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Language is the single most important tool in the CDT workshop. Its importance to CDT learning and teaching is inscribed in GCSE CDT syllabuses and, strikingly, in the 'National Curriculum' Design and Technology Working Group Interim Report November, 1988.

As regards pupil *learning*, of the five 'attainment targets' 'provisionally identified'¹ in the latter all but No. 4 — 'Make artefacts or systems' — necessarily involve language exchange; and if group as well as individual projects are to be allowed as 'means by which attainment targets might be achieved', which seems to be promised here and there in the Extracts from the Programmes of Study, if not in the Sample Attainment Targets, then we can tick off No. 4 as well.

As regards *teaching*, the indispensability of language exchange is unqualified, in the Interim Report as elsewhere. Moreover, staying a moment longer with that document, the references to teaching (caught in the pervasive use of verbs in the passive voice — 'Pupils should be taught to . . . taught about . . . taught skills . . . trained to make judgements . . . taught knowledge . . .') so preponderate in the Extracts from the Programmes of Study that they might be more accurately labelled Programmes of *Teaching*. In this regard it is worth making reference to an article by Sir Graham Hills (Times Educational Supplement, 20th January, 1989):

'Skills relate but do not belong to the knowledge base. They belong to the person, and only to the person, who has acquired them. They enrich that person in a way that the knowledge base does not. They humanize in a way that knowledge cannot, if only because they are acquired by transfer from human to human. They can only be the result of learning, only secondarily of teaching.'

TALKING AND LISTENING IN CDT EDUCATION

CDT teachers hold forth to groups of pupils: explaining, questioning, answering; they also interact with small groups and individuals. It takes a few seconds to type those verbs, but it takes a professional lifetime to master the art-craft-science their proper performance depends on. Effective explaining in any area of the school curriculum depends

on mastery of what is to be explained; on careful planning — including nice judgement of pupils' existing state of knowledge and experience, interests, attitudes; on rhetorical skill, and so on. For CDT teachers, particularly, safety considerations make effective explanation literally vital:

Situation: Pupil about to start the 'making' stage of producing a pendant from acrylic sheet.

Teacher: What are you going to do first?

Pupil: Cut out the shape, sir.

Teacher: How are you going to cut it out?

Pupil: With a hacksaw.

Teacher: OK. Off you go.

Pupil makes off across the workshop in the direction of the bandsaw!

The Language of CDT

In the past decade or so it has often been noted that the particular language of subjects can become, for pupils, a barrier to understanding. In caricature, the teacher is portrayed as talking one language and the pupil another. To the extent that learning is dependent upon making sense of new ideas and information in familiar 'comfortable words' — on relating new to existing knowledge — then that learning is impeded by such a barrier. On the other hand, learners may sometimes need to be able to name things before they can think about them and understand them. Names can help learners achieve the concepts to which they refer; words can act as the rallying point for much hitherto unorganised experience.

Other considerations come into play in this respect. One relates to enabling efficient, economical transactions between participants in the CDT education process. Compare and contrast:

'Miss, have you got one of those, you know, the bullet thingy . . . ?' and 'Have you got a centre punch, miss?'

Or consider this overheard remark from a pupil in an inner-city workshop to his companion as the former returned from showing the teacher a grubby, perfunctory *plan-view* design proposal, the request for an *elevation* drawing ringing in his ears:

'He wants it sideways.'

Financial as well as verbal economy is a further consideration. Imagine the expensive consequences of a pupil mentally swapping the labels 'hacksaw' and 'coping saw' when directed by a teacher to use the former on a strip of 12mm x 6mm mild steel.

Further arguments for taking possession of specialist language are that it is a prerequisite of engaging with the 'literature of the subject', especially that part of it not written with beginners in mind; and, finally, that through joining a specialist discourse pupils may enter a community of specialists — thus, as many CDT teachers report, taking a stake in the subject and in the process feeling more adult.

As regards the 'how' of all this, it is easier to suggest 'don'ts' than 'do's'. The former would include on the one hand warnings against expecting pupils to run before they can walk, to arrive without having travelled, and other platitudes; and on the other, cautions against expecting pupils to learn vocabulary lists unrelated to any context of need. However, such warnings can be taken so literally as to inhibit any 'great leaps forward' or that 'teaching to the child's tomorrow' referred to above. Accordingly, they must be hedged about with qualifications.

The 'do's' — descriptions of good practice — will certainly include:

introducing special terms as and when they are needed: typically in the presence of the tool (eg Warrington Hammer, computer); material (eg acrylic); process (eg annealing, rendering, editing); or other phenomenon (eg swarf, cursor, capacitor) to which they belong. (Some of these terms will be 'special' in the sense that belong chiefly to 'the subject', or to related contexts, and are sometimes borrowed outside (eg alloy, template, warp, weld and braze, veneer and inlay, interface); others (eg flush, proud, mitre, turn, rebate and groove, dovetail and bridle, exploded, rendering, profile) belong nowhere in particular but are put to special use in the workshop.)

encouraging (eg in early project 'paperwork') 'process lists' as well as cutting lists;

bringing as many senses as possible to the business of mastering a term:

hear the word; see it written on the board; feel the word take shape under the pen;

practice in use: causing the term to be used/encountered in talk, writing and reading; where feasible, using odd spare moments (if they still occur!) for such pupil activities as fetching from around the workshop a list of items, or conversely, attaching magnetic or blue tacked labels to the items they match;

developing personal CDT dictionaries;

developing class subject dictionaries; kept in the workshop, regularly consulted and augmented;

developing on a departmental basis minimum vocabulary checklists related to each phase of the CDT curriculum.

Novelist and erstwhile seafarer Joseph Conrad, in contemplating the language of seamanship, celebrated 'technical language' as

'an instrument wrought into perfection by ages of experience, a flawless thing for its purpose.'

Yet, as 'wrought' here suggests (if 'perfection' and 'flawless' do not), language is in a state of permanent change. Just as it has been suggested that knowing something of the origins of words can help pupils master their spelling, perhaps in respect of 'the language of the subject' some delving into origins, alterations, additions and fashions etc might help pupils take possession of the special language of CDT and put it to work.²

Finally, a leavening of humour will rarely go amiss, witness the teaching-practice student heard tell his pupils:

'To remember the name of this process think as follows:
Tesco — Titanic — my lessons:
Counter — Sink — Riveting.'

Questioning in CDT Education

A 'Anyone know what a bevel gear is?'

B 'This leaf is too complicated, isn't it' (ie as model for a metal brooch)

C Teacher: Why do we test?

Pupil: To see if it works.

Teacher: To eliminate —
Silence.

Teacher: To get rid of —

Silence.

Teacher: . . . faults.

D Teacher: What would happen if one of them (mitres) went wrong?

Pupil: It wouldn't fit.

Teacher: And?

Pupil: I'd have to make another one.

Teacher: Right. So can you think of an easier way of making the box?

Pupil: Just glue it.

Teacher: What happens if you just glue something and it doesn't stick straight away?

Pupil: It falls apart

Teacher: So how can we make it hold together . . . ?

E Teacher: What are the advantages of the word processor?

Pupil: You can store things on disc, sir.

Teacher: More basic than that?

F 'What have I just been saying, William?'

William sighed. That was the foolish sort of question that schoolmistresses were always asking. They ought to know themselves what they'd just been saying better than anyone. He never knew. Why were they always asking him? He looked blank.³

There is a very considerable 'literature' on questioning in education. In 1987 a journal was introduced devoted entirely to questioning.⁴ One estimate of the number of questions teachers fire at pupils per day is 395.

'Generally speaking, it seems that teachers spend about 30 per cent of their time asking questions. In other words, they may ask about 100 questions an hour.'⁵

As regards the general salience and importance of questioning in the process of education, CDT education is no exception.

Examples such as those above suggest quite an 'agenda' about questioning in CDT education. Items might be:

the relationship between well- or ill-judged framing of questions and class control (A: licence to call out; teacher doesn't learn who knows/doesn't know what);

open questions that provoke thinking and extended, original responses (D) as opposed to those which (B) close down options;

questions that imply in their structures what unique response is acceptable (even to the very words to be deployed — C); or that turn out to be (implicitly) inviting pupils to play 'Guess what's in my mind (E) — at which they become very skilled;

the subtle issue of questions that ask pupils to tell teachers what (as is clear to all parties concerned) they already know — a phenomenon explored, improbably, by 'Just William' (F).

As is suggested by the questioning statistics cited above, and paradoxically, teachers' questions preponderate over those of learners. For all that, the patterns of pupil questioning, including whom they are directed to (ie other pupils as well as teachers, see below) deserves some consideration by CDT teachers. An hypothesis worth exploring is that female pupils, especially in the less public phases of lessons, tend to ask questions different in kind from those asked by males: that, for understandable reasons, they produce more dependency questions of the 'What do I do next?', 'I can't do this, can you do it for me?', variety.

Explaining in CDT Education

In view of the unique physical dangers latent in workshops, CDT teachers need more than most to develop their professional skill as explainers and instructors. In addition to the matter of using and introducing appropriate vocabulary, as referred to above, skilful explainers need to reflect on precepts such as the following:

when seeking to introduce new knowledge, arouse curiosity — perhaps by questioning; build on what pupils already know; relate new to past learning and generally to pupils' lives — ie strive for the development of 'action knowledge' above 'school knowledge';⁶ ensure pupils know from the word go what they are in for and what the explainer hopes to achieve: what is to be the structure of the explanation/instruction and, crucially in relation to attentive listening, what they are expected to know or be able to do afterwards;

pay close attention to concentration spans, gender/culture-differentiated experience and interests; the paralinguistic apparatus of gesture, facial expression, tone of voice, variations of stress, pitch and volume; 'inter-round summaries', such signalling devices as 'My second point . . .', 'So to sum up . . .', and perhaps a final question to ponder as preparation for the next issue to be addressed.

Talk for Learning: 'actual oral dialogue' As long ago as 1921 the 'Newbolt Report' asserted:

'So called knowledge is not knowledge if the thinking powers are not applied to it, and . . . the only way to get a child to think about it . . . is to get him to talk about it.'⁷

More recently (1975) the 'Bullock Report' declared:

' . . . we must convince the teacher of history or of science, for example, that he has to understand the process by which his pupils take possession of the historical or scientific knowledge that is offered to them; and that such an understanding involves his paying attention to the part language plays in learning.'⁸

Most recently (1988) HMI in an appraisal of secondary schools have confirmed the importance of pupil talk to school learning.⁹ In so doing they make connections with the quality of teacher questioning and make reference explicitly to CDT and CDT-related education:

'Discussions of a more personal nature often flourished in the more relaxed and informal atmosphere of the home economics and needlework rooms and in workshops (para 67)

. . .

Where the form of questioning adopted by the teacher was "open", inviting a more extended and considered response from pupils, there was no clear line which separated pupils' talking in response to questions from discussion (para 68) . . .

Several good examples were seen of talking as a part of planning or preparation for practical activities, particularly in science, CDT and

home economics. The clarification of procedures to be followed in practical science work by means of careful questioning on the part of the teacher or through discussions among groups of pupils was observed in several lessons. On fewer occasions, there were examples of imaginative tasks involving the use of talk set to pupils as part of the consolidation and generalisation of lessons learned in practical work. One example was that of a third-year lower-ability science class, following practical experiments in electricity, being asked to prepare brief presentations which were designed to inform others about the importance of fitting correct fuses to domestic appliances.' (para 69)

There is room here merely to note that in CDT's quiet workshop revolution the stock of pupil talk — shared-focus discussion, small group problem-solving interaction — has risen, sometimes because pupils have had to work in groups owing to lack of enough equipment etc to go round, especially given the contemporaneous shift from handicraft-for-boys to CDT-for-all. ('Good practice' can evolve from contingency as well as 'bad'!) 'Modular technology' work has been an important catalyst. 'In a small group, build a bridge (from X sheets of A4 and some glue) to span Y millimetres — a Mars Bar for the strongest' took its place alongside 'Prepare and mark face side and face edge . . .'. Detached, reflective 'post-operative', debriefing discussion work has a place too. Analysing a piece of his action research experience, Richard Sykes has written:

' . . . time allocated specifically either to small-group or whole-class discussion after the practical work, and in many cases, removed from the practical work situation, was valuable in helping the pupils to realise the significance of what they had been doing, and its relationship with other aspects of their experience both in and out of technology lessons.'¹⁰

Finally, the Interim Report¹ puts unequivocal stress on collaborative group activity as an integral part of Design and Technology core studies — a welcome endorsement of the importance urged by those cited above:

'Pupils will need to acquire and use . . . interpersonal skills involved in working effectively in a group (para 2.32.5) . . . Pupils should be *taught* to work both as individuals and as members of a team engaged in a making task (page 55)' (Emphasis added)

Unofficial talk in workshop/laboratory

'Cor, look at them molecules moving'

For a number of reasons pupils often seek and receive help from each other in CDT lessons, as elsewhere. You could call it a 'subculture of teaching and learning', if you were so disposed. Whatever you call it, it is interesting and important and repays study.

Here is one pupil giving another a refresher course on loading a blade into a coping saw:¹¹

Richard: How do you put one of these blades in?

Michael: Teeth face towards you.

Richard: But I can't get it in.

Michael: You haven't undone the handle, stupid.

Richard: Well I don't know.

Michael: Oh give it here. The handle twists, right?

Richard: Yeah.

Michael: If you hold the bar and twist the handle it comes loose and the blade falls out.

Richard: Oh yeah.

Michael: Right. Put the blade in the far end, right way round. You gotta push the saw down . . . and . . . eh! . . . hook it . . . on . . . phew! . . . like that.

Richard: Then, you just tighten the handle up. Brill! It's good this, in it?

Michael: Yeah.

Michael has to formulate his knowledge for presentation to his friend and appears to produce an effective piece of teaching. Richard accepts the role of pupil, and offers confirmatory 'feedback' in the exclamation 'Brill!', than which teachers can expect no higher praise!

Teachers clearly have an interest in the information and misinformation their pupils may be exchanging. Sometimes safety is involved.¹² Studying such hidden curricular activity — and the din of metalworking is sometimes

welcomed¹³ precisely because it provides cover for what might or might not be dubbed a 'pupil self-help alternative curriculum'! — is inherently tricky, but repays the effort.

Assessment

In the article cited above Sir Graham Hills laments that

'We seem stuck in an educational groove, characterized by preferences for theory over practice, for idealism over reality, for ancient wisdom over new wisdoms, for the written word over the spoken word, for the analytic over the integrated and, most importantly as it turned out, for written examinations over every other form of assessment'

and makes

'a plea for the spoken language rather than the written language'.

If this is to suggest some redressing of the modal balance as between talk and writing in the assessment process and elsewhere then it is to be welcomed. However, what would carry less conviction is any plea for the removal altogether from the assessment process of writing — to which we now turn.

WRITING IN CDT EDUCATION

'Have you got a flatter desk, sir?'

Most school workshops, as this remark underlines, were not designed for writing. However unpropitious CDT environments may be, nevertheless writing has an important and enlarging role in CDT education. This is inscribed, for example, in GCSE syllabuses; and most recently in the 'Interim Report'.¹ On the face of it, the latter's Attainment Targets' 1, 2, 3 and 5, at least, would seem to involve writing activity: writing for notemaking; recording; formulating, stating, developing and planning; and for appraising. Recalling the twin interacting dimensions of the language curriculum suggested above, good writing practice should contribute to the purposes of CDT and to pupils' development as writers.

Voltaire once asserted the importance of being 'permitted to think in writing'.¹⁴ Certainly, writing for thinking with, for learning, finding out, sorting out, making sense of, manipulating ideas, discovering what

you know etc — writing for yourself — is generally neglected in education processes. A good deal of such writing is implied in the 'Attainment Targets' mentioned above; and Richard Sykes has referred to 'the general *learning-purpose* of pupils' own writing' (emphasis added) in reflecting on his action-research project.¹⁵ Pupils involved in the latter made use of a 'technology diary', a development I mentioned in 1983 as

'promoting relaxed, 'expressive', perhaps speculative writing . . . that might stimulate/consolidate workshop learning in its cognitive, affective and psychomotor aspects'.¹⁶

Notemaking and Notetaking

In CDT education notemaking is the most obvious form of writing-for-oneself. The need for pupils to make notes and keep records for their own purposes is not new; however, given a new stress on research at the early stages of design-and-realisation project work, for example, it has increased and is increasing. From the point of view of pupils' development as writers this counts as a considerable plus: the capacity to make accurate notes enhances our effectiveness and autonomy within formal education and beyond — as learners and citizens. 'Good practice' in CDT education in this respect is easy to prescribe, though less easy to 'operationalise'.

As regards pupils' notemaking CDT teachers often find themselves in a dilemma. Pupils need accurate record of information, processes, the outcomes of experiments etc; however, as we have seen, they have also a longer-term need to develop note-making capacity. Should teachers guarantee pupils' accurate record on paper by supplying notes themselves (note *taking*); or should they risk students *making* incomplete, inaccurate notes that will be worse than useless if and when exam revision time comes round? Short term product or long term process?

An APU survey¹⁷ confirmed what teachers at secondary and subsequent stages of formal education have long known: that when left to themselves, pupils (in this case fifteen year olds) are generally incapable of making notes that would be reliable for revision purposes. However, the same survey

found that when given a framework for a given piece of note-making pupils' success rate improved considerably.

In the light of this, a possible, progressive 'scenario' might include:

teacher *models* the notemaking process, preferably using a variety of approaches (eg pattern summaries, key words etc as well as linear notes) and perhaps arranges for study of good, contrasting notemaking/recording practices on the part of, for example, technologists, engineers, scientists;

teacher *provides* frameworks for particular notemaking tasks;

teacher *negotiates* frameworks with pupils, eliciting pupil suggestions as far as possible;

pupils take on the job *collaboratively*, later *alone*: producing notes for each others' use and for their own.

Using such an approach means CDT teachers may make a valuable across-the-curriculum contribution towards pupils' development as autonomous learners. However, the problem of incomplete inaccurate notes will remain, framework or no framework. A partial solution is for teachers to follow up pupils' attempts with an 'authorised version'. The snag here, of course, is that if such follow-up becomes routine, pupils may merely go through the motions of their notemaking, secure in the knowledge that they'll soon be given the 'real McCoy'. So the teacher will need to be canny to keep pupils both developing their notemaking *and* equipped with the records they need.

Communicative writing

In much of the above is implied a claim as to the importance of *during* as opposed to *after* writing; of *writing* as opposed to *writing up*. However, this is not to undermine the importance of communicative writing, preponderant in traditional CDT practice and still of central importance. Such communicative writing occurs in, for example:

description/analysis of, eg, experiments;
reports on projects;
answers in tests/examination papers (including, in future, 'Standard Assessment Tasks');

letters asking for information and other help; evaluations of projects.

In considering such matters there is space here only to explore briefly some issues relating to various levels of textual construction and presentation. A useful starting point for such discussion is provided by Frank Smith's¹⁸ account of the writing process as two-dimensional, thus:

<i>Composition</i> (<i>'Authorial'</i>)	<i>Transcription</i> (<i>'Secretarial'</i>)
Getting ideas	Paragraphing
Choosing words	Punctuation
Combining words	Capitalisation
	Spelling
	Physical effort of writing etc

The focus of what follows is on the 'secretarial' dimension. However, to such a model (interpretive framework) needs to be added some mention of form/'genre'. For example, some attention needs to be given to pupils finding appropriate *forms* for presenting description, analysis, report.

Conventional forms

Conventional forms for reporting are used by fully fledged technologists, designers, scientists and others. Such forms have been developed (like the specialist discourses with which we began) in contexts of need and experience and have stood tests of time and appropriateness. Published advice on report writing proliferates; as a target of schooling the mastery of such forms is important and entirely proper. However, it is important to consider the kinds of travelling 'fledgling' pupils may need to do to arrive at this destination. Such questions as the following arise.

At what stage do pupils need to be inducted into the conventional as opposed to the 'natural', comfortable way of reflecting/reporting on work done?

How is the transition achieved — or is it more a matter of repertoire addition than substitution?

How important, ultimately, are such conventions as use of the passive voice — eschewed, for example, by such distinguished scientists as Chadwick¹⁹ — and the exclusion of subjective response?

How can CDT education trailblaze

the accustoming of pupils to break away from their traditional assumptions (explicitly taught by some teachers, implicitly confirmed — eg by the provision of lined paper only — by others) that only sequenced paragraphs of unbroken prose in standard essay format that eschews headings, graphics, figures, tables etc — that only such writing counts as appropriate?

The 'secretarial dimension'

When the slogan 'Language across the Curriculum' (LAC) was first bruited widely in the land, following publication of the 'Bullock Report', it was said that 'subject teachers' from Durham to Dover, Camborne to Cromer rubbed their hands, saying, 'Good. At last a blitz on spelling'. To the (uncertain) extent that they were accepting responsibility for helping pupils hone their spelling 'skills' — and leaving aside both explanation of their interpretation of LAC and the appropriateness of the 'blitzkrieg' metaphor! — such an acknowledgement could be seen as positive. Just how CDT teachers can contribute to the development of all aspects of the 'secretarial' dimension deserves some attention.

Developing 'good practice' in these respects requires prior analysis of the place and relative importance of the 'secretarial' items listed above. For example, punctuation — which either helps readers to take your meaning or doesn't — is clearly more important than spelling; for the spelling idiosyncrasies of only relatively few writers put meaning at risk. Paragraphing, which is about making structure, sequence and coherence for readers, is partly a kind of macro punctuation.

'Good practice' in respect of 'secretarial' dimensions, cast in the form of exhortation to pupils and teachers, respectively, might go as follows:

Pupils

1. Don't bother about spelling at all while you are writing — in the sense of composing, struggling to get down on paper what you want to 'say'.
2. Be adventurous with words — and never shy away from the word you want to use because you are unsure about its spelling.

3. The late 'proof reading' stage is the time to check on spelling.
4. Use a dictionary (of which more below) to check on words you are unsure about.
5. It sometimes helps to think of other words in the 'family'. 'Relative' or 'relative'? Thinks: let's see, 'relate'. Ah yes. 'Relative'.
6. Get interested in the origins of words. Knowledge of the derivation of a word often helps towards accurate spelling. 'Desiccated' presents less of a problem if you remember the connection with the Latin: 'siccus' = dry.
7. As improving spelling is an active process, never simply copy words from the dictionary. Rather, when looking up words go through the procedure: LEARN COVER WRITE CHECK. Learn words pencil-in-hand.
8. Keep records (eg in pencil, in a pocket note book) of words you sometimes get wrong and devote odd moments to working on them. Erase entries once words are 'mastered' (preferably when you get them right when writing: sometimes you find you can get words right in tests but not when you are writing 'for real'.) Highlighting troublesome parts of problem words in BLOCK CAPITALS can help you focus the problem.
9. If your particular problem is that you don't know which words you're getting wrong then ask a strong-spelling friend (say it carefully!) to 'proof-read' for you.

Teachers

Such suggestions apply in the case of (the majority of) pupils whose spelling difficulties are not acute. Regarding the problems of the minority it is perhaps best to consult a specialist colleague. This promises a unified, consistent approach to such 'special needs' pupils and exemplifies that liaison between teachers about language in education that is fundamental to good LAC practice.

Finally, put spelling in its place. Reportedly, teachers sometimes concentrate on surface, technical aspects of writing — on 'correctness' — to the

detriment of pupils' confidence²⁰ and to the neglect of larger aspects of writing. A consistent marking policy, developed both from an 'elementary' analysis of writing (eg from whole text level — content, organisation, sequence, style — to sentence level — punctuation, spelling) and from a starting point of 'grassroots' analysis of existing practice, provides a promising framework for improved practice in this respect.

Talk to pupils about spelling. Accurate spelling is bound up with confidence; therefore, don't allow pupils to settle into seeing themselves as 'poor spellers'. A 'positive self-image' in respect of spelling is a prerequisite of becoming competent. One teacher I read about would sometimes write on a piece of work which had, say, 30 'miscues': '360 words spelt right. Well done!' Another ruled: 'Any words you underline because you're unsure about them don't count as mistakes' — thus encouraging an active approach.

Writing and 'new technology'

The Interim Report¹ suggests (p.69) 'two possible attainment targets' in respect of Information Technology. It is becoming clear²¹ that word-processing, desk top publishing, electronic mail etc have exciting potential for encouraging pupils to compose, reorganise, correct and experiment in writing and 'publishing' — especially collaboratively. In the context of CDT, with the growing demand for reports, evaluations, speculative and so to speak 'enterprise culture' writing — ie in non-narrative modes whose organisation, sequencing, tone etc present pupils with special problems — the 'new technology' has an important role to play. It may also help with the 'flatter desk' problem referred to above.

READING AND CDT EDUCATION

— you shall try your hand on these proposals . . . : regulating your plan, of course, by the printed particulars'

Martin Chuzzlewit, 1843, Ch 6

In regard to mastering the 'printed particulars' and in much more 'the effective use of reading' is a prerequisite of success in CDT education. This is implied in respect of achieving the 'National Curriculum' Design and Technology Working Group's 'attainment targets' 1, 2 and 5, at least.

Ransacking libraries and texts, and taking intended meanings from written examination questions, project briefs, instructions, safety notices, directions for the use of equipment and so on — these and other activities claim an ever-enlarging place in CDT education. In conspiring for pupils' success in this aspect of the CDT curriculum, teachers need to consider texts and tasks and, again, to bear in mind the twin language-related guidelines proposed at the outset: ie to make reading contribute to achieving the purposes of CDT education and the latter a by-product contribution to pupils' reading development.

Texts

'Explain "mock up".

When you do things wrong."²²

Offering pupils appropriate texts is obviously important. However, the texts teachers provide are surprisingly often inappropriate.²³ The most important single guideline for teachers in addressing this problem must be that they should appraise or compose texts carefully in the light of the uses they have in mind and of what they know of their pupils' reading capacities.²⁴ Such factors as attractiveness of language and layout — 'the design of instructional text'²⁵ — will receive attention. Again, in recent years experts have tended to recommend the use of various 'readability formulae', which stress word- and sentence-length²⁶ as further indicators of appropriacy. Interestingly, some useful recent contributions make no reference to these, preferring to focus on such sources of difficulty as specialist 'technical' vocabulary, specialist use of non-technical words, sentence structure, elaboration, density, distracting 'noise' obscuring signals and the often sudden shift to having to grapple with apparently impersonal non-fictional text on the part of pupils who tend to be more at home with the personality of fiction.²⁷

Tasks

In their recent *Secondary Schools: An Appraisal* (1989) HMI state (para 78) their criteria in respect of 'the quality of reading' as:

'the competence of pupils in reading with understanding, their ability to

locate and use reference sources to support their work across a wide range of subjects and interests, their general attitudes to reading, the range of books available in the school, the extent to which pupils were encouraged to read independently, the ways in which pupils were helped to use libraries, both in the school and elsewhere, and the extent to which the school made provision to extend pupils' reading skills in relation to their ability'

This constitutes a useful checklist as regards the tasks of the CDT reading curriculum; and the shortcomings of the practice HMI observed imply an action agenda for CDT teachers as for others:

'... few schools had reading policies which systematically encouraged the development of what are usually called advanced reading skills. These include, for example, the techniques of skimming and scanning, and the development of reference skills using print materials from a variety of sources, including those found in the library (para 79)

The extension of reading skills as an aid to efficient study was rarely part of a school's policy (para 80)

Independent reading was not sufficiently encouraged . . . In most subjects, reading was frequently restricted to textbooks and information/worksheets (para 81)

most subject departments did little to promote the use of libraries as a learning resource' (para 82)

'Good practice'

CDT teachers, thin on the ground and, because of truly major curricular shifts, called on to reeducate themselves to a degree unmatched in other curriculum areas, could be forgiven for less than enthusiastic response to exhortations in respect of the reading curriculum. In what follows I suggest points of practice, some of which entail *additional* work but most of which, after initial adjustment, may not. They address criticisms raised by HMI and bid to enrich CDT education in the process.

An overarching requirement, here as elsewhere in respect of language-in-education improvement, is for teacher

collaboration and liaison as part of developing and enacting a solidly-based institutional policy. 'Delivering' 'National Curriculum' and helping pupils meet the assessment requirements entailed so that institutions flourish in the competitive, survival nexus implied by the 'Education Reform Act' (1988) — while at the same time finding room for non-foundation work — demands cross-curricular review and collaboration: something urged on teachers in the past but now inescapable. The subject structure implied by, though denied as inevitable in the rhetoric of, 'National Curriculum' documents must involve meeting attainment targets through a variety of programmes of study rather than on a one-to-one, subject-target basis. CDT teachers, given the recognition of their curricular contribution promised in 'National Curriculum' planning to date, will be as involved as any. In the meantime, while the grander design is taking shape and where effective institutional arrangements for curriculum collaboration cannot be assumed, entrepreneurial, 'grassroots' liaison initiatives — for example, with librarians in respect of the advance provision of resources pupils may draw upon in project work — need to be developed.

At the level of detail, the following suggestions about the CDT reading curriculum may or may not coincide with the analysis of CDT practitioners. If they stimulate alternative analyses they will have achieved their purpose handsomely.

1. Make clear the purpose of any reading task set and what pupils will be expected to 'know, understand and do' after reading.
2. Provide guidelines and opportunities for 'surveying' text — perhaps using SQ3R. Use of text 'organisational devices' and referencing skills generally can also be reinforced by requiring pupils to include the former in their projects.²⁸
3. The same in respect of 'skimming' and 'scanning'. These terms have come to be used as follows:
Skimming: sampling as much as you need to get the general drift of a text — to find how far it relates to

your purposes. For this it may be useful to read just headings and the first and final sentences of paragraphs; to glance at words in italics, at proper nouns, dates, figures, quotations, asterisks, words relating to your purposes etc. Scanning: homing in on particular material (perhaps a date or a name) you need, for example, to answer a particular question.

4. Occasionally a speed reading exercise. Pulling a ruler down the page *just above the line you are on* has been found helpful: it is as though you are pulling your eyes down through the text. It can be fun to see how fast you can go and what you can manage to take in.
5. Provide a 'balanced diet' of reading assignments. Go beyond asking for the mere retrieval of facts to tasks which require the discovery of relationships within, reflection on and evaluation of texts.
6. Consider the possible value of group sequencing activities. For example, take a description of a CDT process or experimental procedure; cut it into paragraphs; mount them onto cards; ask groups to assemble them into appropriate order. The value as a check on understanding and as collaborative close-examination of text is evident.
7. Group work on subject-related 'Cloze procedure' exercises.²⁹
8. Use of written briefs, worksheets etc pushes pupils into reading and disallows over-reliance on oral instructions.
9. Teacher identifies in the text particular targets. Pupils (perhaps in pairs) are asked to locate and mark/list these. Targets are such that thoughtful selection is required.
10. Pupils ransack text (eg technology in context) to distinguish fact from opinion and identify author's point of view, omissions etc.
11. Texts are reworked into different formats: for example, the main points of a piece of explanatory prose are recast as a table or — perhaps in the case of a process — into strip cartoon form.

12. Pupils read a passage, then (perhaps in groups) formulate questions to which they genuinely need answers. Questions are passed round and discussed.
13. For virtual non-readers prepare sound tape to accompany written material.
14. Bear in mind the special needs of pupils at an early stage of learning English. Some bilingual materials (eg safety signs, equipment instructions, worksheets) may be appropriate. Explore the resources and services (eg translation) available. (This can present subtle problems: eg when you produce a worksheet in both English and Bengali, say, only to discover you have provided Standard Bengali rather than the particular nonstandard dialect of Bengali spoken by the pupil(s) concerned.)
15. Encourage pupils' use of a specialist 'library', keeping 'readability' in mind. Such texts — books, magazines, DIY material, manuals — can have a special meaning for pupils who get precious little from other print material. Exploit opportunities to discuss with pupils what they read — including what they read independently, for pleasure.

As I make a final check on this article, the *Times Educational Supplement* (10 March 1989, p.A12) prints the National Curriculum Council's recommended Attainment Targets for English, levels 1-5. CDT practices such as those sketched above will certainly contribute towards *their* realisation as well as to the purposes of CDT education:

READING (Level Five, which should be reached by average eleven year olds)

Pupils should be able to:

Continue to read regularly over an increasingly wide range of more complex verse and prose, fiction and *non-fiction* (emphasis added).

Show through discussion that they can use text to infer, deduce, predict, compare and evaluate.

Select and use appropriate referencing skills when pursuing an independent line of enquiry.

Make use of organisational devices offered in information books or other printed matter.

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- It is in no sense the case that teachers are not concerned about correctness. Indeed they may at times be so entirely taken up with it that they can fail to recognise a pupil's potentialities . . . DES 1979 *Aspects of Secondary Education*. London: HMSO, para 3.21.
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PRIMARY CDT

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