

Group Projects: Issues, Practice and Monitoring

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Introduction and Background

The constraints of GCSE, A level and some AS level assessments in CDT/Design/Design Technology force learners to work as individuals. The current assessment tail is wagging the learning dog. Whilst individual projects enable the overall assessment and labelling to be specific, the learning is completely counter to the real world: the trying out of ideas, the difficult questions, the bouncing of ideas, the arguing out of a solution often developed by informal and formal meetings using the spoken word. The current school system could be perceived as only the teacher being involved in such discussions with learners: what a burden, what a loss of a rich pool of ideas! It was disappointing to see the suggestion that individuals should have 'tasks individual to themselves' in a recent Technology Education report (Black, Harrison, et al, 1988). Denton's Group Task Management (1988) seems closer to the expectation of the working of the real world in Design and Technology.

Many industries rely on design teams rather than individuals to solve their development problems. It is surprising that the educational world has not seen team or group work as a means to educate the whole person as a simulation of real life. The issue is central to the introductory sections of the Interim Report of the Working Group on Design and Technology (1988) in the National Curriculum.

For the last six years at John Hampden, as part of the 'A' level Design course and GCSE courses in Design and Technology, it has seen an objective of the teaching programme to include an industrial project created out of a real life situation. The projects raised by local industry have been varied and also from agencies dealing with Third World problems.

The design briefs that are given have three main bases for learners:

- a live problem outside the classroom environment
- working in teams
- under real pressure with direct goals and required to present and communicate using more than one method.

In the early years of the scheme the school made the contact with different companies. More recently many projects have been the result of companies or agencies contacting the school.

Preliminary meetings and discussions take place between a member of the staff and the company/agency about:

- the suitability of the project in relation to the age group and the CDT course
- how the projects are to be presented by the learners to the company

The presentation of the brief by the company/agency often includes visits to put the problem into context.

In line with industrial practice the team of 2-4 learners would be given a deadline. The ideas and solutions would have to be presented in graphic form, 3D modelling and an oral presentation.

Recent projects have included:

1. Inspection safety system for checking VDU assembly in a 'live' state.
2. To design and make a pill dispenser which would dispense a single pill for patients suffering from Parkinson's Disease.
3. Incubators for premature babies in the Third World.
4. Polishing device for ceramic material samples.
5. Alternative energy sources for the Rendille nomadic tribe in East Africa.
6. Safety secondary switch for a rotary cleaning machine.
7. Investigation of belt tensioning of PayVee belts on compressors.
8. Printing of 'Sell by' date labels for a large bakery to increase flow and speed of production.

How Were the Teams Selected?

Brown (1988) suggested that some learners decide to work in groups. In the early days of these projects the selection was based on questions such as: 'Who would like to work together?' or 'Who is interested in electronics?' Working with friends where patience and formal respect for others was not a high priority could, in some circumstances, be a way of losing friends quickly!

Selection of groups took on a different approach when the CDT department was invited to take part in the Sainsbury Engineering Educational Scheme. Formal interviews were made

by a panel consisting of the Headmaster, a person from higher education and an engineer. The task of the panel was to select students who were committed and able to cope with the whole Educational Scheme and not only the project.

However the panel were aware that a strong element of teamwork was involved and in one year this was the main factor in reaching a decision.

Groups have been brought together for other work by individual strengths and weaknesses, not on a social mixing, but related to, for example, experience, practical and graphical gifts. The social aspects really developed as the team worked together. It would be foolish to try to match selection with outcome, but some underlying principles are beginning to emerge for 'A' level groupings:

- strengths, weaknesses of potential contributions of individuals to the group
- what is their social disposition (e.g. quiet, outgoing, passive, demonstrative, understanding, etc.)
- observation of natural friendships and discussion of course work as a whole group.

The staff then draw up lists of teams and by negotiations and individual interview a consensus of who works with whom is reached, each group generally having a balance of attributes.

Working in Groups

One simple way to look at working in groups is to consider the key motivations that are occurring. There are two simultaneous motivations occurring whenever we work in groups. The first and obvious one is to complete the task that we are attempting. The second less obvious but crucial process is the building up of the inter-personal relationships in the group. Let us look at these two clusters in turn. It is helpful to use existing ways of explaining the clusters (Jaques, 1984, Bales, 1950).

The task area can be divided into a series of interactions:

asks for information: gives information
asks for opinion: gives opinion
asks for suggestion: gives suggestion

When the elaboration of these terms is considered, the relevance to project work becomes even more obvious:

asks for information

orientation: 'Could you tell me why we. . .'
 repetition: 'I don't understand could you explain again'
 confirmation: 'Have we agreed to. . .'

gives information:

orientation: 'The next step will be. . .'
 repetition: 'You said that the measurement was. . .'
 clarifies: 'Putting the ideas together means that. . .'
 confirms: nods in affirmation

asks for opinion

the contexts would be evaluation, analysis, expression of feeling.

gives opinion

the contexts would be as above but may also include 'I wish. . .'

asks for suggestions

the term is probably self explanatory as also its interaction:

gives suggestions

this would include: taking the lead, direction but not removing autonomy from others.

Not all the interactions need to have a verbal aspect, facial expressions and gesticulations play an important part.

The inter personal (or socio-emotional area in jargon!) has the following interactions:

agrees: disagrees
 reduces tension: shows tension
 seems friendly: seems unfriendly

For a group to function with energy *all* the interactions are necessary. The way that learners were selected for the team work as outlined in the previous section would enhance the potential in this area. The non-verbal interactions become even more important in this set.

Agrees, disagrees does not involve hostility, although some would argue that hostility has a part to play. There is obviously an overlap with 'confirms'.

Reduces tension, shows tension are best taken as a pair. Reducing tension would be an activity where a joke or light hearted input enables a laugh and loss of tension.

Seems friendly, seems unfriendly probably needs no explanation!

Another way of looking at the pairs is to take them as keys to problems. Taken in order through the two lists the problems are:

communication (asks for information, gives information)
 evaluation (asks for opinion, gives opinion)
 control (asks for suggestions, gives suggestions)
 decision (agrees, disagrees)
 tension reduction (reduces tension, show tension)
 reintegration (seems friendly, seems unfriendly).

When the left hand side of the first (task) list is considered it represents attempted answers to the right hand side questions. In the second (process) list the left hand list represents positive reactions as opposed to the left hand list of negative reactions.

In any group there is no consistent role for participants. We keep changing role and sometimes may take up two or more roles simultaneously. What is needed to keep the group functioning is the opposite role: tensions, disagreements, panics are all productive. Arguments, disagreements, tensions are crucial to the progress of a team or group, as are the resolutions.

As teachers we need to be aware of these interactions and monitor and assess them whilst a group is functioning. It is also clear that the group need to be aware of the parts too and be enabled to utilise the group dynamics for most energy. The above categories are a useful tool for analysing the performance of a group used as a checklist of activities at say 1-3 minute intervals . . . that is if you have time for that sort of detail.

Enabling Groups to Function

It is possible to tell learners the various categories shown above. However that does not enable them to put anything into practice. There are various ways to initiate group activities. One of the typical problems that learners have is to participate realistically in any discussion. We often use what is called a snowball technique. The learners are given a small problem to solve, e.g. what are you going to call the 'company' which your group becomes for the project? Each person is asked to write

down 4 or 5 ideas. Then they are put into pairs to look for differences and explain the reasons for their choice. Then they are put into the fours in which they will work and asked to come to an agreement/consensus. Finally each group appoints a reporter who is asked to state their choice with some reason for the choice. It is possible to work with up to 50 (fifty) learners at a time using this snowball technique. The four phases are approximately taken up by the following time allowances:

individual 5 minutes
 pairs 5-10 minutes
 fours 10-20 minutes
 reporting 20-30 minutes.

The times depend on the complexity of the task, the size of the groups and the available time! It is usually better not to run it formally on a time basis but to use the individuals involved as a guide to when to move to the next phase. If you need to move on, then at least warn each group that you are only giving them a further x minutes.

From this exercise the group had had some training in everybody taking part, disagreements and some mechanism for agreement.

Farnham and Wightman (1981) used a similar approach with group work for the evaluation phase of project work.

Needs of Learners and Purposes of Projects

In order to avoid complex jargon let us simplify learning into four areas (Harris and Bell 1986):

memorising
 decoding
 creating
 loving

Memorising is not only the recollection of facts and figures but also the way that others react to particular statements, questions, stances.

Decoding is less obvious. It is the sort of activity a learner has to do when a problem, say in Mechanisms, is set. First of all the problem has to be converted into something comprehensible to the learner (that is decoding), a series of calculations or trial and error work is carried out. A report/answer is required so it is converted back (coded) into technical language. Decoding can also

be observing the reactions of somebody else and trying to decide what those reactions mean. It is a part of problem solving.

Creating should speak for itself, although it is not only coming up with bright ideas! It is another crucial part of problem solving.

Loving is the crucial one for this paper with a focus on working in and enabling groups of humans to work together. As we have seen it is not all pouring oil on troubled waters, it may also be stirring the waters! It is associated with the inter-personal (socio-emotional) area identified in the previous section.

Learners need to develop all four areas. The project is an excellent basis for enabling learning in creating, decoding and loving. We could suggest some learners aims for projects as:

- i. adopting an active approach to the development of memorising, decoding, creating and loving
- ii. assuming greater responsibility for individual and peer learning
- iii. acquiring a greater depth of knowledge in a limited area based on the learner's own interests and study
- iv. bringing together existing skills, techniques and developing new ones
- v. working in collaboration with other learners, thus acquiring necessary experience in communication, cooperation and compromise.
- vi. working in an interdisciplinary context.

These are based on work published 10 years ago (Dowdeswell and Harris 1979) and only slightly modified for this context!

CDT workers do not need convincing of the active learning associated with projects, but they may need to consider v. and vi. above for the proposals that are expected in the National Curriculum. Oral communication, working in groups and interdisciplinary work are key aspects of any learning. The commonality of certain of the expectations in different subjects should enable cross curricular cooperation rather a restrictive subject approach.

The project learning environment now has to meet the learners expectations. If our premise of the 6 aims above are accepted, the project learning environment should

- provide an atmosphere in which the learner can feel the maximum of involvement
- generate an atmosphere of reality
- have a reasonable chance of success
- generate a closer relationship between a group of learners
- generate a closer relationship between the group of learners and the supervising teacher
- provide an atmosphere of minimum constraints
- discourage passive assimilation of knowledge
- discourage passive assimilation of knowledge
- discourage uncritical acceptance of ideas, design, data, evidence etc.
- encourage learners to think outside their immediate design and realisation problem.

It is asking quite a lot in the current scene of changes: examinations, records of achievement/profiles, TVEI, National Curriculum, LMS etc., etc! The maximum involvement will require learners to understand how groups function both in theory and real life. The reality may enable a closer cooperation with local firms, or in rural areas with farmers, landowners in order to meet their needs; some schools focus more on humans with special needs, or the needs of Third World countries. The crucial factor is a real problem (Black and Harrison, 1985) rather than one cooked up for an examination, but that reality is heavy on time of teachers in a shortage area for negotiating such reality. For individuals it is almost impossible to find adequate realistic projects, but there may be a possibility for groups.

The suitability of a topic has to take into account many factors. Not only does it have to meet the aims and learning environment already outlined but also further questions need to be asked.

- What is the likelihood of achieving a successful outcome in the time available?
- Has the group sufficient competence in the areas of knowledge and skills involved? (Again groups may be able to meet these competencies where individuals could not).
- Is the project suited to the personalities and temperaments of the group of learners?
- Has the supervising teacher enough knowledge or contacts to support the group?
- Are the necessary resources (books, papers, equipment, technician assistance etc) available or accessible?
- Are there any associated problems of management (e.g. any readings/work required outside school hours)?

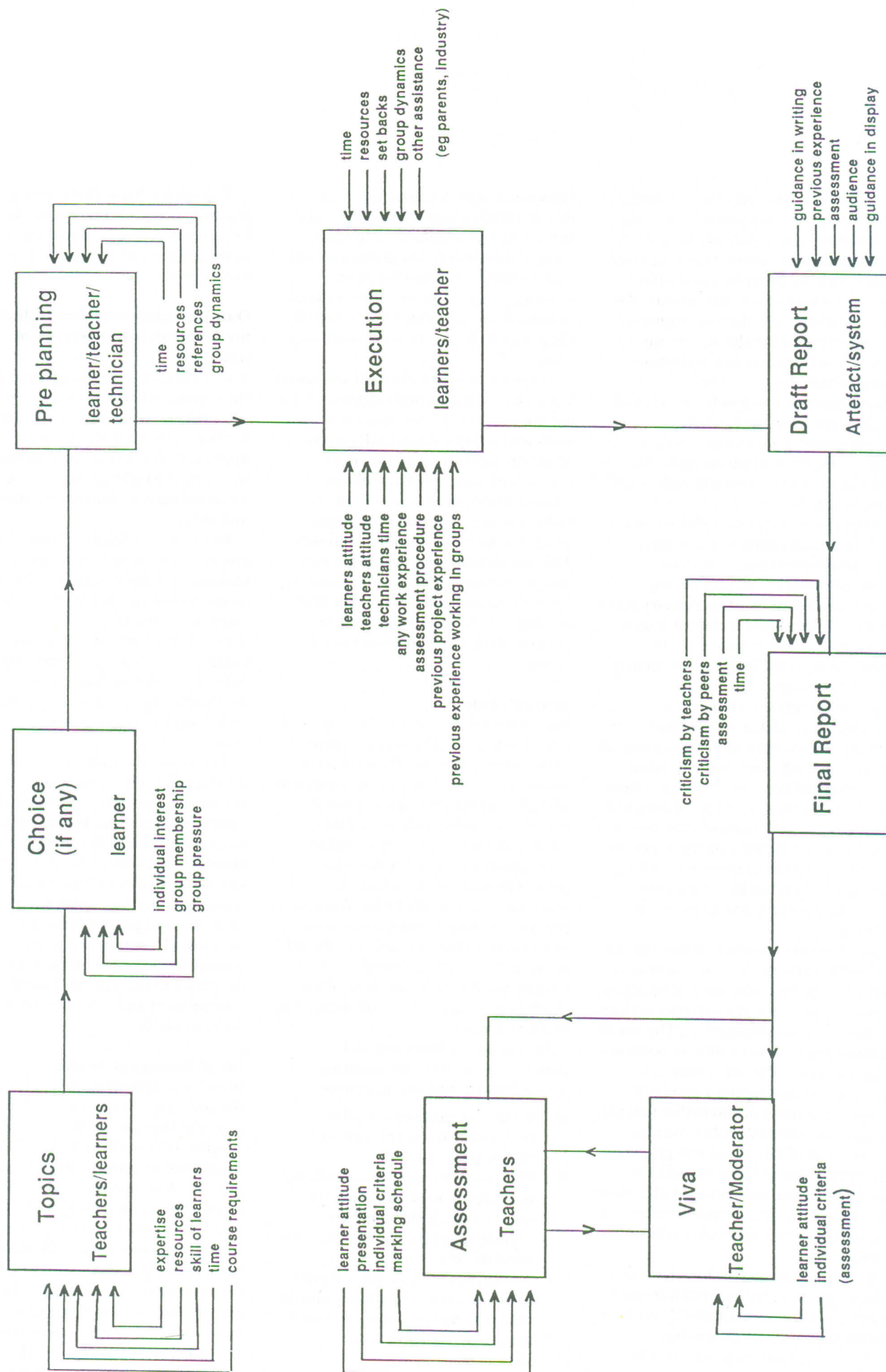
The life of a project involving groups or teams can be summarised as shown in the diagram.

Observations and Educational Benefits

The educational experiences are vast and varied. High motivation was observed in most of the groups. To capture all the benefits and outcomes of such an approach would be a mammoth task, yet a somewhat limited attempt to catalogue some observations follows.

How you quantify the experiences and growth of the individual or a group is very difficult, but the following attempts to highlight some very positive outcomes. Firstly, the experiences of individuals within any group are focused on a central theme yet contributions in the early stages are diverse, hesitant and sometimes explosive! But as the group starts to respect each other for their strengths and weaknesses, positive gifts and skills tend to rub off and higher standards, co-operatively, are achieved. (All the groups observed so far have tended to grow in a positive way.) Being in a team you are instantly faced with a vulnerability of having to rely on others and the outcome is one of two options: failure, or building a sense of esprit de corps.

From the outset of any group activity one of the ground rules that all learners have to understand is that all the team must be seen to contribute. This is



especially emphasised when the verbal presentation is given and all must take part and be seen as part of the team. A measurement of observation is received in how well the group link and offer continuity to the flow and delivery. An air of confidence in their colleagues is usually expressed in this way by saying; 'I now hand you over to Chris who is going to talk about. . .'. The encouragement is not only given for all to participate but the level of encouragement grows towards each other as they begin to trust each other and respect and understand each other's expert contribution.

Maturity and social confidence shows itself in an individual in many ways. Being exposed to their peers and knowledgeable people; conveying information simply rather than trying to impress by the use of technical jargon, soon gives way to balance, clarity, respect and good diplomatic tendencies. The learners very often have to negotiate, interview, counsel for information and deliver reasoned argument with many different groups of people and they quickly find levels of flexibility and tolerance towards others. In one particular case of presenting the project to the full board of directors, it was a case of 'thinking on their feet' for a long session where it was not only the conveying ideas but justifying their claims in a positive and tension-free manner'.

The learners are quick to learn about themselves and the level of maturity is measured by how they are able to adjust, especially to the things that they perhaps do not like about themselves. The whole exercise of group work and working as a team facilitates the opportunity of creating and developing a good self image. They are quick to realise that you cannot fool people, neither can you impress out of falsehood and jargon. The realisation of being oneself and developing communication skills, where they have to be simple and effective in all forms, has to be a very quick learning curve!

In most cases, groups have tended to adopt a meaningful order of approach fairly quickly and adaptability has been the main area where groups have differed. In most cases, one student inevitably takes the lead and this has normally been an accepted pattern.

However, leadership qualities have differed from group to group — some being good co-ordinators and being respected for this by the group and other leaders being respected for their knowledge. In any event, an element of submission is demanded by the rest of the group if they are to go forward as a team.

There are many intellectual and social values within individual students which are not necessarily exercised until team work and group work is undertaken. Many projects are set so that learners can embark on a problem-solving activity alone and assessment of the tasks comes as a complete package, which tends to be convenient and tidy. The complexities of assessing groups and project work can become daunting yet at the same time encouraging and exciting for the member of staff or personnel who have to administer a system.

Teacher's Role

But what of the teacher's role, especially when he/she could be actively involved in the project and also the method of assessment? This is one of management, affording direction when required. Initially, his or her role should be passive, offering advice more in the management area rather than the project itself. In many schemes of assessment, especially by interview, it becomes very apparent/evident as to how much the teacher has contributed; in fact there have been projects which have been totally teacher-dominated, much to the culminating embarrassment of all concerned.

Industrial, professional and commercial involvement is strongly advised for the following reasons:

- (a) If the company presents the problem — it sets the scene of reality and purpose;
- (b) Professional help and consultancy is offered and certain areas are always outside the scope and knowledge of the teacher (which is a good thing!)
- (c) A point of contact on a personal level is made automatically and an encouraging relationship is usually made with the team and industrialist.

The teacher's role in this instance is made clear and his place is on the 'side line', sensitive to need and support and offering help and assistance at a time of loss or by invitation of the team.

Outcomes observed on individuals have been through that experience of teamwork

It is noticeable in nearly all cases that the approach to individual study, after taking part in a design team, tends to reflect a more mature approach. There is an improvement in asking the right questions and formulating constructive arguments and ideas.

Working to a deadline collectively in a group is a pressure that has to be managed far more acutely than working on one's own and as a result of this, has an encouraging knock-on effect when the student reverts to individual work. Goals are arrived at; the work load of an individual approach as a result is noticeably improved, because there is order and less 'urgent panic' affecting flow.

The most noticeable area of development within each individual is the result of the verbal presentation. Simplicity, clarity and order of thought is certainly evident in subsequent individual presentations reflecting a sound, quiet, but well balanced confidence. In the examination interview and general presentation of coursework, visiting examiners frequently comment on the positive delivery and the natural flow of commitment and interest afforded by the candidates.

Initial Training of Teachers

In order to appreciate the problems and the advantages of group project work it is crucial that the students in Initial Teacher Training have as much experience of working in groups as possible. For example students at Brunel work in groups for projects in Design and Technology in each year of the course, as also occurs on the parallel Industrial Design Course. In addition the first year of the Education Studies course also uses small groups as its basis. Students are encouraged to work in syndicates for all their work sharing problems and sharing reading and problem solving. Needless to say that

most students have been encouraged to work on their own for all work including projects at school. The idea of cooperation rather than competition is alien to all their previous experience. Some take to the idea well, others find it more difficult to cope with. It is interesting to see the way that cohesive groups do not wish to have any discrimination between them on the marks allocated, whereas those groups where there are slackers usually wish to see that lack of effort is penalised.

The basis of working in groups can be evolved through role play, simulations and the use of a variety of other small group techniques. For example in method course/professional studies work microteaching often takes place with students not only teaching the rest of the group but also role playing learner roles. The crucial element of this type of small group work is the initial briefing and more particularly the debriefing. The reflection on the actions of individuals and the effect on the learning environment is illuminating to

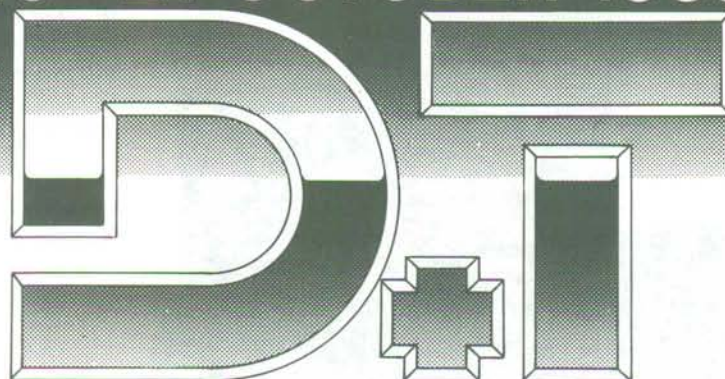
students for their future work in the real school environment. However it is often difficult to find schools for all the students to have experience of group projects in action. There is potential for the imaginative cooperation between initial teacher training institutions and the schools for the development of group projects which we hope to see as a crucial part of the final Design and Technology expectations in the National Curriculum proposals.

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