropriate means of expression, scale and conventions, be realised through map making, engineering components, building components and services, operational sheets, electronic circuits or component layouts, flow diagrams or family conventions appropriate to any chosen area, but this is nothing new. Chemical apparatus, electronic componeñt layouts, flow diagrams or family trees. Pupils will need to be familiar with commonly used all have conventional representation equally as well used as those associated with engineering and building drawing. Whilst it would be sensible to commit to memory those which have regular use, it is equally nonsensical to expect to recall from memory of minute detail of rarely used conventions, but rather for their source to be known. An example of this is the detail often called for in current G.C.E. 'O' level examinations in Technical Drawing, of a bolt screwed partially in a tapped hole drawn in section. A case indeed where the detail of the convention has taken over from the original intention. 'But what will examiners do and how will I know what to teach?' is a likely response. This is the challenge to the examination boards and an opportunity afforded in syllabus revision for G.C.E. and C.S.E. now that 16+ is dead. If the outcome is a revamped Technical Drawing with a new name, then it rightly deserves to fade into ignominious oblivion. Modern Mathematics applies many of the concepts of the geometrical section (nets etc.), whilst Design and Craft is making increasing demands on pupils to express and develop ideas graphically. There is little left of the traditional subject, at least to 16+ level, to warrant exclusive subject identity.

How will progress and attainment be assessed? Are these to be the only factors taken into account? Will the authoritarian and prescriptive effects of G.C.E. be continued? Is a single mark or grade sufficient for the purpose, or would a profiled award be more appropriate and if so what will be the determinants of the profile? These are but some of the questions of principle which need to be explored before suggestions for syllabus revisions along established lines harden into reality. It is not within the scope of this paper to attempt to answer them, but as an extension to some of the ideas developed in the paper, examples of the different demands to be made on pupils by Graphic Communication, and some of the criteria which might form a basis for evaluation follow. It is important that concurrent with the evolution of an idea into a project or an examination question, the means of evaluation and the evidence to be used in evaluation should be developed. How far towards the ultimate goal of the course will a piece of work take a child, how will we know that we are along the right lines, and how will we be able to judge how far we have travelled? These are problems which will exercise the minds of teachers and examiners for many hours of discussion. The following examples are presented as offerings from which the discussion may at least commence.

Example 1
Packaging – design and presentation

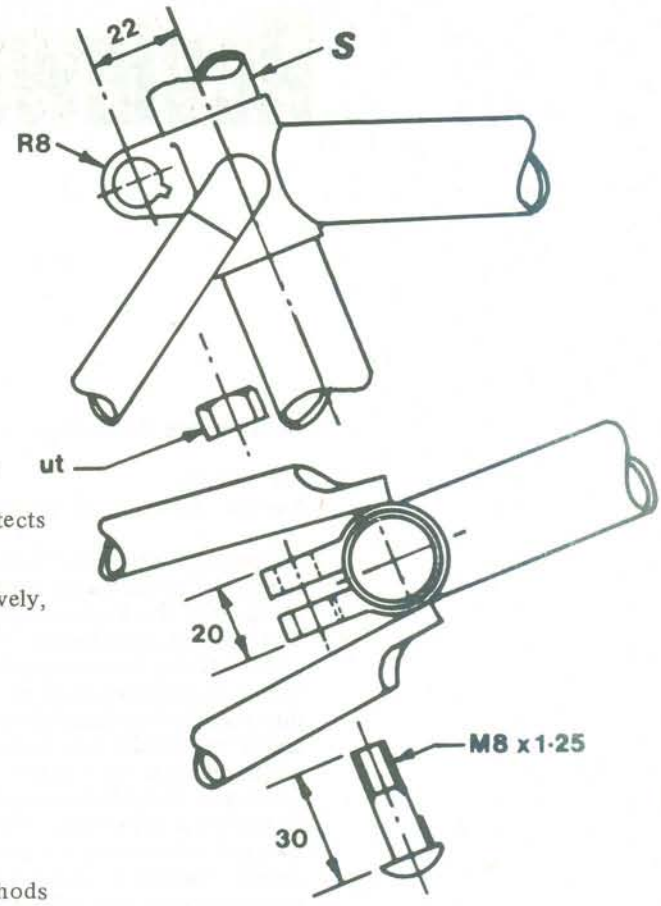
A photograph of a machine made pottery egg cup is shown with dimensions in diagram 1.

It is proposed to market the egg cups in pairs and a suitable pack is required which will protect the pottery from damage during transit and act as an attractive aid to sales when on display.

EGG CUP DIMENSIONS
Height 50 mm
Outside diameter 60 mm
Thickness of pottery throughout 4 mm
Egg recess is part of an ellipse with axes 75 mm x 45 mm.
Centre of ellipse is 8 mm above the egg cup rim.

Egg cups from Grayshott Potter

By sketches, modelling or drawings, design a suitable pack to be made from folded card. You may use scissors and adhesive tape to assist your development of ideas, but the final proposal should be capable of being cut and folded from card with the minimum number of separate pieces. Indicate any printing or decoration and include in it the statement:



Assessment indicators:

Does the answer show an appreciation of the problems:

Functional – that the package holds and protects the eggcups from each other and from external forces

– that it displays them effectively and attractively, with the graphic work on the package adding to the point of sale attraction

– that the package is suitable for multiple packing during transit and group display at the point of sale.

Manufacture – economy of materials

– single sided printing

– minimum of joining or adhesive required (self locking if possible)

– ease of assembly and packing.

Graphic presentation: Have appropriate methods of presentation of ideas and finished design been considered and used?

Are the developed design features translated into the final design?

Can the pupils produce unambiguous graphic statements in good quality

– informally in freehand

– formally through instrument assisted drawing

– through lettering, decoration and dimensioning of the essential features?

The author acknowledges permission of the Surrey Ceramic Company, Grayshott Pottery, Surrey to use one of their designs in this example.

Example 2

Functional Design – engineering detail

The saddle pillar S of a bicycle is clamped in place by a bolt which keys into the cycle frame and a hexagonal nut.

It is proposed to design something else to replace the nut so that adjustment can take place without the use of a spanner.

(i) List the factors you would have to take into account

(ii) Sketch ideas for a device which would meet these factors

(iii) Present the information illustrated in your sketches in an appropriate manner and scale so that a skilled workman would have all the information needed for him to make the device.

Assessment indicators:

Is there evidence from the list of factors or elsewhere in the answer that the pupils have understood the requirements:

– that the device must be able to rotate without causing damage to the cycle frame or to the operative?

– that the device does not protrude so far as to be a source of danger or annoyance to a rider?

– that an adequate shoulder for clamping is required?

– that an adequate depth of thread must be provided?

– that an appropriate finish will be required?

Is there evidence of the pupils ability to:

– translate the above factors into features of the design?

– select appropriate views to show the details in sketch form?

– represent features clearly and in good proportion?

– produce quality linework in sketches?

– select appropriate formal views to communicate to a workman the details, if such is the mode of communication?

– convey dimensional information unambiguously?

– convey, where appropriate, non-graphic information?

– consider means of production and its effect on design?

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