

CONTRASTING PERCEPTIONS OF AN INNOVATION
IN TEACHING CIVIL ENGINEERING

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DECLARATION

This thesis has not been composed by me alone. I have acted as agent for my mentors, supervisors, friends and assistants. I hope what is good in this thesis stands as thanks to them all.

Thus only in so far as it has a conventional meaning in this context do "I declare that this thesis was composed by myself."

Mohamed Mostafa Mahmoud

A B S T R A C T

The thesis reports an 'illuminative evaluative' study of an innovation for teaching the undergraduates in a civil engineering department in a university.

The thesis is organised in three parts - nine chapters.

Part 1: Chapter I addresses the general need for innovations in universities.

Chapter II introduces in an abstract form the 'innovative methods' practiced by the teaching staff of the 'Learning Unit' subject of this study and a summary of concepts derived from recent research on students' learning is introduced.

Chapter III focuses on the general problems of evaluating educational innovations.

Chapter IV reports the conduct of the study and methods used (participant observation, interviews, questionnaires, analysis of documents etc.).

Chapter V provides the background and history of the innovation. This is also the context of the study where the undergraduate curriculum and the work of the third and first year students are outlined.

Part 2: Chapters VI, VII and VIII.

Part 2 examines a major concept - the multiple perceptions of the experience. To understand and explain the events surrounding the 'Learning Unit', the researcher focused his search on the varying perspectives of the teaching staff on the one hand, and the students on the other. The varying perspectives altered the very way one defined the problems and the kind of alternatives one generates as solutions.

In Chapter VIII the teaching staff in the same department who were not directly involved in the innovation provided an important comment on the experience.

Part 3: Chapter IX develops the analysis begun in Part 2, and focuses attention on the absence of a unitary point of view. An attempt to integrate the results of the research and its implications in the areas of innovation, evaluations of innovations and the teaching/learning processes in higher education, is reported.

This thesis is dedicated to the memory of my

parents, Mr. and Mrs. MOSTAFA MAHMOUD ABD EL RAHMAN

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CHAPTER 1

Introduction

This chapter sets the scene for the case study which forms the main part of the thesis. It starts by discussing the phenomenon of 'change' in institutions of Higher Education. It then focuses on 'change' in professional schools, interest in civil engineering education and the need for innovations in this field. The final part is a guide to the thesis, its logic and presentation.

Major reports such as: (Group for Research and Innovation in Higher Education Newsletters 1-6) are suggesting new waves of change are taking place in institutions of higher education. These are meant to replace older modes advocated before. These changes have a familiar ring; contact replaces isolation as new social groups (industrial agencies and business, government departments) engage themselves in universities' affairs.

British higher education is now a heterogeneous system. Methods of teaching vary, and many different kinds of courses are offered in very different institutions. University staff expand to include people from different occupations, educational technologists, systems analysts etc. This diversity challenges the authoritarian system of the University when more and more members of the institution aim for a say in decision-making.

Cultural and social change involves shifts in how people assign value to various parts of their world. Ambiguities arise as old certainties melt. This thesis explores this process as educational practices confront a system in transition; it focuses on issues which arise as a consequence of change.

Education critics in many fields, and especially in the field of professional schools, agree that the student becomes a competent professional in the office after graduation rather than in the professional school.

The contention that professional schools (in this case civil engineering schools) do not produce competent

practitioners, has been spot-lighted by a special committee set up by the Institutions of Civil Engineers, which was established in February 1973, under the Chairmanship of Dr. Henry Chilver, Vice-Chancellor of Cranfield Institute of Technology to:

"Consider the education and training requirements of the Institution for Chartered Civil Engineers and to make recommendations to the Council as may be deemed necessary".

In its report published February 21, 1975, the committee states that: "good education and practical training provide a foundation for a professional career", but adds that "only experience will show whether a civil engineer has the necessary qualities to be accepted as professional". It recommends that the institutions make substantial changes in the programmes of education and practical training of professional civil engineers. In particular, the report recommends: "That existing approved first degree courses in Universities and Polytechnics should be assessed by the Institution on the basis of the relevance of their curricula to civil engineering and should be reviewed again for approval by the Institution every five years;

*That moderators should be appointed by the Institution with the agreement of the relevant University and Polytechnic departments to assess graduation standards to help to undertake the five-yearly reviews, and to advise on the comparability of standards of different courses:

*That breadth of course structure and content in first degree courses should be encouraged, although appropriate depth should be pursued in a limited number of fundamental subjects ... ;

*That the Institution should provide advice on similar courses for post-graduate education of civil engineers, and should encourage suitable educational establishments to arrange courses if such courses are not already available and where they are required".

The response from the Universities to these recommendations

varied but it was summed up by a Professor of Civil Engineering, who stated:

... the Universities really are every bit as keen as the most fervent council members on improving the education of civil engineer students. They are delighted when any professional body bestirs itself so far as to consider properly and in depth its objectives for education and the criteria for its examinations.

To present them with a set of petty-fogging rules about crude grades of A-Level passes for example, is however as useless, and as tactless, as a husband giving his wife a set of detailed rules about how to do the house work".

(R.A.3)

The British Association for the Advancement of Science in its meeting in August 1977, which took place in the University of Aston in Birmingham, discussed a report on "Education, Engineers and Manufacturing Industry". On page 50, "List of Conclusions and Recommendations", one reads:

"Significant changes in engineering course curricula have been made up during the past ten years.

The traditional engineering course which aimed to shape all students in the same mould is rapidly becoming the exception ..."

Schein (1972), argues that the professions need innovations to improve practice and to clarify the professionals' role in society. The argument is based on the premise that professional roles are now undergoing radical change. Indeed Palmer concluded that:

"Professionals generally have abdicated their traditional function. My definition of professional - as one who professes a faith - is an anathema to the engineer, the chemist, the business manager, the academic. They see themselves not as bearers of a faith or proclaimers of a confidence, but as practitioners of technique ... pure, empirical, pragmatic, marketable technique ... (that) admits of no need of faith".

(Palmer, 1973: pp.2-3)

Is Reform Possible?

There are major dilemma inherent in the ideas of professional reform. Some argue that the profession cannot be counted upon to reform itself. It is too completely a prisoner of its own entrenchments, including its pecuniary interests. Edgar Schein has addressed himself to the problem of what kind of professionals are needed for the future. He argues that in our rapidly changing society we will increasingly generate problems which the professions, are presently constituted, will be unable to handle. He has distinguished three types of role that our institutions are preparing their students for their professional lives. The first is the role of custodianship. This is characterised by the practitioner's acceptance of the currently existing norms of the profession that he will enter and by the acceptance of the current levels of knowledge and skill in that profession. He is solely concerned with using the technical training he has learned at the University. The second role is that of content innovation. This is characterised by dissatisfaction with existing levels of knowledge and skill in the profession with resulting innovation in terms of the content of the discipline. The third, and the one he suggests Universities should be aiming to produce, is "role innovation", which involves redefining what is legitimate engineering practice and what are the bounds of present expertise, dealing not only with new problems as the content innovators did but with problems previously regarded as outwith the bounds of professional practice.

However, economic recessions and a declining birth rate have revealed tensions, battles for resources, for students and for prestige are raging. Higher education has found itself contemplating increased centralisation, control and conformity. The rhetoric has continued to state the need for flexibility, the preservation of diversity, the capacity to respond sensitively to local and national industrial and technological community needs and changes. As Ashby wrote in 1974:

"The future of the University, the way it reconciles tradition and innovation will be determined less by trustees and presidents than by the values of thousands of individual teachers.

Ideas and initiative do not come downwards from the administration as directives to be obeyed; they percolate upwards from individual scholars and scientists as recommendations to be approved by the administration.

No other great institution works like this. The University must".

(Ashby, 1974: p.149)

Many University teachers have committed themselves to developing innovative courses; typically they put a great deal of effort into planning course procedures, designing learning materials and making revisions. Sometimes, however, the results do not seem commensurate with the time and energy spent. In particular, the results are not often evaluated systematically. Even where evaluation is attempted.

"In most such cases (experimental programmes and schools) we wind up with a retrospective story of the program, the faith, the confident expectations, but with inadequate account of just what was done, how, and when and of just what happened and didn't happen as a result ... The real question is how we can make the best use of the 'natural experiments' or 'results' when some courageous enthusiast with faith in his ideas wants to 'try something out' and is willing to gamble ... If only they were good reporters too ... and regarded the 'write up' as a part of the commitment.

That is just the way the ethnologist works: he does not design, control, manipulate or change anything. Ultimately, he is simply a non-interfering observer and a good reporter".

(Maslow, 1965: p.13)

(Cited in Smith and Keith, 1971).

This thesis is an attempt, through a detailed case study, to show the evidence that can be collected to describe an evaluation, and to learn from the outcome of the evaluation.

It reports an "illuminative evaluative" study of an innovative programme for teaching undergraduate students in a university civil engineering department. What is often missed from evaluations of innovations is the reaction of those affected by it and the unexpected consequences of those both on teaching colleagues and the students. This thesis concentrates on the 'contrasting perspectives' of the participants in the innovation.

The thesis is organized in three parts, and into nine chapters.

Part I sets the scene in terms of both the nature of the innovation, and the research methodology which was used to carry out the evaluation. To do this it is necessary to be concrete about earlier attempts at similar innovations, and, in particular, about the specific innovation to be investigated. This has to be described in sufficient detail to allow the subsequent comments of the participants to be interpreted within their context. The abstract counterpoint is necessary to build up the concepts deriving from previous research, which again help in the interpretation of the participants' perceptions of the innovation. It is also necessary in justification of the particular method of evaluation adopted in this study within Part I, Chapter 1. Part II of the thesis leads to the analyses of the data and to the main interpretative concept used in making sense of the interview comments, 'the multiple perceptions of the participants'.

The Learning Unit, the subject of this study as an emergent situation, tended to be less specifiable, less predictable. To understand the events surrounding the 'Learning Unit', the researcher approached the task by doing five case studies, each predicated on a different set of categories and from a different point of view or angle of vision.

In these case studies the search focused on the varying perspectives of the teaching staff on one hand and the students on the other. These varying perspectives altered the very way each participant defines the problems and the kind of alternatives they generate as solutions.

Chapters 6 and 7 trace the emergence of these perspectives through the comments of the innovators and the students directly involved.

The teaching staff who are not immediately involved in the innovation have another very different perspective and this view is explored in Chapter 8.

Part III brings together the interpretation from the previous chapters seeking underlying themes and then examines the more general implications for education and for research.

In the final chapter, the 'meta discussion' focuses on the multiplicity of discourses, none of them marked with the undeniable stamp of truth and the theoretical and methodological implications of their existence.

Implications of the study for the remainder of higher education, on the basis of what has been written in the thesis, will address the problem of multiple perceptions of innovations and the problems for those involved in undertaking or evaluating such innovations.

It is this richness and variety of experience which will have to be modelled, if we are to be able to present a 'recognisable reality' to teachers or students and so make innovations more effective.

CHAPTER II

Innovations in Higher Education Teaching and Learning - A Review

The expansion of higher education after the Robbins Report created problems in coping with additional numbers and less well-qualified students. One response was to consider ways of making teaching more cost-efficient - and that was one of the initial reasons for a new interest in teaching and learning in higher education in the late 1960's.

At that time, the discussion of teaching and learning focused largely on two aspects of the question - at the lowest level, on methods of teaching and at the highest level of abstraction, on theories of learning.

In the earlier days, research concentrated on the use of media as teaching aids. By concentrating on the problem of improving the presentation of stimulus materials, and working with some of the cruder concepts of communications theory, much of this research concerned itself in a lop-sided fashion with ways in which information was transmitted to the student.

Users of media claim that the involvement of different senses in the receiving of information leads to a more integrated understanding of a given topic. Other advantages mentioned indicate that since recorded phenomena can be presented repeatedly (generally at the teacher's and students' convenience) learning can be combined with instructional flexibility. To accomplish the one-way transmission of information, it was noted that instructional media can be effective substitutes for some types of traditional teaching. This is particularly true when qualified teachers are not available or when the traditional format of instruction is not appropriate in view of the learners' special circumstances (distance learning). The use of tapes, films or slides may also serve to free instructors of large lecture courses for more personal interaction with their students.

The audio-tutorial A/T approach (see below) utilises slides, filmstrips, tape-recordings, etc in providing self-paced modularized instruction.

Researchers in this area did not explore too closely what the student has learned and at what speed or for what purpose.

Understandably, that led to a passive attitude towards student response: the student was seen in a dependent situation, relying upon information directed at him, whether through the agency of media, or through the more traditional forms of the lecture and the textbook.

But the use of media alone did not satisfy the aspirations of those who were hoping for improving efficiency in the educational process.

They moved away from thinking about technology in education, i.e. chiefly concerned with equipment, the elaboration of *ad hoc* messages and the incorporation of technology into traditional teacher-centred activities - to thinking about the technology of education, i.e. the systematic application of the resources of scientific knowledge in the process that each individual has to go through in order to acquire and use knowledge.

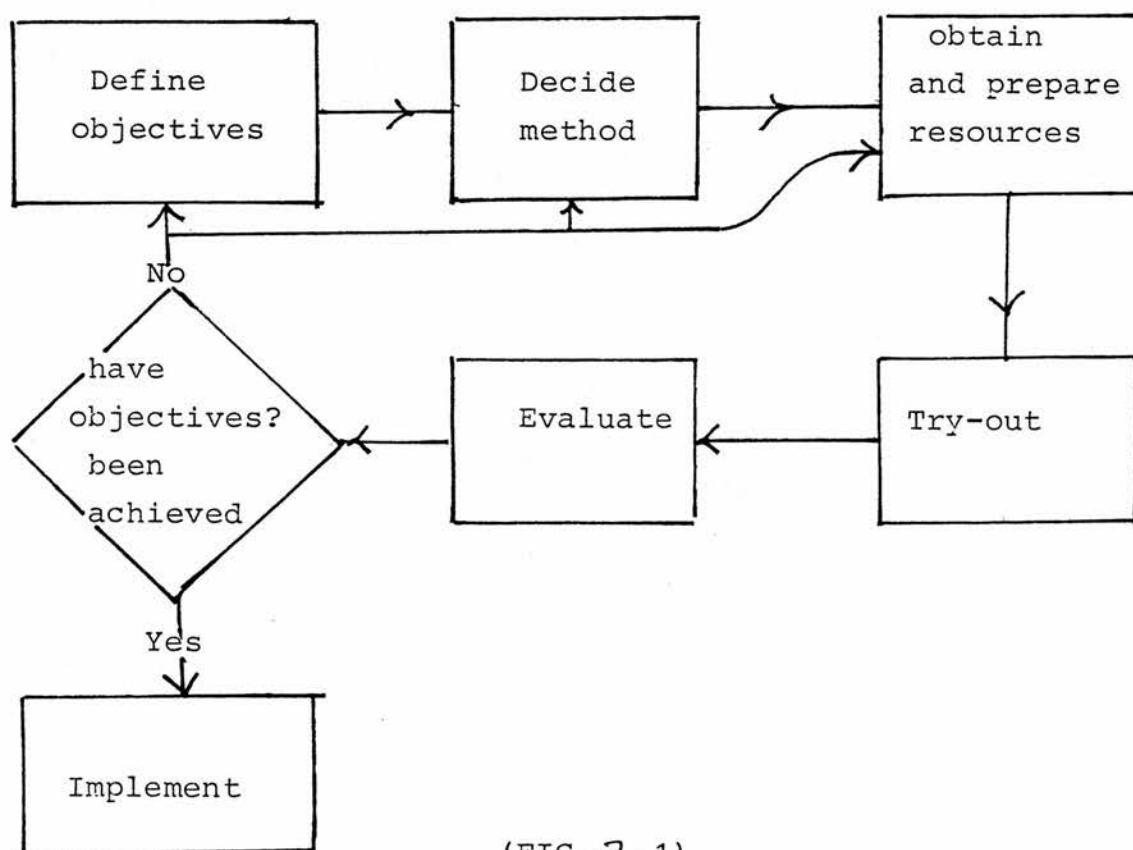
The aim behind such thinking would be to move away from dispersion of effort and waste, to a full and integrated use of all the resources of the technological age. The hope was that technology would cease to be a miscellaneous collection of new equipment and methods, but the aim was to apply modern technology methods of organisation and measurement, its evaluation and experimental techniques.

The teacher-turned-technologist would then gradually assume the functions of an 'educational engineer' whose job it was to increase the output of the entire scholastic machine (1).

(1) Report on the meeting held to discuss the training of educational technologists, National Commission of the FRG for Unesco, Constance, 18-22 June, 1970.

The methods of organisation which were developed under such names as 'operational research' or 'systems analysis' appeared to be suitable intellectual instruments for an overall critical study of existing systems and for suggesting new educational configurations in which there would be a place for the resources of technology. Administrators were invited to apply relevance trees or critical path analysis to the bottle-necks in the educational systems. Teachers were encouraged to apply the principles of feed-back and self-correction to the active functioning of educational institutions.

Systems analysis aimed to measure exactly the objectives to be attained in terms of performance, to define the levels of application and to allow for the constraints under which the educational system operates and so arrive at rational operating models. The major aim was to marshal the various agents into a unified process in pursuit of maximum efficiency. The simple model (Fig. 2.1) for the development of a teaching topic, shown below, indicates the conception of instruction on which educational technologists were operating at this time.



(FIG. 2.1)

From MacKenzie, Eraut and Jones (1976), page 142.

Although this conception was 'system' led, it was recognized that the new materials produced could also allow teaching to be individualised.

So the search was in part for improved efficiency and in part for better ways of facilitating learning.

The enthusiasm generated by educational technology was reflected in developments in a particular department of civil engineering which became the focus of this evaluative investigation.

Fig. 2 (2) summarises the "innovations" which were devised by a group of staff in this department over a period of years. These include, integration of subject matter to teach basics, team teaching, use of visual aids, introduction of 'projects' in undergraduate teaching, group teaching methods using closed circuit television programmes and the use of a 'feed back classroom'.

From 1971 onwards, the lectures in this department have been using tape plus overhead transparency explanation, and tape/slide sequences, to introduce the initial teaching material to their students. Versions of audio-tutorials, open-ended laboratories where induction loops, radio headphones and self-marking exercises have also been in use. Games, simulations and role-playing have been explored [Fig. 2 (2)].

curriculum
organization

Rational Planning

The management-by-objectives approach,
programmed learning, Educational
Technology and Systems Approach

Methods of
content
delivery

Use of various media
C.C.T.V. for student groups

Individualized
instruction

Modular Instructions (Modules)
Audio-tutorial approach to learning
Student directed learning. Independent study

Learning
through
experience

Simulations, Games, Role playing-case
studies and research

Course
management

Small group teaching
Team teaching. Teaching Assistants

Course
evaluation and
student
assessment

Summative and formative course evaluation
Cost-benefit analysis. Continuous
assessment and regular feedback to
students, open book examinations

[Fig. 2 (2)] The Learning Unit Innovations.

The discussion which follows consists of two major parts. Firstly, the focus will be on the major innovations of the Learning Unit as conceptualised by the researcher. These are (a) Attempts to develop student autonomy in learning, and (b) teaching and learning through small group discussions. For perspective the researcher will introduce an arbitrary time, T_1 , in which an innovative vision of teaching at the University is formulated. This vision, a point of view or a perspective is built about the innovator, his problems and his environment. It contains statements of goals and objectives towards which he was striving. Also it contains subgoals to be approached "on the way" toward the more general and ultimate objectives. In formulating his point of view the innovator studies the "state of the art" in terms of techniques of teaching and theories of student learning which were fashionable at that time. A detailed study of earlier attempts at similar innovations to be investigated will allow the subsequent comments of the participants to be interpreted within their context. Secondly, an examination of the concepts derived from previous and current research on student learning, although some of these were not available to the leader of the Learning Unit when he formulated his point of view, is necessary to build up, and help in the interpretation of, the participants' perceptions of the innovation recorded as part of this evaluative study.

[II.1.A] Attempts in developing students autonomy in learning:

At the root of the debate about "meeting individual differences" and "individualized instruction" lies a simple idea and a number of ways of trying to implement it. The idea is self-evident yet the corollaries are in considerable debate. This central conception is that "the variety of individual differences among students needs to be reflected in the instructional methods adopted". The consequent problem has been magnified as the range of students entering

higher education became wider and more varied in performance and background. Most people accept this premise as self-evident. The implementations all begin with the central statement "because students are different" and follow with a "therefore".

The seven major implications about which there is debate include:

- .*. 1. The style of lecturer - student interaction and instruction must differ.
- .*. 2. The materials that are used must differ.
- .*. 3. The lecture hall procedures must differ.
- .*. 4. Starting points and rates of progress must vary.
- .*. 5. The scope of the curriculum must be expanded.
- .*. 6. Curricular and instructional goals must vary for individual students.
- .*. 7. Students' choice is essential.

In short, individualized curriculum and instruction possesses many faces. Presumably, the causes and effects of individualized approaches will vary according to which of those faces one examines.

In the following section the general dimensions underlying the ideas will be clarified to develop a general model that encompasses multiple and particular instances and implications of individualization. This is important because educational discussions flounder as people holding varying referents nevertheless utilize similar labels. Furthermore, these labels are often used injudiciously or inadvertently across situations, age levels, and contexts. Overly simple interpretations and overgeneralizations are a consequence.

II.1.A(i) An initial model of individualized curriculum and instructions

In order to provide an initial framework within which to locate the innovations examined in this evaluative study, it will be helpful to envisage a hierarchy of curricula moving towards individualisation.

In the sense of an approximate ordering or 'hierarchy' one can imagine at one level the stylized, traditional, lock-step curriculum in which all students are engaged at the same time with the same books and are working towards the same goals.

The next level of individualization involves a variation in rate. The students move through the same materials towards common goals, but they move more rapidly or slowly. In this situation one attempts to account for differences in general ability and motivation or perseverance.

At the third level one retains the same goals but alters the means or material as well as the rate of progress through the materials. Many remedial and branching types of programmes illustrate such an approach.

The fourth level changes goals as well as materials and rates. Finally, the most individualized programme, level 5, involves the element of student choice in what is studied. At this level the student set goals, chooses materials and determines his or her rate of learning.

(Figure 2.3) summarises these levels and its implications.

(Fig.2.3) A model of individualized curriculum and instruction

Level:	Implications:
5. Students choice in goals, materials and rates	Students determine ends, means and rates of progress
4. Different goals, different materials, and varying rates	Students work toward different ends (for example, enrichment) which involves different materials and varying rates as well.
3. The same goals but varied materials and rates	Students are directed towards the same outcome but may branch into special material (often remedial).
2. Individualization: variation in rate	Possible variation in starting point; some students move through the material faster.
1. Traditional lock-step	All students in the same books and materials, moving at the same rate towards the same goals

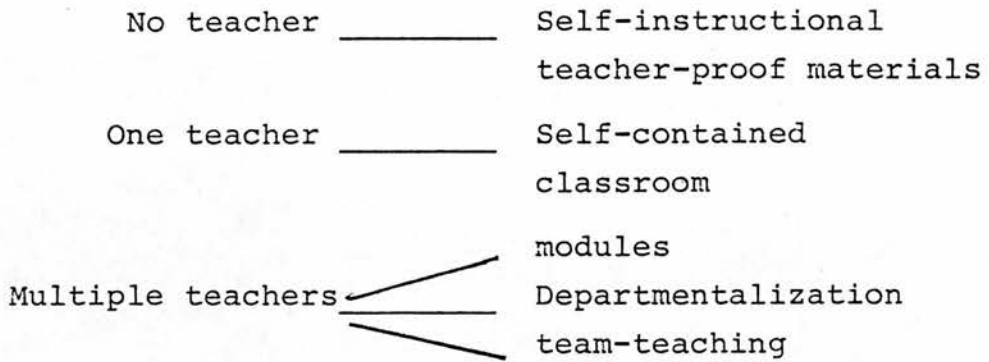
As one analyses this model of individualization (Figure 2.3) represents, a number of additional ideas arise that educational innovators must attend to if a clear language is to be available and if clear propositions are to be developed. Firstly, Goals; where students' choice of goals becomes an element of individualization of curriculum and instruction, one cannot escape the fact that political as well as professional decisions are being made. When educators argue for no or few content imperatives except as chosen by the students, they are taking an important political stand with which other contending groups - external examiners, validating authorities, employers and university administrators - might wish to quarrel. These have also other implications for assessment, since when all students approach the same goals, standard criterion of assessment are readily established. Secondly, the expansion of educational goals to include independent or idiosyncratic development, attitudinal or affective changes suggests immediately a need for altered measures. At a relatively high level of abstraction, the lecturer, the books, the materials and the departmental organization and procedures all can be assimilated under the same general concept "means of instruction".

In sociological jargon they are functional equivalents, even though their concrete manifestations are quite dissimilar.

Figure 2.4 shows the role of the lecturer and supportive materials in varying forms of curriculum and instruction. At one end point, the student might interact with no teacher but only with self-instructional materials.

Currently, a number of curriculum projects are underway in which lecturers do have such minimal involvement. The PSI or Keller Plan, The Audio/Tutorial approach (see below) approach a "teacher proof" status. A further step on the scale is the use of multiple teachers. Several variants occur, interdisciplinarity and the involvement of a number of departments and team-teaching.

Currently the term 'individualized instruction' is not used consistently by practitioners of individualized methods.



(Figure 2.4) Role of teacher in individualized curriculum and instruction

In United Kingdom, "individualized" is commonly replaced by words which describe more precisely the approach used such as "self-paced" and "resource based". However, individualized instruction is not synonymous with independent learning or learning in isolation from other students. While individualized methods may encourage independence from the teacher, this is not usually the main aim, nor do students necessarily work in isolation from their peers.

It is more common to restrict the use of the term "individualized instruction" to those developments that have occurred since the 1950's which are systems of individualized instruction. Goldschmid and Goldschmid (1974) have identified the characteristics of individualized instruction which are common to all approaches as: emphasizing learning rather than teaching, the use of clear goals, active student participation, a stress on feedback and evaluation and individual pacing. These characteristics are, however, manifest in many different forms.

Among the best documented teaching systems which incorporate some of these ideas are the modular instruction, the personalized system of instruction (PSI) and the audio-tutorial approach. The audio-tutorial approach has become quite common in the biological sciences and it would be uncommon to find a major institution in which at least one example of such individualized instruction was not to be found. Different methods of individualized instruction

vary greatly in their emphasis. Some are based explicitly on a learning theory while others are more pragmatic arrangements which have been adopted because they achieve certain desired outcomes. In all cases the schemes originally promoted have been modified and adapted by others and it is often difficult to classify any particular method in use today as it is likely to be a hybrid or a substantial variation on one of the major themes.

As these approaches are to be found within the innovations adopted in the Learning Unit, they will be discussed here in some detail, together with evidence of their implementation and effectiveness elsewhere.

II-1-A.(ii) Modular Instructions: (Modules)

The idea of modularised programmes of instruction was popularised by the growth of programmed instruction in the 1950's.

A module may be defined simply as a "self-contained and independent unit of instruction with a primary focus on a few well defined objectives (Creager and Murray 1971). Nowadays, modular instruction can either take the form of a few modules inserted into an otherwise traditional course or it can form a complete course through a prescribed sequence or through student choice from a range of modules.

In behaviourist terms, the components of a module are (Creager and Murray 1971):

Statement of purpose (Rationale):

description of the purpose of the package.

Desirable Prerequisite Skills:

If particular skills are needed before the beginning of a module, they should be stated explicitly.

Instructional Objectives:

they describe what the learner should be able to do after completing the module.

Diagnostic Pre-test:

to determine whether or not the student is prepared to

undertake the module. Outstanding performance may indicate that the student need not take the module.

The Modular Program:

Learning activities and instructions so that the learner can independently complete the module. These activities may include writing, reading, listening, viewing etc. Different learning activities to achieve the same objectives provide the learner with an opportunity to follow his own particular learning style.

Evaluation Post-tests:

to provide an index of the learner's accomplishments. Modules may also include lists of equipment and supplies, self-evaluation tests, optional activities, teacher's guide etc.

The instructor acts as a resource person who can be called upon for assistance when required. The provision of pretests aids in diagnosing the need for remedial study and they can be used to direct students to appropriate remedial sequences which may take the form of other modules.

Modular instruction is characterized by its flexibility. They can be arranged in a variety of sequences to meet the individual needs of each student. Some modules can be studied at home. They also can be shared among institutions. Undoubtedly, modules offer a wide range of instructional possibilities.

Modular instruction has not been subject to as much evaluative research activity as its antecedents, mainly because it is too general a term involving discrepant ways of implementing it.

II-1-A. (iii) The Personalized System of Instruction (PSI):

The personalized system of instruction is also known as the Keller Plan after one of its founders, Fred S. Keller, who originally established the approach. It utilises the Skinnerian operant conditioning principles of specification of terminal behaviours and effective management of sequences.

In practice PSI usually has the following features: unitization (information broken down into small manageable units), self pacing (whereby the student proceeds through one unit at a time at his own pace), criterion-referenced mastery (which must be demonstrated prior to advancing to the next units) and the use of student proctors. Where courses are quite small it may be possible for one instructor to provide all the individualized attention (e.g. immediate feedback on tests).

Lecture and demonstrations are used for purposes of enrichment, providing motivation and giving an overview of the course. These are far fewer than in a conventional course, attendance is voluntary and they are not essential for mastery of the subject.

The key elements of the system are the requirements for progressive mastery and the self-pacing which necessarily follows. Students are reinforced in their learning by receiving feedbacks on their performances and they are not penalized if they are not successful at any stage.

There have been a number of studies comparing the effects of PSI with conventional courses.

Kulik et al. (1979a) undertook a meta-analysis of 75 comparative studies. Their findings were "that PSI generally produces superior student achievement, less variation in achievement, and higher student ratings in college courses, but does not affect the withdrawal rate or student study time in these courses". The key features of the system appear to be three: small steps, feedback and a unit-mastery requirement.

There have been many variations on basic PSI systems some of which do not retain the same basic principles as the original but still use the same name. One common variation is to use variable routes through course units and provide additional optional units. This adds flexibility to the basic linear path and can allow for greater student choice in the selection of content (Melton 1981). Where students are lagging behind or when administration of individualized sequences becomes difficult, the self-pacing aspect can be

modified by setting up periodic regular testing for all - though one might question whether the PSI label, modified or otherwise, is appropriate in such cases.

II-1-A.(iv) The Audio-Tutorial Approach to Learning (A/T):

The audio tutorial or autotutorial approach was developed from 1961 onwards by Postlethwait and his colleagues in a biology course at Purdue University (Postlethwait et al. 1972). Basically, in the A-T system a wide variety of learning experiences is provided in an integrated form and the students' activity in these learning experiences is guided by audio-tapes.

Postlethwait explained that "In the audio-tutorial system the instructor's voice is available to the student to direct and supplement his effort. This does not mean that a tape lecture is given! This refers to an audio-program of learning experiences logically sequenced to provide information for skilled learning to proper performance of the next activity or else build on the foundation of knowledge previously laid. The overall set of integrated experiences includes lectures, reading of text, or other appropriate material, making observation on demonstration set-ups, doing experiments, watching movies and/or any other appropriate activities helpful in understanding the subject matter".

Originally, the system includes three major types of study session (Postlethwait et al. 1972):

a) Independent Study Session (ISS)

Weekly A-T programmes are placed in a learning centre equipped with cassettes for individual study. Each student can pace his study, proceeding independently through the material to achieve the stated objectives for the week.

b) General Assembly Session (GAS):

Lectures, special films, major exams or other large group activities scheduled on a weekly basis.

c) Integrated Quiz Session (IQS):

A small group session, scheduled to meet weekly for one half-hour, that involves eight students and an instructor. For this session each student is expected to prepare a short

lecture about the material studied in the ISS.

At present, the A/T approach is closely identified with a learning centre where the student can work individually in a learning booth, stopping at any point in the programme to use additional resources such as supplementary texts and discussions with the instructor on duty or with peers. The learning centre is open for an extended period of time and to which students can go at times convenient to themselves.

Self-pacing can occur, but only within the confines of the week's activity. While written guides are used as in PSI, the use of audiotapes enhances the contact a student has with the instructor and enables students to feel a degree of personal contact which is missing from the written word.

Although the mastery concept is not central to the audio-tutorial approach, Postlethwait adapted the A-T approach to implement this idea in what is known as Minicourses (Postlethwait and Russel 1971; Hurst and Postlethwait 1971). A minicourse is a short, self-contained instructional package (audiotape and portable materials) for use in a carrel, in the library or at home. Whereas A-T units are too large and inflexible to allow repetition of study, necessary, for re-testing and mastery learning, the design of the portable minicourses does allow repetition of any or all segments - until an acceptable level of performance is attained. At British Universities, and many other universities, existing constraints preclude testing for mastery; courses must be contained within the term/semester; science subjects usually have fairly stringent weekly schedules; self-pacing is not encouraged; students are expected to attend lectures and labs at specified times; and assessment tests (intermittent or final examinations) are usually end of semester/term or end of year fixtures. Nevertheless, teaching for mastery - at a realistic level - even in traditional universities, can properly be a goal for teachers and a challenge to students. Kulik et al. (1979b) conducted a statistical synthesis (a meta-analysis) of 48 studies which compared audio tutorial approaches with conventional instruction. They found that

audiotutorial instruction had a significant but small overall effect on student achievement in college courses and it had little effect on withdrawal rates or on student course evaluations. It is important to point out that these conclusions were based "solely on comparative studies that used a control group", (Kulik et al. 1979b).

Furthermore, the statistical synthesis or meta-analysis usually discuss very few studies whose results they synthesize and their approach tends to be mechanistic. They tend to devote all journal space to statistical treatment of the whole literature with little attention to individual studies or to substantive and methodological issues. Listing and statistically treating a literature that is too large and diverse for the reviewer to describe or for the reader to comprehend will not preserve the intelligent discussion of critical issues necessary for reaching the best evidence.

Mintzes (1975) examined 19 studies on A-T instruction and concluded:

"Although a good amount of research has been done in the field of A-T instruction, I believe it is fair to say that many of the results have thus far been disappointing. This may be due in part to a lack of methodological sophistication on the part of researchers, as well as to their failure to tackle questions of sufficient importance".

Mintzes, a biology lecturer, and a scientist supported the notion indicated by Novak (1970) and McDuffie (1973) that future research on A-T should be theory-based, and that the research should grow out of conceptual models founded on psychological learning theory. Novak favoured the cognitive theories of Ausubel (1968). Mintzes went further, adopting a positivistic stance to suggest that A-T system may provide a vehicle of a unique variety for research on sensory learning modalities. "Since A-T is made up of several components (visual auditory, tactile), it may be possible for researchers to manipulate and control these various inputs, thereby studying the effects of each on learners with differing cognitive styles".

The researcher adopted a very different approach i.e.

"illuminative evaluation" (see below) in conducting this study in contrast with the studies reported by Kulik et al. (1979b) and Mintzes (1975).

II-1-A.(v): Student-Directed Learning:

Student-directed curriculum and instruction represents another approach to individualization. Rather than prescribing most or all of the tasks and materials, as is true of self-paced programmes, students are permitted and encouraged to tailor their own learning experience within limits of greater or lesser restriction.

The intention is to give students more responsibility for their own learning.

In many cases, this is a response to students' demands for more control over their educational lives, and in other cases it represents a strong feeling on the part of the teacher that learning is ultimately more effective under these circumstances. Negotiation between students and teachers over learning activities provides for shared responsibility and control.

Independent Study:

Many of the innovations observed by the Nuffield Group and reported in the Newsletters (1973-1976) were concerned with a particular methodology of learning prescribed areas of knowledge or predetermined skills. The 'Independence' involved was conceived as a means of promoting student motivation, of adjusting the pace of academic work to take account of student differences and of developing better specific problem-solving techniques. On the other hand, Independent study differs from the previous categories because it is not tied down to classroom or learning centre activities. Independent study is considered to be:

a) A learning activity largely motivated by the learner's own aims to learn and being largely rewarded in terms of its intrinsic values.

b) This activity if carried out under the auspices of an educational institution is somewhat independent of the class or other kinds of group institution's, past and present, practices.

c) The activity utilises the services of teachers and other professional personnel primarily as resources for the learner. Percy and Ramsden (1980) concluded after studying two examples of 'Independent Study' from English Higher Education that; firstly, in all courses students should be presented with a variety of choice from among all possible modes of learning. Course content should not be presented to the students as immutable if it is possible that other areas of content could be studied equally usefully. Students should thus be given as much choice as possible in what is to be learned. Secondly, since the techniques of individualized and media learning are developing and there is always the possibility that a student may be effective simply working on his own, the student should be given as much choice as possible in how and when he learns. Thirdly, it is now accepted that the assessment structure of a course is liable to define for students the course horizons and the possibilities for learning within it; assessment requirement should be diversified to allow for a choice of course work and/or examinations, dissertations and/or oral presentation, project work or assessment of practical work or experience. At least, then, students may perceive the situation as one in which they are allowed to make an independent evaluation of their own strengths and weaknesses and by choosing between the modes of assessment, to exercise control over how their learning is assessed.

From the discussion above, one may claim that the value of developing autonomous learning is becoming increasingly recognized. Carefully designed packaged courses in various media are being made available, at which individuals can work at their own convenience and pace. But the fostering of self-learning involves more than the exploitation of educational technology: it requires also considerable changes in the psychodynamics of teachers and learners.

If one considers the civil engineering curriculum, for

instance, one can consider the types of knowledge and expertise that the civil engineering profession creates, legitimates and lays claim to. That is the "technical" portion of the knowledge or ability required for successful performance of a civil engineering task. This could be rendered in a precise list of specification - for instance in a text book or working manual. A convenient method of transmitting this knowledge could be a lecture. On the other hand, there is a variety of types of 'tacit' and private knowledge that is the personal property of the successful civil engineer. It cannot be made explicit, and it remains untranslatable into precisely formulated rules or prescriptions. Unlike techniques such means of production are not transmissible by means of public formal methods rather by example, or observation of practice or participation by the student. The best means to achieve this tacit form of knowledge seems to be through small group works. Hence the following detailed discussion of that mode of teaching and learning.

II-1-B: Teaching and Learning through small group discussion:

The basic idea, in small group teaching is that the students, in small groups, play an active role in the instructional situation. Group sizes range, roughly from five to twenty students and one or two members of staff (tutors or 'seminar leaders'), who meet with the intention that discussion rather than instruction shall be the main mode of learning.

The distinctive intellectual functions which seem most appropriate to small group work are those involving co-operative exploration; for example applying engineering principles to the design of a particular bridge, or applying skills in the design of electronic apparatus to providing 'hardware' for an experimental problem in psychology. Other intellectual aims are, testing out of principles, integrating data for the benefit of others and the development of understanding. Understanding is essentially relational. It consists in establishing significant relationships of knowledge or of knowledge and skills. Application is one such relationship. The essential point about understanding is that it is personal and public. There is a distinction to be made between 'group understanding' and 'individual understanding'. Group understanding implies a consensus which may be built up through a collaboration of individual understandings. The distinctive potential of small group work lies in the expression of a diversity of views and interpretation, and its distinctive style is reciprocal. Each member interprets data for the benefit of others, and reshapes them in the light of the contributions of others, hence develop 'group understanding'.

A small group may also serve a 'social' function. It is argued that small groups provide a haven in the disturbing drift of large institutional life: that they are territories where individual identities can emerge in some safety; that they allow university teachers to work in closer contact with students and even to bridge the

student-student gap.

The leader makes it clear that he is not concerned with the transmission of knowledge but rather with its participatory exploration. He can be devil's advocate, challenging his students and opening up new lines of attack and constantly shifting ground. He can be the neutral chairman, who defines procedures but excludes the expression of his own opinions on the grounds that these are likely to be given undue weight.

This is an uncomfortable role for students to adjust to, but one which can eventually prove productive. The tutor should make it clear that students have to accept responsibility for their own learning, to develop autonomy as scholars, and hence to learn to use him as a consultant and guide rather than as an instructor. This is no easy task since the tutor cannot escape the responsibilities of a leadership position and the problems in the area of authority-dependency which this sets up.

General gains to students from small group teaching and learning may be: improvement in motivation, maturity, broadening of outlook, experience of responsibility by undertaking specific tasks, ability to think creatively, stimulus and confidence.

These gains demand a heavy investment of time. In teaching, the need for knowledge expresses itself as concern for 'coverage'. Participatory small group teaching is not an effective way of providing coverage. If small group teaching is to be effective as a critical exchange in which significant relationships are suggested and explored in order to promote an understanding of the structure and logic of knowledge or a group of the problems of applying knowledge or skills in various situations, then the problem of content-process should be faced head on. Nothing is more destructive of participatory small group teaching than concern for 'coverage' of subject matter.

Other factors which work against a wider use of small group teaching are the lack of provision for departments to make printed materials, in multiple copies, available to discussion groups, including the copyright problems involved.

Several patterns of small group teaching have been reported by the Nuffield group for research and innovation in Higher Education (May 1976). Other studies were published in earlier dates by Abercrombie (1971, 1972), Collier (1969), Nisbet, S. (1966) and Richardson, E. (1967). In the latter studies both group rules and teaching roles have been defined as explicitly as possible with attention paid to the psychology of groups.

II-2:(i) Concepts Derived from Research on Student Learning

In the discussion of the different innovations available to university lecturers one finds tightly controlled programmes of study, such as the Keller Plan, alongside unstructured or structured small-group tutorial techniques. Both of these contrasting approaches are thought to improve students' learning. How is it that innovations are following such apparently divergent paths? Entwistle et al. (1975) attempted to place innovatory methods of instruction between two poles of a single dimension (Fig. 2-5) and indicated:

"Inevitably any such classification oversimplifies; but it does emphasise the different models of learning which the innovators have been following, whether explicitly or implicitly".

Most of the early work on learning was conducted within a behavioural framework, involving only simple forms of learning. Often the experimental subjects were required to learn nonsense syllables, and where continuous prose is used, the outcome of learning is indicated simply by the number of correct answers to a test. It was rare for research workers to examine whether the meaning of a passage has been understood, or to look for different kinds or levels of meaning which students may have found. But then in 1976 Marton published the first of an influential series of articles from a research group in Gothenburg. Marton (1976) broke with experimental/quantitative paradigm of psychological research into human learning, and used realistically complex material combined with

Figure 2:5: INSTRUCTIONAL METHODS AND ASSOCIATED LEARNING THEORIES

<i>Exploratory learning emphasising freedom and self-expression; evaluation retrospective and subjective</i>		
METHOD OF INSTRUCTION	ASSOCIATED LEARNING THEORISTS	TYPE OF THEORY
Leaderless discussion groups	Rogers) Humanist
Co-operative projects	Maslow	
Free background reading		
Individual project work	Bruner	Cognitive
Tutor-led discussions	Perry	Developmental
Tutor-led seminars	Marton) Cognitive
Learning Cells	Ausubel	
Lectures	Broadbent) Information Processing
Hand-outs and guided reading	Lindsay and Norman	
Computer-managed learning	Pask	
Keller-Plan courses	Gagne	Task Analysis
Programmed learning	Skinner	Behaviourist
Computer-assisted instruction		
<i>Tight control of content and method; outcomes measured psychometrically and related to predetermined specific objectives</i>		

NOTE : Except in those instances specifically mentioned in the text no direct link is implied between a particular method and the learning theory which happens to be on the same line.

(Figure 2:5)

qualitative analyses of both what the students had learned and how they had tackled the task. They were given, individually, an academic article of fairly general interest which contained a tight argument supported by detailed evidence. Each student was required to read the article through in the usual way and to be ready to answer questions on it afterwards. The subsequent questions concerned both understanding and learning strategy. Naturally, there were substantial differences in the levels of understanding subsequently demonstrated, but more interesting were the differences in approach to learning which were related to these differences in outcome.

The two main approaches to learning described by Marton were categorised as 'deep' and 'surface' (Marton and Saljo 1984). The main defining feature of each of these categories is the contrasting intention shown by students as they read the article. Thus the deep approach involves an intention to reach a personal understanding of the material presented, and this calls into play characteristic learning processes. The student adopting a deep approach interacts actively with the content, examining the evidence and evaluating the logical steps by which the conclusions are reached. The student relates the new information to previous knowledge and personal experience, as well as to other topics and subject areas. In contrast the student adopting a surface approach shows an intention merely to satisfy task or course requirements, which are seen as external impositions, largely unconnected with personal interests. The surface approach can still be active, but it relies on identifying the elements within the task most likely to be assessed, and then memorizing those details. It was found that students who adopted a surface approach to studying were less likely to reach high levels of understanding of the text and were more likely to fail at least one examination. Students adopting a deep approach remembered even details from the text after five weeks and were very unlikely to fail examinations (Svensson 1977; Marton and Saljo 1984).

Pask (1976) was able to show that even when students were required to demonstrate personal understanding after learning, there still were two characteristically different styles of

achieving that outcome. Styles can be seen as relatively consistent preferences for behaving or thinking in certain ways. Pask showed that some students, holists, relied more on what Pask called comprehension learning. They preferred from the beginning to look at the learning task in its wider context. They also made wide use of illustrations examples, analogies, and anecdotes in building up an idiosyncratic form of understanding deeply rooted in personal experience and beliefs. Other students, serialists, concentrated on operation learning. They preferred to start with a narrow focus, to concentrate on a cautious manner on details and logical connections, looking at the broader context only towards the end of the topic. Extreme holists were impulsive, even cavalier, in their use of evidences, tending to generalize too readily and to jump to unjustified conclusions. Pask described this tendency as the pathology of globe trotting. Extreme serialists showed improvidence, often being too cautious in their learning and failing to see important inter-relationships or useful analogies, thus leaving their understanding impoverished. However, some students were sufficiently versatile to use both styles, in conjunction with the particular balance between them implied by the nature of the task.

Research conducted at Lancaster University (Entwistle and Ramsden 1983, Ramsden, 1981) has shown the importance of previous knowledge in allowing a deep approach to be adopted, particularly in the sciences. The other crucial factors are interest or relevance, self-confidence as opposed to anxiety (Fransson 1977) and the type of assessment of procedure anticipated. Saljo (1975), Marton and Saljo (1976) have shown that when factual tests are anticipated, even the best students shift from a deep to a surface approach in their learning. These findings, and those of Miller and Parlett (1974) on 'cue-consciousness' in relation to assessment, demonstrate the necessity for looking at teaching and learning in higher education as a whole.

The crucial effects of assessment procedures on study have also been demonstrated in two well known American studies.

In Making the Grade (Becker et al. 1968) students' activities were interpreted as being largely coping ploys designed to achieve the grades necessary to make progress through their degree courses. Subsequently Snyder (1971) explained such behaviour in terms of a distinction between the formal and the 'hidden' curriculum. The formal curriculum, as perceived by the staff, demanded originality, problem-solving, independence of thought and analytic skills. But what influenced students most was the hidden curriculum, this being their perceptions of what was most rewarded by the assessment procedure.

In much of the research on student learning there has been an over-readiness to interpret the findings entirely from the lecturer's perspective. Thus it has been assumed that the success of a course of study should be judged solely by the degree results. But in fact, the benefits of the experience of higher education are seen more broadly and more variably, by students. Taylor (1983) has shown that students have different 'orientations' towards higher education. They vary in the extent to which their energies are directed towards academic vocational, personal, or social goals. They also show a difference in interest between an intrinsic concern with the content of a course and an extrinsic valuing of the other perceived benefits (such as qualifications or recreational facilities). In addition Taylor suggested that students behave as if they had implicit study contracts. They seem to have an idea of what they want to get out of the academic and social opportunities provided by higher education and they evaluate their satisfaction in relation to that contract, rather than just in the narrow way defined by the institutional assessment procedures. The contrasting orientations show close parallels with the forms of motivation identified at Lancaster. It was found that the deep approach was strongly related to intrinsic motivation and less strongly to need for achievement, while surface approach showed high correlations with fear of failure (Entwistle and Ramsden, 1983).

Besides identifying these correlates of deep and surface

approaches, the research at Lancaster described two other sets of intentions related to higher education. The first was described as a strategic approach with the main intention of obtaining the highest possible grades. This approach involves using both deep and surface approaches as determined by the perceived nature of the assessment procedure. It also involves being very alert to cues from lecturers as to what is important for the examinations and what criteria are used in marking. Interviews analysis have suggested that the strategic approach also involves careful planning and time management (Entwistle 1986), as part of generally well organised study methods.

The main motivational correlates of the strategic approach were found to be extrinsic or vocational motivation and need for achievement. The second additional approach was described as 'non-academic' and is characterised by negative attitudes to studying and disorganised study methods. This approach showed a weak negative correlation with intrinsic motivation, but was strongly related to social motivation.

II-2:(ii) The Context of Learning:

The S.S.R.C. research at Lancaster (Entwistle et al. 1983) used qualitative research methods with additional quantitative analyses, to investigate the students' perceptions of contextual influences on their approaches to studying. The most powerful influence on approach to learning as perceived by the students was undoubtedly the assessment procedures. Short-answer tests and multiple-choice questions were mentioned repeatedly to elicit surface approaches, while open-ended essay-type questions were seen as encouraging a deep approach to learning.

In both qualitative and quantitative analysis approach to learning appeared to be influenced by workload, freedom in learning, and 'good' teaching. A heavy workload or a feeling of pressure was associated with a surface approach, while being free to choose congenial styles of learning and individual topics for assignments was perceived as encouraging personal interest and a deep approach.

'Good teaching' was described in terms of several components which related mainly to lecturing. It included pitching the material at an appropriate level, and presenting it at a reasonable pace within a clear structure. But the strongest influence shown in the interview comments came from the lecturers' enthusiasm, empathy with students' learning difficulties, and, above all, the quality of explanation (Entwistle 1986). The Gothenburg studies (Dahlgren, 1978) found that first-year students had particular difficulty in answering questions which demanded a thorough understanding of the basic concepts they had been taught. One way of dealing with this problem has been suggested by the educational psychologist, David Ausubel, (1978) where he emphasised the need for identifying the 'anchoring ideas' in a discipline, determining the students' current knowledge base, and on providing for students advance 'organizers' (ideational frame works) into which subsequent information can be fitted.

II-2:(iii): Intellectual and personal development of students and the teaching of applied sciences:

Acquiring an understanding of the evidence and reasoning that leads to the "fact" of science is undoubtedly part of learning experiences in Universities. To help students develop the analytical skills they need to reason from experimental evidence to a conclusion is a common objective.

Many, if not most, students find it difficult to examine evidence critically, to establish a line of reasoning and to reach a conclusion or interpretation. Students are frequently unable to accept the existence of more than one equally valid interpretation. They will expect the lecturer to tell them the 'right answer' rather than try to establish for themselves a line of reasoning leading to the best interpretation. Interpretation, reasoning, rational planning are likely to be obvious and relatively simple procedures to the lecturer, and are assumed to be so for the students. The magnitude of student difficulty in, and resistance to, practising these

procedures can thus be extremely baffling to the teacher and may well be a severe impediment to the student in learning and dealing with it in a meaningful way. Insight into many of these problems has been provided by the work of William Perry (1970) on intellectual development in college students. In very general terms, Perry's developmental scheme proposes that college students gradually change the way they view learning, knowledge and values. In the initial stages of development, students hold dualistic views of absolute right-wrong and good-bad. Authority is viewed as both the ultimate and the immediate source of decisions regarding right versus wrong and good versus bad. The authority may be any source the student accepts - be it a lecturer, parent or text-book - but in students' view, the authority of the chosen source is absolute. Development proceeds through a series of well-defined stages to more pluralistic views where knowledge and values are perceived as relative. The student recognises that authorities can make conflicting yet equally valid interpretations. Moreover the student perceives that validity is determined by the coherence and internal consistency of an interpretation as well as by the available evidence.

II-3: Summary:

In this chapter, an examination of the problems which initiated the need for innovative programmes have been discussed. Use of media, programmed learning, educational technology and systems approach as early examples of innovations are summarised. The evolving pattern in instructional innovations at University level is sketched as an introduction to the activities of a group of university teachers in their innovative endeavours. Attempts to develop students' autonomy in learning and teaching and learning through small group discussion occupied a major part of the chapter since these were considered to be an important part of the activities of the Learning Unit, subject of this study. An abstract

discussion of individualization of learning leads the way for an initial model of individualized curriculum and instruction.

Current examples of autonomous learning schemes are discussed. These are, the Personalized system of instruction, the A/T approach and Independent study. The examination of the processes of teaching and learning through small group discussion identified its aims, objectives, potential and limitations.

The third major part of the chapter dealt with the recent research on student learning., Deep, surface, strategic and non-academic approaches to learning are examined.

Holist and serialist learning styles and their pathologies are contrasted with deep and surface approaches. Cue-consciousness, formal and 'Hidden' curriculum, the influence of assessment on learning are related to students orientations. Study contracts and motivation towards learning tasks represent additional descriptive concepts which will be of considerable value in interpreting the experiences of students in the evaluation.

The context of learning and the perceived characteristics of the students learning environments were discussed since previous research has indicated the important part these contextual influences have on learning outcomes.

Finally, we considered students intellectual development from a view of the world in absolute terms of good-bad, right-wrong through to the development of 'contextual relativistic reasoning' and the affirmation of personal commitment concluded the chapter.

This chapter has thus provided a firm conceptual base of innovations and student learning from which to move on to the work of the Unit in Chapters 5, 6 and 7.

But first, we need to consider the methodology used in general, and in particular, in the evaluation of innovations in Higher Education.

Problems and Methods in the Evaluation of Innovations in Higher Education: An Analysis

In examining teaching/learning processes within universities, one has to accept that a great many of the most important messages that teaching staff communicate to their students are implicit and not obviously measurable. Not only is information being conveyed, but also teachers' attitudes, approaches and expectations. These have to be perceived or deduced by the student.

A student does much more when listening to a member of staff than pick up "content", as the staff member does more than transmit a solid lump of "knowledge".

People in universities are involved in the creation, collection and propagation of knowledge. In examining teaching within universities, one has to accept that "reality is socially constructed". (Berger and Luckman, 1967; Holzner, 1968). In this context, one takes it simply to refer to the fact that knowledge is not absolute. And if knowledge is a socially constructed entity, then the examination and control of knowledge, the basis of the social construction of reality is an essential starting point of any study. (Young, 1971). The examination of the effects of introducing an innovative course in an established university department is particularly amenable to this approach. In such a study, one is concerned with accepted wisdom and change in several areas.

First of all, one is concerned with the wisdom of change itself, its nature and its rationale. This will lead to an exploration of the ideologies of those concerned with setting up the innovation and the views of those who worked with it and were related to it in subsequent years.

Second, the students, what the new learning experience was like for them, their "coping strategies" and their justifications.

Third, the teaching staff perspectives, and using a time or a temporal perspective, the examination of the changes which have taken

place and why the innovation has the history it had.

Fourth, yet no less significant, the researcher has to be involved in change in his own field, introducing new methods and approaches to the study of innovation in an established educational institution.

Evaluators are expected to devise and collect information about educational action and present it in a context of values and interests. When this research project started, evaluation was still, however, not a well-defined or clearly understood activity. The educational researchers modelled themselves on physical scientists and conceived of their processes of data collection and analysis in terms of a rhetoric in which the concepts of 'hypothesis', 'deduction' and 'falsifiability' have played a prominent part. The intellectual tradition behind such a form of studies is that of psychometrics. The effectiveness of any educational enterprise is determined on this approach, solely in terms of students' terminal scores on some appropriate (and properly standardized) objective test. The reliance on predetermined outcomes is obvious. In every instance, the evaluation measure has to be defined in terms of the anticipated end-point of the learning process (Glasser, 1970). This "product-oriented evaluation" (Becher, 1981) can appear in a number of different guises. It has been labelled "agricultural-botany mode", "the psycho-statistical" and in Scotland was called "experimental education", (Stenhouse, 1979).

This approach is closely related to a tradition in agricultural research strongly influenced by the work of Ronald Fisher. Crucial to this was the insight that in field experiments in which variables cannot be closely controlled, random samples are to be preferred to samples judged to be representative, because randomization allows error to be calculated by the use of statistics of probability. Thus two agricultural treatments applied to random samples may be tested comparatively for effectiveness against the criterion of yield by establishing a level of significance of difference on which the hypothesis of superiority of a treatment is compared with the null hypothesis. Behind this appeal to probability is an appeal to replication.

The attraction of this research paradigm in an applied field is that a criterion of yield allows discrimination between action or policies without the need to derive prediction from theory. Educational theory is not developed to the point where it is a reliable guide to action in the way that physics guides engineering, and the possibility of finding one course of action superior to another without understanding exactly why is, of course, a short-cut. In short, the experimental method classically seen as discriminating through a crucial experiment between competing theories was adopted to discriminate between competing policies for action (Stenhouse, 1979).

An alternative is the input-output approach. It rests on a precise definition of objectives in behavioural terms and on measures designed to test the achievement of those objectives. The extent of interest in engineering education in Britain has been limited. Members of the engineering schools couched their research interests primarily in the traditions of "systems approach". The central topics of concern have been the specification of "educational objectives", the validation of course instructional materials, the reliability of examination techniques and the prediction of academic success.

In such settings, the evaluator may be expected to help the development team to clarify, and express in appropriately behavioural language, the set of the 'intended learning outcomes'; or he may have to analyse and identify them for himself from an inspection of the product and from discussion with the team.

His next responsibility is to design measures of achievement of these objectives, and finally, he has to apply such measures to an appropriate sample of target population. The 'Personalised System of Instruction' (PSI) is the most wide-spread method based on the 'systems approach'. Other examples mentioned above, include programmed learning, whether it is a 'linear programme' or branching programmes, taped instructions including audio-tapes, computer assisted instruction, etc.

The salient features of evaluation of this type are, firstly

that they tend to concentrate on straight-forward quantifiable gains in factual knowledge. An understanding of how and what students acquire in their university education must include recognition of the importance of factors like the developing images they have of themselves, the set of ideas, values and beliefs that come from the family and social background, the future that they see for themselves, the demands of labour markets, and the attempts to realise their ideals and ambitions (Sheldrake, 1975).

Students are profoundly affected by the immediate environment in which they work. One does not mean their physical environment although this is part of it.

The emphasis is on the academic context, the whole network of beliefs and assumptions, organizational goals, rewards, constraints and penalties that form part of it. These may be laid out in black and white or they are subtly communicated in more latent or implicit fashion. In the input-output mode, the evaluator fails to take into account the quality of the actual process of learning or the broader context in which it takes place. Other problems are the difficulties of the representativeness of the samples, the measurability of changes in behaviour and the assumptions that educational situations are stable enough to regard all other relevant variables as reasonably constant. Thirdly, the psycho-statistical paradigm offers to do better than professional judgement in judging what best to do, and that in over-riding professional judgement it fails to strengthen it. It appeals to research judgement, if the design and conduct of my research is correct, then my results must be correct. If you think they are wrong, then fault the design and conduct of the research (Stenhouse, 1979).

Finally, this approach reflects an analytic approach, based on the principle that any complex situation can be disaggregated into separate, relatively simpler components which once they are satisfactorily dealt with can be combined to help make sense of the whole (Becher, 1981).

It is hard to do systematic research, especially research about

people, without disguising from oneself the assumptions implicit in one's decisions, first to collect and then to analyse one's evidence in one way rather than in others.

The hidden assumptions restrict the kind of results one produces; what is more, they can constitute the very models and metaphors of human life in terms of which one's results are conceived.

It is sobering to reflect that while massive efforts have in the past been made along the path of experimental studies, correlational studies and so on, little has been expended on the "case study". Yet, if we are forced to choose, it is almost certainly the detailed study of the individual department that will most quickly advance our systematic knowledge. In this type of study the emphasis is on qualitative factors relating to learning experiences and the environment in which they occur.

There is no particular concern with predefined quantifiable outcomes, since the most significant elements in the educational process are considered to be both unpredictable and unamenable to measurement. If one thinks about the individual person, then we have a whole set of theories about the individuality of people, personality theories ... etc., but there has been very little (comparatively) about the individuality of social situations, in institutions.

One hears a great deal about the properties of institutions in general, but very much less about what one might call the 'personality' or the 'identity' or maybe even the 'character' of groups, settings, social structures in general. One way of approaching the individuality of social settings, in this case a university department, is to study it as a "Learning milieu" (Parlett, 1975). This can be defined as "the environment as experienced." There is immediately a tension between 'is it out there?' or is it only in the perceptions of the members of the group under consideration?

Does a particular milieu exist only 'in the eyes of the beholder', as a collective perception, or is it something that you can actually grasp and look at?

There are a lot of difficulties and ambiguities about the term "milieu". There is a question of delineation, where it begins and where it stops? Secondly, the question of the separate component parts that form a milieu and how these overlapping systems interact? Thirdly, the multi-faceted nature of the milieu and the degrees of congruence between its various dimensions. Fourthly, milieus come in different ages and may in fact go through life cycles. Young milieus are more open to change and redefinitions than ones which have been long established. The whole movement of Goffman and his colleagues (sociology and socio-linguistics) has helped us to realise how much there is a constant flux in our social behaviour, and how any individual at any one time is constantly monitoring the social and communicative texture of the surround, so that certain actions/types of talking/gestures/topics for discussion and so on are inappropriate. And as we are constantly making these sorts of adjustment we are also helping to define what the frame of reference/register of discourse is that ~~We~~ are operating in.

These questions lead to some ideas about the way one is thinking about milieus as a concept and what this implies and what sort of analyses and interpretations it edges one into. It is incomplete, but it raises several other questions when it comes to studying what education is all about.

What actually happens to students who go to particular colleges, and who are members of particular departments and particular courses, in their local milieu, that is different from students who are going to other departments or universities? This is trying to get at some of the most interesting and troubling questions about how the ways in which institutions are mediating and presenting knowledge i.e. the management and control of knowledge, come to instil certain long-term patterns in students. Investigations in this category may be found under a variety of 'brand-names', illuminative, naturalistic and responsive perhaps being the best known.

Some of the "process-oriented" evaluations are virtually indistinguishable from ethnographic case studies and have helped to prompt a resurgence of interest in case study research (Stake, 1978).

The emphasis here is on means rather than ends, and on the wider context in which learning is intended to take place.

Behind this approach lies a belief in holism rather than analysis, that is, a view that reality cannot be dissected into separate elements without a serious cost to both meaning and validity (Becher, 1981).

The differences between research which has grown out of prediction studies and the research on students' experiences, is not the quantitative/qualitative distinction in methodology, but a more fundamental philosophical division (Entwistle; 1974, 1976).

"The quantitative methods imply reductionism and the use of formal or mechanical models which embody assumptions about chains of causality. In contrast the alternative paradigm involves approaches to research rooted in phenomenology which derive from a direct exploration of students' experiences of learning. The traditional research paradigm involves explaining student behaviour from the outside, as a detached, objective observer. The alternative approach seeks an empathetic understanding of what is involved in student learning derived from students' descriptions of what learning means to them. It involves a shift not just of methodology, but of perspective." (Entwistle, 1982; p.40).

The view that an innovation is an on-going process, elusive and always being modified represents many serious problems to the educational researcher. Paradoxically, it is the educational researcher who attempts at least figuratively to halt that process, to "hold it still" long enough to make a sketch of it.

An over-simplified method suggested to carry out this task is the use of observation and loosely-structured or unstructured interviews.

The implicit assumption here is (a) that the locale of the research provides a rationale and justification for the work which is done; (b) that the educational research has begun to move nearer to 'where the action is'. But that does not guarantee that we shall necessarily understand what the action is (Atkinson, 1975).

By delving into the activities of the students and the staff, the researcher begins to collect data that may appear to be threatening.

Even within a group as small as that of an innovation, there are competing definitions of the same situation and of the events that take place. Despite the hopeful ambitions of some sociologists and psychologists the processes of even a small group are not readily described - there is no simple version of reality. To unmask the constructions that people make of the same "reality and to provide an often unsettling alternative view is a challenging activity" (Sheldrake, 1975).

Universities do not exist in a vacuum - a truism that is often given lip service, but seldom really heeded. The everyday reality of educational settings is highly complex and not fully susceptible to experimental control. Realities are often less than intentions. The structures and processes of educational institutions contain complexities which are latent, unanticipated and unintended. These cannot necessarily be predicted from the stated goals. Investigators and theorists have not focused hard enough, long enough, nor carefully enough on the small and mundane as well as the large and important issues and problems necessary for idealistic practitioners to carry out their dreams (Smith, 1971).

In many cases what people do and what people say they do are often different. There is a difficulty in studying human communities since one needs to deal with the way that false or incorrect knowledge "works" for people will certainly testify that it does work. Since different people or classes of people have different theories and disagree about them, they often engage in deliberately making a theory work. People may hold differing, often contradictory, perceptions of events.

Such social complexity is not susceptible to reduction to any simple research design nor can it be accommodated in any one research method.

Educational ethnography, participant observation, case study or field study has been perceived as a very simple method. Biddle (1967), called it: "The broadest and simplest methodology used in classroom studies." The researcher goes into an educational setting with a pencil and pad, makes a few observations, takes some notes,

and writes a report, a dissertation, or a book."

Unfortunately, some educational researchers believed in this definition. In their work there was an element of the naive conviction that if one carefully observed the class, listened attentively to the teacher, then one could make sense out of the experience. In other words, order could be found there. The result of such studies is that the 'alternative methodology' in educational research came under severe criticism. They have been attacked as being, 'one-shot studies' (Campbell and Stanley, 1963), 'one-off' (Atkinson and Delamont, 1981), "non-comparative and the absence of control make them of almost no scientific value." Even those outside the field of educational research went on to attack such studies as a "collection of opinions, stories and anecdotes rehearsing well worn arguments in an entertaining way." (A university lecturer of a science subject).

Part of the reason which warranted such criticism was the fact that the educational research community has only recently discovered participant observational research. A corollary to this discovery is the lack of knowledge of the substantial body of research that has been carried out with this genre of methods. In some quarters the belief seems to be that there is little precedent for such work and that there have been minimal attempts to speak to the methodological issues underlying the inquiry (Smith, 1978).

On this side of the Atlantic, the same sentiment has been expressed:

"In the context of educational research as such, this ethnographic approach is a relatively new phenomenon - although it is now a good deal less innovative than it was when Parlett and Hamilton first produced their programmatic paper. In advocating this ethnographic style the evaluators have often been guilty of 're-inventing the wheel'. Certainly in their published accounts they betray little acquaintance with the fact that such methods have been used by sociologists for many years - and more significantly that there has been a great deal of reflection and writing on the conduct of research of this sort. There seems to be a marked reluctance on the part of the evaluators to engage in critical reflection on the nature of their research." (Atkinson and Delamont, 1981; p.6).

Several writers did engage in "critical reflection on the nature of their research."

At the present moment, one of the most fundamental observations about the concept of 'ethnography' as used in education, is that it is evolving and changing rapidly. This seems related to an explosion of research activity from several research communities which are partially in communication with each other, to what amounts to an "invisible college" in the making. Macdonald (1975), Miller (1974), Atkinson (1980), Hammersley (1980) and on the other side of the Atlantic, Smith (1971), Stake (1976), Stufflebeam and Webster (1980), Cronbach (1980), etc. Smith (1979) summarizes some of this diversity.

Smith (1982) counted the proliferation of distinctions, with accompanying labels which contain ethnography as the root concept, the count was 29. If one adds "illuminative evaluation" to the list, we can have thirty names. (Table 3-1)

Ethnographies are analytic descriptions or reconstructions of intact cultural scenes and groups (Spradley and McCurdy, 1972), which delineate the shared beliefs, practices, artifacts, folk knowledge and behaviours of some groups of people.

The ultimate aim of an ethnographic study is to reconstruct the culture being studied. Several strategies are adopted to achieve this aim. First, these strategies elicit data which are phenomenological. That is, they represent the world view of the participants being investigated. Second, ethnographic research strategies are empirical and naturalistic. Third, ethnographic research is holistic. Ethnographers seek to construct descriptions of total phenomena within their various contexts and to generate from these descriptions major variables which affect human behaviour and beliefs towards the phenomena. That seems to argue for a "more holistic, systematic, interdependent network of events at the concrete level and concepts and propositions at an abstract level." (Smith, 1978).

It is clear from what has been said, that the educational researcher will be engaged in an eclectic range of methods of data

anthroethnography	Spindler, 1981
anthropological educational ethnography	Delamont and Atkinson, 1980
anthropological ethnography of schooling	Spindler, 1981
anthropopedagogy	Morin, 1971
blitzkrieg ethnography	Rist, 1980
classical ethnography	Mehan, 1980
classroom ethnography	Hammersley, 1980
constitutive ethnography	Mehan, 1978
contract ethnography	Wolcott, 1975
co-operative ethnography	Hymes, 1980
educational ethnography	Spindler, 1981
educational ethnology	Hymes, 1980
ethnographic approach	Fitzsimmons, 1975
ethnographic case studies	Herriott, 1977
ethnographic methods	Lutz, 1980
ethnographic monitoring	Hymes, 1976
ethnographies of classroom life	Hamilton, 1981
ethnography and policy making	Mulhauser, 1975
ethnography of schooling	Wolcott, 1975
ethnopedagogy	Burger, 1971
evaluation ethnography	Rist, 1980
focused ethnography	Erickson, 1977
macro-ethnography	Lutz, 1980
micro-ethnography of the classroom	Smith, 1967
neo-ethnography	Bullivant, 1978
new ethnography	Erickson, 1973
psychoethnography	Spindler, 1981
socioethnography	Spindler, 1981
sociological educational ethnography	Delamont, 1980

Figure 3-1 Recent Variants of Ethnography
Among Educational Researchers

collection drawn from a variety of research technologies. In response to these methodological problems the educational researchers have had to look beyond the resources of educational measures in the search for new means. History, sociology, psychiatry, social anthropology and psychology are some of the disciplines which have to be culled for similarity of problem structure, methods of attack which might enhance the educational researcher's technical versatility.

The following types of data provided by ethnographic research strategies seem to be of particular use to the educational researcher.

(1) Contexts:

These include information about the human and technological context of the research population and programme setting. They are necessary for identification of social, psychological, cultural, demographic and physical environment (i.e. the department size, layouts, furnishings, facilities and use made of them, etc.), for assessing the impact of the innovation and to establish variables which could be used for generalization and comparison with other settings and population.

In addition, the wider context of the whole institution must be examined for the types of influence that particular innovation has exercised on implementation. That is to assess how this innovation was viewed from outside by senior members of the teaching staff, administrators, other institutions. That will include examination of and the analyses of documents, reports, taped interviews, discussion groups and conversations to trace the evolution of the innovation from the planning stages on.

(2) Process Data:

These refer to information determining what occurs in the course of the innovation. That is to trace the paths of students entering and leaving the innovation, to discover what intellectual experiences and activities students underwent while in the innovation. To review the initial experiences, intentions, disappointments (if any), achievements, excitements of entering students.

To explore the circumstances and events surrounding and relating to students when they left the innovation.

To document some of the common experiences, perceptions, opinions, problems, pleasures and frustrations of the innovations' teaching staff.

(3) The Innovation's Philosophies:

The data collected under this heading refer to the need for examination of the underlying models, aims, rational~~s~~ of the policy makers and the teaching staff of the innovation. Values rarely exist in isolation. They are typically part of organised frameworks called ideologies which provide characteristic ways of thinking about man and society.

Research design based upon combinations of data collection methods and analysis strategies provide more complete and complex data on phenomena than do uni-modal research design. Yet, the data collection methods described presented a non-problematic state of affairs.

The natural sciences were traditionally characterised by their methodology and given legitimacy by the tight control which they exercised over it.. But what are the 'methods' social scientists use to cope with uncertainty in social interaction that are peculiar to the group in question that is 'ethnic'.

The traditional format of the ethnographic description, effectively obscured what methodology there might be, and the data collection was left to the individual's discretion. The structure of a sociological text is a formal convention, imposed after the event, on a pattern of unstructured or differently structured, material and ideas in the writer's mind.

The methodology of field work is still problematic and ethnographers should reveal their own workings. The reader of ethnographic reports should, to use an analogy from Goffman , be let in behind the scenes to see the performances off-stage.

Miller (1975) poses two questions in relation to evaluation,

the answers to which are crucial in determining how the evaluation shall proceed, namely:

"Who is the evaluation for?" and
"What is the evaluation for?"

Smith (1981), developed a scheme of the multiple stances or roles played by practitioners of qualitative professional social inquiry (PSI). In this scheme he dissolved the distinction between educational researchers and education evaluators.

"The four roles are:

- (a) Client/Democratic
- (b) Institutional/Bureaucratic
- (c) Professional/Autocratic
- (d) Aesthetic/Artistic

The underlying dimension has to do with power and the political processes enmeshing the researcher/evaluator.

- (a) In the client/democratic stance the subjects or participants in the study have final control over entry, definition of problems, procedures, ownership and release of data and interpretation. They are the audience of the exercise.
- (b) Institutional/bureaucratic researchers are "company men", persons who work for whatever institution (government, university, school system) which hires them.
- (c) The professional/autocratic mode refers to a research and evaluation perspective whose orientation is to the professional research community. At its worst, its inquirers observe and write for each other and ignore the continuing problems in the public schools. At its best, they develop a specialized role for knowledge development and utilization and the training of young teachers, administrators, curriculum developers and other practitioners. Control rests in the hands of research peers.
- (d) The aesthetic/artistic category: The metaphor is the artist who is attempting to capture a private vision of reality which might creatively illuminate a part of the educational world."



One does not find the contemporary debate about naturalistic research very satisfactory in particular, because it offers rather idealistic accounts of the research process which may not always gel with experience and which rarely represent practice with accuracy.

In Britain, the 'SAFARI' Project (1975) formulated clear and substantive research questions early in the life of the project's methodological issues and questions concerning the conduct of educational research and evaluation became a major preoccupation.

A central feature of SAFARI was the assertion of value pluralism both at the level of culture and of epistemology. Accordingly, it was suggested that no absolute criteria of value could be applied to educational innovations.

Concepts such as objectivity and validity, as they are traditionally employed by social scientists, were eschewed for the more pragmatic concepts of accuracy, fairness and relevance (Kushner, 1981). The seniority of the research team at the 'SAFARI' project provided their reports with an extra weight. They stressed that evaluation is an activity. As such, its problems of theory are realised and may be recognised in practice. They have treated their principles as problematic and one may learn from them. Any solution to the problem of how to do evaluation is provisional, not final. In their own words:

"The 'new' evaluation is unlike the more 'technical' approaches to evaluation to the extent that its principles of procedure must be reinvented to suit the constraints and possibilities of each case in its own action-context." (Jenkins, 1977).

This is not the same as "re-inventing the wheel."

Secondly, the SAFARI team brought to our attention the insight that in the 'alternative' approaches to evaluation, the principles of procedure are always open-ended. These principles are not explicit rules guaranteeing truth or justice.

The 'Safari' and 'Understanding Computer Assisted Learning' teams were guided by an approach to evaluation developed by Barry

MacDonald which can be classified close to the "client/democratic" role mentioned above.

The proposed investigation, in this thesis, was intended to study an ongoing innovation in a university department. The initial problem statement and the proposed research paradigm was intended to tell the story of the innovation and to place the events within its contextualist perspective. The researcher's role came close to the aesthetic/artistic category.

Amongst workers in this field, the demand has been expressed by Cicourel (1964), and others, that the sociologist should present what amounts to an autobiography of his own thought processes over the period he was "in the field", so that his own theoretical development becomes precisely one of the principal matters to be described and accounted for.

Research into university practices has often created unnecessary controversy by tactless reporting. Tact, political sensitivity and scrupulous attention to correct formalities are all required.

In this section, one would examine the "methods" of research which have been adopted in the past, the varieties of field work and additional research techniques that were employed by other researchers and the issues raised as a result.

The 'illuminative approach' (Miller et al, 1974) has been characterized briefly in the following way:

- "(a) It is problem-centred beginning (as all applied research does) with issues and concerns as defined in real life settings;
- (b) It is practitioner-orientated - designating its chief function to provide information and insight for professional educators;
- (c) It is cross-disciplinary - drawing especially on psychology, sociology, psychiatry and social anthropology for concepts and ways of thinking;
- (d) It is methodologically eclectic - interviews, questionnaires, observation and analysis of documents are used in various combinations, according to the circumstances, defined problems,

and stages of the investigation;

- (e) It is heuristically organized - the researchers progressively focussing and redefining the areas of inquiry as the study unfolds, in the light of accumulating experience and as the crucial issues-to-be-studied become uncovered."

Addressing the mechanics of the research methodology, Miller divided the process into three stages.

Firstly, at the data collecting stage, the researchers used various techniques to gather the fullest and most accurate records possible (e.g. full notes supplemented by tape-recordings where possible; Joint interviewing and cross-checking of notes, etc.).

Secondly. at the data organizing stage, the researchers indexed and classified their notes and records under subject headings; removed the names; wrote down preliminary summaries and interpretations; searched for negative instances; deliberately sought to question the basis for each other's conclusions.

Thirdly, at the data reporting and discussion stage, the researchers adopted a conservative criterion for inclusion of direct quotations (any whose verbatim accuracy was suspect were excluded); the researchers sought to ensure that the balance of opinions was fairly represented, and that examples cited were typical instances; questioned each other and themselves about whether each statement made by them was justified and how their own values and reactions might be distorting evidence; they thought through the implications of what they were writing and whether it safeguarded individual privacy; and they tried to write clearly and unambiguously. (Miller, 1974; pp. 10-11).

This description can hardly point to the treacherous waters the researcher will have to navigate with regard to the ethics, management and politics of such studies. Parlett (1977) gave a detailed discussion of this method of research. A number of other researchers (Smith, 1978,79,1980,81,82; Norris, 1977) adopting an "ethnographic" approach to their educational research problems have contributed a wealth of insights in that direction.

Their comments are important examples of the evolving nature of scientific ideology and practice. They also suggest that methodological pluralism has some benefits as well as hazards, or as Smith puts it:

"They indicate the labyrinthian and somewhat tortuous routes one investigator took in searching for a theoretical-methodological rationale to solve the problems he was confronting."

(Smith, 1978: p.326)

In the following chapter, the researcher will discuss the research methods he adopted, and the problems associated with them.

Research Procedures

"People who write about methodology often forget that it is a matter of strategy, not of morals. There are neither good nor bad methods, but only methods that are more or less effective under particular circumstances in reaching objectives on the way to a distant goal." (Homans, 1949; p. 330).

The methods of the social sciences all imply some degree of social relationship with the subjects of the research, and this is of crucial relevance when the methods consist of some form of "ethnographic" approach, as is the case with the research reported in this thesis. The researcher and the researched share, temporarily, the same social world.

The conduct of the research is achieved through the relationships and negotiations sustained by the researcher and the actors involved. The precise nature of the methods used and the issues which emerge as problematic for the researcher are emergent properties of the shared social world evolved by the ethnographer and the subject of his or her research.

Goals for educational innovations tend to be stated in the form of some desired changes or accomplishments for students. Consequently, efforts to improve tend to focus on specific pedagogical procedures and the measurement of student outcomes, with some accompanying feedback designed to provide information for revision. This effort to refine ends and means and the relationship between them is exceedingly important but insufficient. It fails to account for other factors which may be of considerable importance.

The Learning Unit - subject of this study - as an emergent situation - tended to be less specifiable, less predictable. To understand and explain the events surrounding the Learning Unit, the researcher thought to approach the task by doing five case studies, each predicated on a different set of assumptions, a different set of categories and a different point of view or angle of vision.

In each of these case studies the search was for varying perspectives of the lecturers on one hand and the students on the other.

These varying perspectives alter the very way one defines the problem and the kind of alternatives one generates as solutions. Another aim is to study the gradual evolution of the Learning Unit. This means looking at the Learning Unit as a whole system, as an evolving system and to see it as it unfolds, differentiates and reaches out.

This is an extremely important change in research strategy, it changes the basic logic of social change from one of linear causal logic to one of mutual causal logic, or systematic logic which involves development through feed-back.

In this process the educational researcher will often illuminate and spell out an underlying dilemma or policy contradiction that is implicit in discussion but which has not been brought to the surface and discussed openly. The important point here is that whatever the fluctuating state of harmony or discord, the voices describing the 'Learning Unit' are always in polyphony, and therefore an accurate reading of the 'score' requires an understanding of the various 'parts' or 'voices'.

The researcher - as a participant observer - was privy to a view of a totality. As the researcher moved from event to event and conversation to conversation, each time he was trying to see through the eyes of a particular member of the Learning Unit. Again, the researcher was struck by the differences and conflicts in perceptions that had important implications in the dynamics of the Learning Unit.

The definition of perspective to be adopted in this thesis will be Shibutani's:

"A perspective is an ordered view of one's world, what is taken for granted about attributes of various objects, events and human nature.

The fact that men have such ordered perspectives

enables them to conceive of their changing world as relatively stable, orderly and predictable."

(Shibutani, 1955; p. 564).

Quoted in Smith, L.M., 'Federal Policy in Action', 1979.

The elements to be brought into harmony are numerous and change in importance, that is, they become more or less problematic at different times in the life of the 'Learning Unit'.

The researcher as he read documents prepared for the interviews, carried out interviews and reflected upon them began to form a precept of the project as a total system. That totality becomes the practical and theoretical agenda for accenting the elements of the differing perspectives.

If one is trying to see some modified totality of the phenomenon under study, one should realize the ultimate impossibility of being alert to the infinity of parts and processes. And one should realize one's purposes help in defining what levels of abstraction and specificity one looks for, finds and talks about.

Similarly, one's observations, theories and purposes help define what is the case, the bounded system under investigation and what is context, both contemporaneous and historical.

The five case studies with the varying perspectives of its participants and the perspectives of those outside the 'Learning Unit' are not isolated, independent or unattached. The interdependence aspects of systems accents the inter-connection of parts.

An important aim in this study was the careful analysis of the documents portraying the history of the Learning Unit. Attendance in meetings and listening to negotiations, study of contexts, processes and effects were all necessary for the researcher to understand what has been a troublesome relationship between causes and effects, ifs and thens, or antecedents and consequences.

The eventual goal would be to present a narrative account of

the Learning Unit as a case study in innovation. Lessons from history are often forgotten.

"The sad thing is that we could have done so much and done it so much better if we had been willing to learn the lessons from history, instead of going in search of some Holy Grail whose contents would give us the same kind of predictive reliability in history that we have in Astronomy." (Scriven, 1972; p. 115).

In the section below, the conduct of the research itself, the varieties of field work, and additional research techniques that were employed will be discussed.

IV:(i) Securing Formal Administrative Permission for the Study

The researcher did not encounter any initial resistance from educational administrators since the leader of the Learning Unit had invited a member of the 'Anabas Research Project' to study the innovation. A member of the same research project had already been in the same university where a similar study was conducted.

Studies vary in their contractual arrangements, some are designed to advance general understanding for a broad readership, others to provide pertinent feed-back to a decision making committee.

The researcher's first meeting with the leader of the Learning Unit produced a set of tentative agreements. Firstly, in order to minimize disruption of the Learning Unit activities, no experiments, control groups, pre-test, post-test style of research would be accepted. The leader of the Learning Unit qualified that by saying that experiments had been done in the past and students were not pleased with them as they felt that they "missed out on something."

Secondly, that the researcher should not publish anything unless it is cleared with the administration at Hammond Street. "I think I would have to say to you that I would imagine that my university would not want anything, well, I would know that my

University would not want anything published unless they had cleared it. And I think they would feel very strongly about it."

Thirdly, that the researcher would be permitted to remain at the Learning Unit for as long as he felt it necessary to obtain the data required to complete the study.

Fourthly, the role of the field worker would be that of an observer with access to all instructional activities and to the published papers of the Learning Unit and its learning material. The leader of the Learning Unit declared, "What am I prepared to have you do here? Anything you like". And then went on to list his immediate concerns at the time. These were, students use of the pre-recorded learning material, personality characteristics of students, what the leader called "convergers and divergers", and how to improve work-efficiency to cope with "inefficient thinkers" amongst students in the Learning Unit .

Fifthly, that the researcher could use data-collection methods that he felt appropriate to complete the study. but no experiments were to be conducted. The first meeting with the leader of the Learning Unit was recorded on a portable tape-recorder.

IV:(ii) Setting up the Evaluation Study

Being involved is the sine qua non of ethnographic research. The researcher negotiated broad access to all activities which took place at the Learning Unit and obtained permission to attend classes, meetings and other events unannounced or without prior arrangements. That represented convenience in maximizing use of time and broadened the basis of seeing normal or usual events. The researcher tried to be around for a period of time that reflected commonsense boundaries, a year, the life of a certain project and so forth. By observing throughout such a cycle one is privy to the special problems of phases in the social activities of the system.

The physical isolation of the Learning Unit from the rest of the university presented the researcher with a reference point and

made it easier to identify the members of the teaching staff who were engaged in its activities. The researcher in his activities to establish and maintain rapport with the teaching staff and students was helped by joining the teaching staff in coffee breaks and at lunch-times. The researcher took part in the coffee/staff room social life essentially by being present and listening to conversation.

The students seemed to accept him without any special concern. Since he was introduced to the students as a 'Research Student', was dressed in jeans, stayed out of arguments and was seen to be no part of the authority structure, students had difficulty differentiating him from other visitors to the Unit.

The teaching staff who were engaged in writing material for the use of the Learning Unit students had a recurrent perception that the researcher was involved in some directly evaluative exercise. It was a common reaction to take it that the researcher was involved in action-research which was directly and immediately oriented to the formulation of improved teaching practice on the teachers' part. The researcher was asked on occasion to help build a questionnaire, to give advice on areas to be evaluated and to counsel some of the students who were planning to drop out. Other members of the teaching staff would occasionally air their 'pet' educational theory and seek the researcher's approval for their ideas. A member of the Learning Unit staff who has invested time and energy in its activities decided to visit the researcher in his university office to assess for himself the potential of the proposed study and to air his own ideas on the philosophy and the workings of the Learning Unit.

Students did formulate their own interpretations of what the research might be about. The most usual assumption was that it was an evaluative research project.

In all these, the researcher tried to disabuse both students and teaching staff and other members of the Learning Unit of the idea that he was sufficiently expert in educational theory and methods to offer any immediate advice in this area.

IV:(iii) Defining the Role of the Field Worker

It is customary to describe the performance of ethnographic research in terms of the role that is adopted by the researcher in the field (cf. Schotzman and Strauss, 1973). Innovators' concerns are quite different from those of educational researchers. And these inherent differences between educational researchers and innovators may jeopardize the research climate.

Many practitioners feel that programme evaluators cannot make recommendations concerning the innovation's processes since they (the researchers) often have no teaching experience. Innovators may feel that researchers are insensitive to the demands of the practitioners' job and immediate problems. Already pre-occupied by their own administrative problems, it is known that many practitioners (innovators) view research - particularly when it involves any aspect of data-collection- as an added burden with little return.

(1965)

Weiss, and Rodman and Kolodny (summarize the problem by noting that the differences between researcher and practitioner (innovator) can be summarised as one of role-conflict. The innovator, according to Weiss, must believe in what is being done; while the researcher must question it.

The relationship between the innovator and the evaluator cannot be attributed solely, or even primarily, to the role conflict. One must also consider teaching staff perception regarding the relationship between administration and evaluation. Research may be viewed as a means to an end. Quite frequently, research is commissioned not because of benign scholarly interest, but for political reasons. Evaluation studies can be used to delay unpopular decisions, bring in more funds, or answer adverse publicity, while on the surface the study may appear to be motivated by genuine scientific curiosity. The memorandum requesting the study may even be phrased so as to further scientific enquiry or enhance the knowledge base. The covert reason, however, may be to generate data which will support an argument for keeping the programme.

The issues and problems discussed above are but a subsample of the political considerations plaguing programme evaluators. Thus it would appear that evaluation cannot be separated from either inter-departmental politics or the pressure of the political mainstream. In order to build a research climate, the evaluator must be prepared to be involved in discussing all or many of the issues that have been outlined above.

If research is to survive and grow within this climate, researchers must develop a set of skills well beyond their formal academic training. Gold (1958), identified four ideal typical roles for the researcher. These are; complete participant, participant-as-observer, observer-as-participant and complete observer. In complex organizations such as a university department these definitions may facilitate the understanding of researchers' roles at the conceptual level. This assumes a picture of an undifferentiated social milieu; which is contrary to the researcher's experience.

In a university department, there are many categories of members, differentiated by their occupational specialization, their sphere of influence within the occupational hierarchies and their place of work. The researcher's interest cannot be directed towards all these members of the organisation equally.

The researcher's main interest was primarily oriented toward the Learning Unit, and the contact with other institutions was contingent upon that main focus.

Consequently, the extent to which the researcher was a disengaged observer or a participant in the action depended to a considerable extent on the nature of the particular group the researcher was with and the nature of the occasion.

The following four cardinal guidelines were accepted by the researcher:

- "(1) That investigators should not investigate others in ways they would not themselves like to be investigated.
- (2) Researchers should be understanding and open to differing points of view, at the same time

avoiding collusion or over-involvement.

- (3) Individual informants should be treated with respect and not be pressured to participate if they do not wish to; they should be given full opportunity to express themselves on matters that concern them.
 - (4) Those people who are studied should feel afterwards that they have been enhanced, rather than diminished, by participation in the inquiry; they should not be left feeling they have been ignored."
- (Parlett and Dearden, 1977; pp. 34-35).

Although the researcher tried to remain much more of a marginal figure, the give and take of negotiations in the field meant that it became expedient and natural for the observer to become an engaged participant for brief periods. Such occasional participation has been described as "the engaged-observer, as transitory-participant".

Participation of this sort arises when the researcher can "help-out" in various ways. For instance during days in the field, the researcher was invited on one occasion to act as journalist in a third year class 'simulation' exercise.

There is a fine line between maintaining a 'pleasant' relationship and one that is "too cordial". The researcher remained conscious of that by examining continuously his perceptions and interpretations of field events.

IV:(iv) Data Collection: Procedures and Problems

The evaluation model, as it was envisioned by the researcher was sequential and developmental; the later phases would be shaped by results of earlier phases.

"The term 'ethnography' is broad enough and it does not denote with any precision a single method of data collection and analysis. It is generally used to connote the use of 'qualitative' research methods, often in combination, deployed in a period of 'field work'. Central to this ethnographic

commitment is the use of some version of participant observation, usually coupled with the intensive interviewing of informants." (Atkinson, 1981; p. 6).

Data collection techniques used by the researcher included the following:

1. Elicitation of participants' constructs.
2. Interviews with key informants.
3. Mapping and enumeration of the physical and social setting.
4. Non-participant observation.
5. Collection of archival materials, records and documents.

These strategies and the manner in which they have been used are discussed below.

"Eliciting of participants' constructs refers to the process of determining the set of "agreed upon" which inform the world of each participant. These include the categories into which people classify items in their physical world; the values which they use to assign meaning to what they do, the categories of knowledge they deem important; the canons of discrimination they use to sort items into categories; and the rules by which they assign relationships to phenomena in their world." (Kimball, 1965).

In the researcher's view, people know about their lives and the institutions in which they work in a tacit and sometimes unarticulated way. As researchers, we can observe these complexities and sometimes describe them well, but it is difficult to know what they mean. The task of understanding can only be successfully pursued when we can provide the conditions under which people can move from merely articulating what they know (i.e. providing us with data) to theorising about what they know (i.e. creating meanings).

"The task of understanding, then, is necessarily a collaborative activity." (Kushner, 1980-81).

There is a variety of ways to determine how participants in a study define their world. These include specific surveys, sorting and ranking procedures and procedures which require participants to enumerate all the numbers of a particular category of things. These

constructs, once delineated, can be used as ways of explaining why people behave as they do in their own terms; they also can serve as a basis for comparison with other means for defining and assigning value to similar or identical phenomena.

In the case of the Learning Unit , several issues were made clearer when the students (as interviewees) were asked to present their experiences in the context of other relevant experiences outside the Learning Unit but within their university context as a whole.

It was in such a comparison or such a contrast that the researcher and the students could see the distinctive features of the new.

Also used was a short 'case history' of one group member. While no individual history or case study can be said to be truly 'typical', concentration on a single individual may be useful if he or she demonstrates a common issue or a recurring pattern. This provides an opportunity to illuminate the general by detailed consideration of the particular.

A third element which proved useful in illuminating the social construction of reality of the Learning Unit - though by no means the only way - was through the analysis of events which disrupt it. Such an approach has been used to good effect by Garfin, Kel (1967). Such disruptions of everyday life make visible the taken-for-granted background features of social life which usually pass unnoticed.

Key informants are individuals who possess special knowledge, status or communicative skills and who are willing to share that knowledge and skill with a researcher (Zelditch, 1962).

Interviews with key informants can be used as a means of eliciting participants' constructs, for generating historical data, for corroborating observations made by a researcher and for sensitizing a researcher to specific dilemmas or critical issues which exist within the phenomenon under investigation.

In the case of the Learning Unit, informants included the teaching

staff directly involved in the production and running of the learning materials, present and past students of the Learning Unit, teaching staff in the department who were not directly involved in the running of the Learning Unit, visitors to the Learning Unit and some of the audience attending several of the different conferences in which the Learning Unit activities were presented.

Over all the researcher interviewed 66 individuals. All the interviews were tape-recorded and transcribed verbatim. These resulted in hundreds of pages of data. Most of the interviews were unstructured in the early days of the research project.

Interviewing as a social research method presents the researcher with two sets of problems. Firstly, the complexity of the method itself and, secondly, the *volume* of the data it produces.

Two sets of rules for the conduct of interviews have been observed by the researcher. These might be headed sensitivity and flexibility.

Sensitivity is a two-sided affair. Firstly, listening to what the respondent is actually trying to say, and not substituting for this what others have said, or jumping to hasty conclusions about what is going to be said.

Secondly, a sensitivity to one's own questions: by being clear enough about exactly what is being asked from this particular person on this particular occasion: and checking the point the respondent has picked up and how near it is to the one intended.

Flexibility concerns the way that the interviewer is able to cover the material he wishes; to probe the areas he has mapped out for himself, without disrupting the natural flow of the conversation, to pick up useful leads and not to ignore one which will mean that important matters are bypassed. The interviewer guides the respondent to where he wishes, but this guidance must not obtrude.

Such flexibility depends on an intimate knowledge of the area being investigated. The researcher found the use of a schedule of questions of some use in the early days of interviewing. As the interviews improved and 'progressive focusing' on issues within the

Learning Unit developed, this schedule was used less, until it formed no more than a check list, and finally was dispensed with.

The researcher felt that the first and the most critical questions regarding the validity of the data concerned the intensity of observation of the system under study. Field work is a labour-intensive research mode. The actors are caught in a thick web of historical and contemporaneous inter-connections. The researcher adopted the multi-method approach (Denzin, 1970), in his data collecting stage.

By triangulation Denzin means the use of multiple kinds of data, brought to bear on a single problem or issue. The central thrust of this multi-method approach seems to be an argument for internal consistency. The data hang together.

Smith (1978), summed up the argument for this method as follows:

"Attempts to triangulate or to build multi-method matrices with qualitative data often result in congruencies which strengthen the validity of the picture one is drawing. When the data do not converge then one checks the points with more data, reconstructs the phenomenon, that is, makes more subtle distinctions than one began with, and then one goes for more data to recheck the new descriptive model, conceptual system or interpretation."

(Smith, 1978: p. 345).

IV:(v) Data Organizing and Reporting and Discussion Stages

"Field studies" are high risk, low yield ventures in terms of the time that must be committed to them and the fact that they are more suited to generating rather than to verifying hypotheses. The researcher is "inundated" with paper. Smith (1979) summed up the researcher's problems at this stage by saying:

"We haven't found methodological statements - either at the theoretical or the practical level - which indicate how one is to "read documents" gathered in field research."

(Smith, 1979: p. 488).

Adopting what seems to be similar to stock-in-trade measures of field anthropologists, with whom he shares the problem of handling a mass of data much of which is ambiguous and difficult to verify at first hand, the researcher made use of the following procedures:

Firstly, at the end of every interview session, visit, discussion or reading of a research document, there was an abstract of criticisms, insights, extensions, alterations, implications and in many ways this was similar to the "interpretative asides" (Smith and Geoffrey, 1968; Smith, 1978). These 'asides' have helped in processing the masses of data collected.

Secondly, the researchable issues are not chosen in advance, but emerge in the course of study.

"The design is constantly modified and added to, and, having begun as general and open-ended, the inquiries become more sophisticated and specialized as the investigation proceeds." (Miller, 1975: p. 9)

In the research reported in this thesis, the researcher initially conceived the project in terms of 'An Analysis of Independent Learning'. However, the exigences of the situation shifted the focus of investigation to 'the multiple perceptions and multiple realities' of the Learning Unit. This is another important pointer to the flexibility needed to move freely and well within a broadly conceived educational research aim.

Thirdly, drafting the final report of a 'field study' is an intrinsic and an important part of the investigation. Estimates of the need for one day for organizing and writing for every day in the field is a very modest estimate. Ethnographic studies demand time. If the researcher cannot afford the time the ethnographic approach should be abandoned. Hastily written, poorly argued statements can easily lead to severe unintended consequences for both individuals and groups.

Models of reporting field research fall on a continuum from mostly narrative to mostly theoretical with varying amounts of each as alternatives in between (Smith, 1979), (see Fig.4-1)

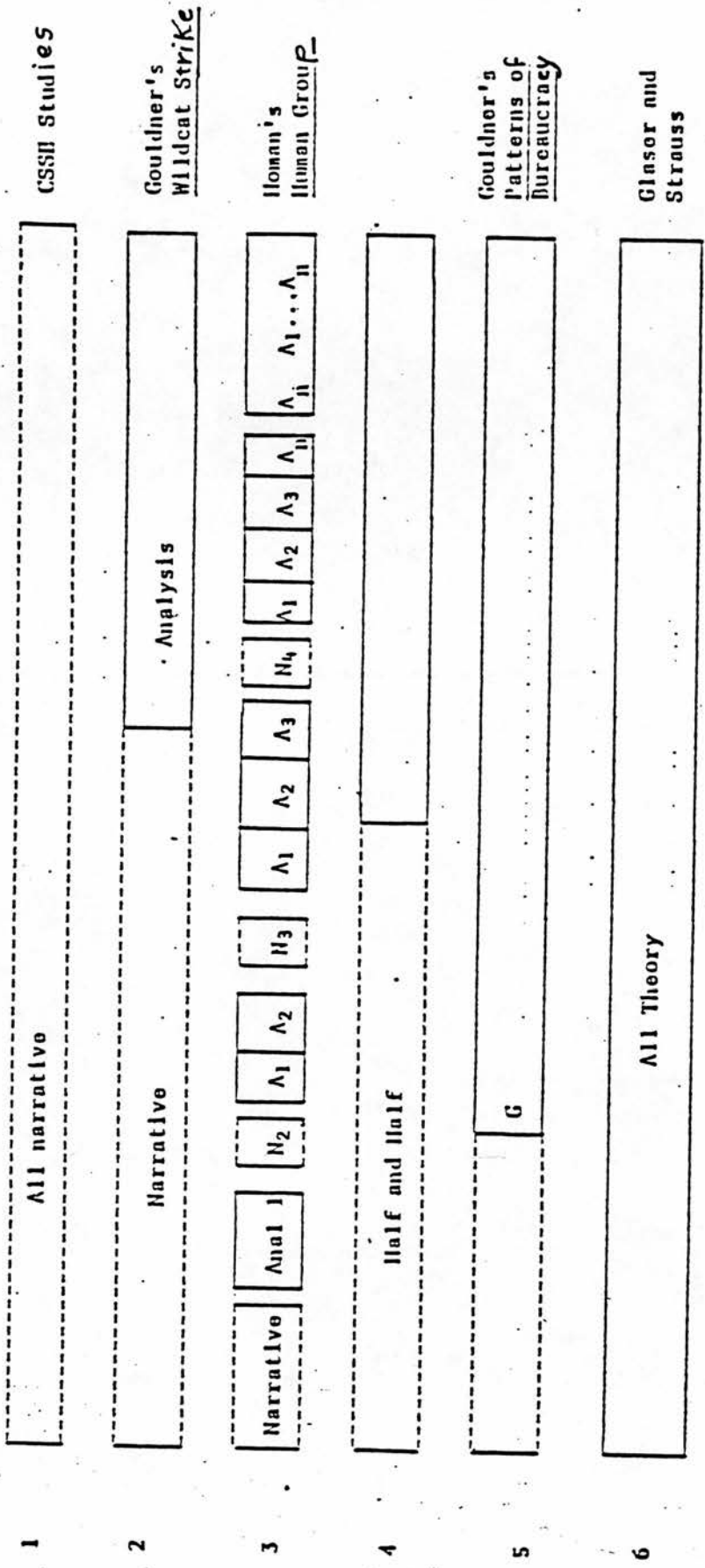


Figure 4-1 Models of Reporting Social Science Case Studies

Stakes (1978), "Case Studies in Science Education" (CSSE) were all narrative. George Homan's format in the 'The Human Group' (1950) was based on the development of six separate case studies.

In each, he presented a section of descriptive narrative material (usually a chapter for each). He then presented a chapter or two of analyses. Each analytic section repeated briefly what had gone before but then built a new piece.

In Smith's diagram that has been denoted A_1, A_2, \dots, A_n . The analytical pieces cumulate, differentiate, generalize, integrate and eventually create an impression of the reality being described.

In reporting the research findings in this thesis, several issues arise. Firstly, an important issue related to the process of conceptualisation of field studies is the following question:

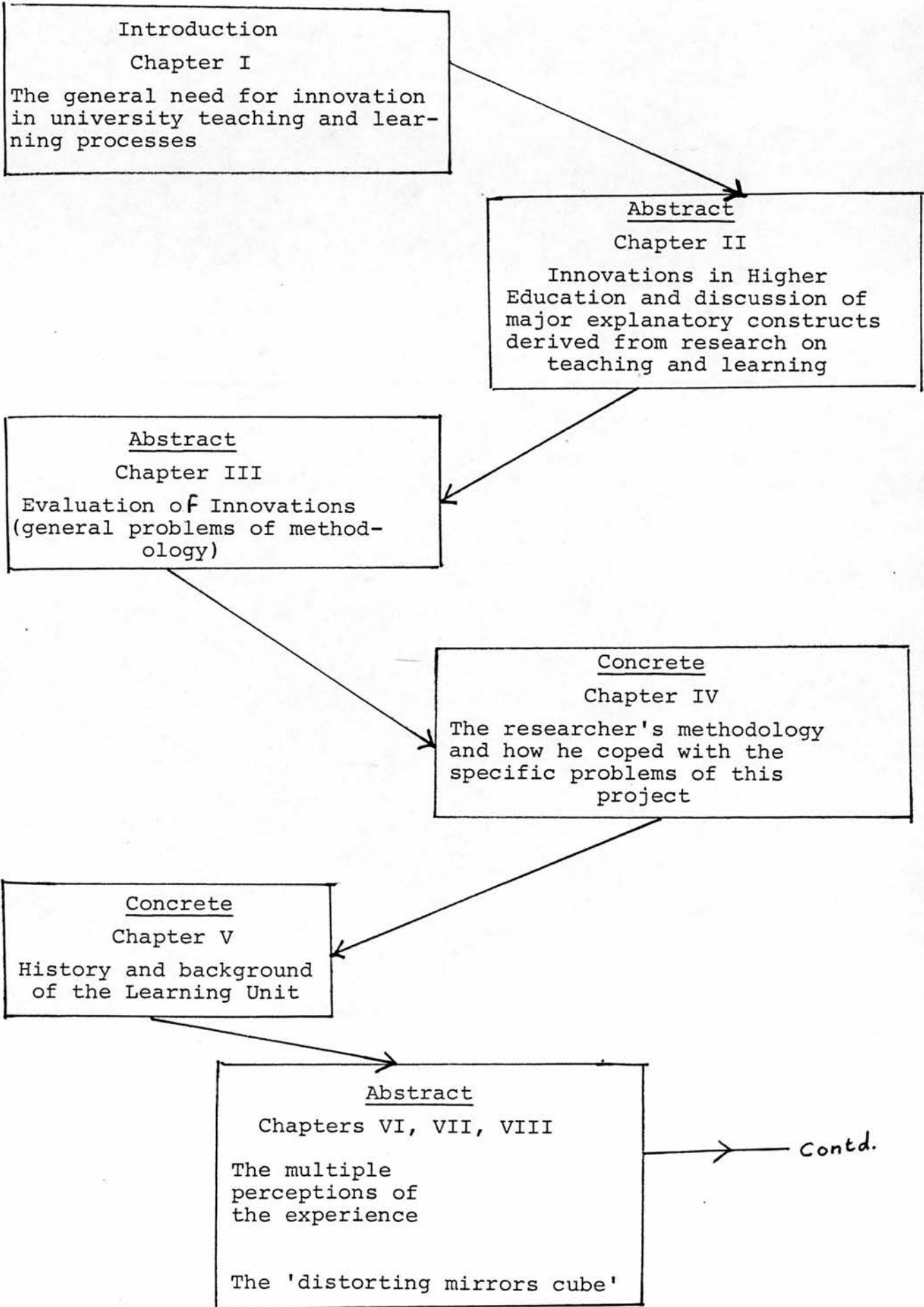
Should the researcher enter the field tabula-rasa free of bias, ideas and preconceptions or should he approach the field with foreshadowed problems, ideas, issues, themes and literature which would initially focus attention?

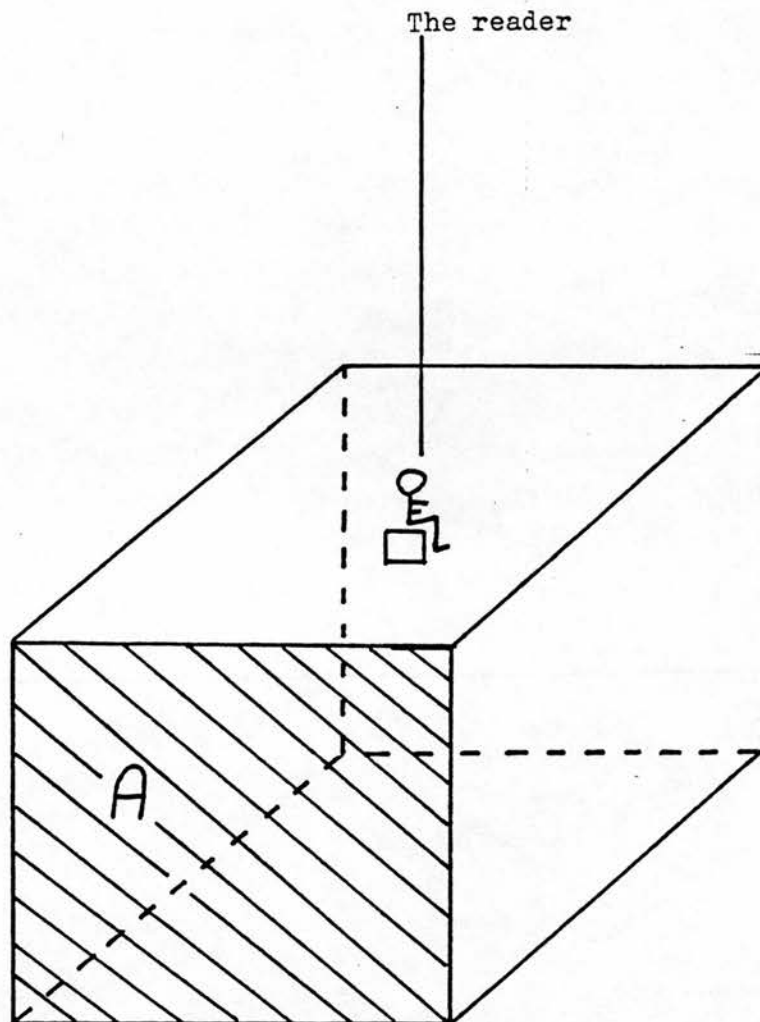
To some extent this is a non-issue as no trained observer can be wholly without preconceptions. It thus seems fairer to accept and utilize pre-existing concepts, but nevertheless to try to report dispassionately, and as a detached observer as far as possible, the experiences of the participants being observed. Approaching a setting with several competing theories to each of which one is partially committed allows one to explore more fully the conceptual realities of the events in the setting (Smith, 1978). Secondly, the researcher in presenting the thesis has chosen to alternate between the abstract and the concrete in the analysis of the data, as well as in presenting this background (see Figure 4-2a).

As one moves from chapter to chapter one is building up the total impression by painting a broad picture and then trying to illustrate some of the issues involved in very detailed concrete ways.

The reader is invited to develop a holistic picture which presents the interdependence of the parts and participants in the Learning Unit as the thesis progresses.

Figure (4-2a)





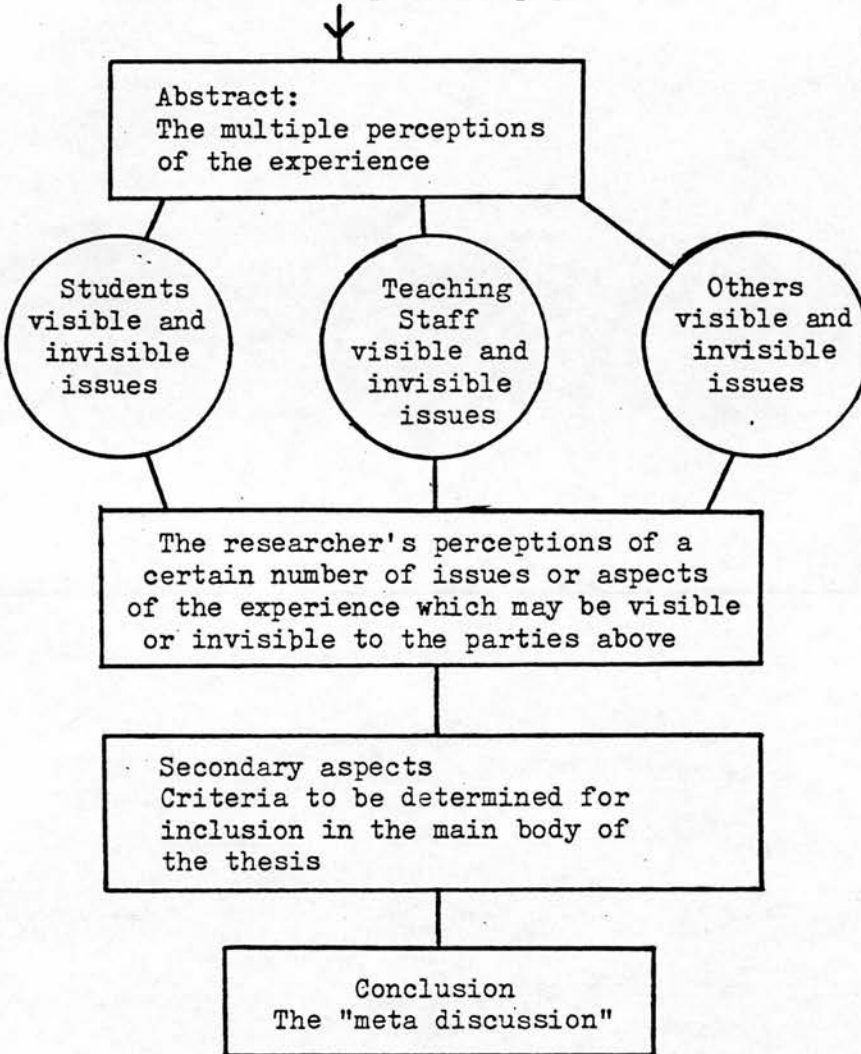
- A - plane mirror.
- B, C, D, E, F - distorting mirrors.

(Figure 4-2b)

The distorting mirrors cube

Figure 4-2c

Continued from previous page



In the earlier chapters the reader is allowed a glimpse of the Unit and its operation. As we saw in Chapter 2, a theoretical discussion dealt with the principles and practices of relevant teaching and learning innovations in higher education. It also included a discussion of the major explanatory constructs derived from research on teaching and learning.

Chapter 3 discussed the general problems of evaluation of innovation.

At the concrete level, the researcher's methodology and how he coped with the specific problems of this project have been the main themes of this chapter.

The history and the background of the problem is the focus of Chapter 5. The discussion here at a concrete level, exposes the reader to two dimensions. Firstly, the reported description of what the members of the Learning Unit "have been trying to do" in their earlier days. Secondly, the description of the Learning Unit in a physical way and in terms of its stated objectives and its simplest concrete level.

In this innovation, the researcher had the exciting case of multiple statements of the participants' points of view. The issues they elaborated were the issues they struggled with through the years.

Five years of field work produced five case studies with varying perspectives of its participants and the perspectives of those outside the Learning Unit. Those perspectives are not isolated, independent or unattached. The interdependent aspects of the system accents the inter-connection of parts. The Learning Unit's environment can be described as being in flux. Each of its parts is evolving and changing. One case study is selected to be detailed in this thesis (see below).

The focus in this case study is the researcher's aim to recognise the underlying assumptions, categories and conceptions of the participants. The very way the leader of the Learning Unit has structured the problem, the latent belief system, the metaphors and the analogies he uses are to be detailed.

In the second part of the thesis, the first level of analysis takes place in Chapters VI, VII and VIII. This is where the multiple perceptions of the teaching staff, the

students and those outside the Learning Unit will be detailed.

To facilitate the conceptualisation of this very complex pattern the researcher introduces the model of the 'distorting mirrors cube'. (See Fig. 4-2b), the cube is made of 'distorting mirrors' except that one face is a plane mirror.

The image seen from inside, in the plane mirror, can stand as a metaphor for the Learning Unit in its 'physical sense'. Other surfaces will give the perceptions of the images seen by the participants when they comment on aspects of their experience in the Learning Unit.

These aspects, in the researcher's conception, will not be perceived equally well by all these groups. The people, the individual actors, arrive on the scene with intentions, purposes, needs, attitudes and emotions. They also have skills, abilities and talents, all of which they bring along to the Learning Unit.

In the researcher's analytic framework, the general and specific objectives of each group will be accompanied by a statement of means that have high probabilities of reaching the ends.

If one were to take a very purist view then one would tend to opt for construction of the analysis which took a number of issues or aspects of the experience and these are gone through in a systematic manner in Chapters VI, VII and VIII. In the researcher's experience, one of the main criteria for selecting these issues is the visible-invisible dimension which these aspects have displayed. In many ways, the rationale for certain practices within the Learning Unit have been invisible from the student's point of view.

The leader of the Learning Unit changes, on occasions, the justifications for the procedures he adopts and also changes these procedures. This makes it difficult for people outside who see what he is doing at different points in time, to understand how the rationale changes. This points to the fact that there are several levels of analysis at this stage of the discussion and that change takes place over time.

The analysis tends to emphasise what one might call 'critical incidents' to portray and illustrate the contrasting perceptions of the participants. Other aspects are also

reported, in the hope that the 'totality' of the experience can then be better perceived by the reader.

The multiple realities required a change in style of writing, whereby building these parts, the reader would be able to conceive the Unit's entity and be exposed to the layers of reality and its multi-faceted nature.

The researcher wanted students to identify problems and demonstrate ideas in their own way and in their own language. That is, the researcher studiously avoided putting words into people's mouths. However, without pre-structuring, the information collected tended to be disorderly. The researcher, therefore, was on the lookout for emerging themes and common patterns.

The various 'parts' or 'voices' of the Learning Unit and its audience pointed to the 'action' as being on a 'stage', like a Greek play where one is dealing with three different choruses, each one commenting on the shadows on the wall and each of these walls being uneven, so that one ends up with different images and different interpretations of the 'action'.

These different perceptions will lead us to the 'meta discussion' which takes place in the final chapter, where the aim will be to integrate the three results' chapters together and see them together with the earlier chapters about the nature of innovations and the nature of evaluations of innovations, and so develop a coherent theme which reflects the real complexity of developing a 'new idea' and implementing it even within a single institution.

CHAPTER V

Origins and Background

The origins of the innovation can be traced to a rapidly changing situation in what was then a relatively young department within a newly established University.

The Civil Engineering department in that technological university (will be called 'The City University' below), was emerging from a parent department of Mechanical Engineering.

In order to preserve the confidentiality of my observations and the anonymity of the staff/students concerned, all names used in the course of this thesis are pseudonyms.

Throughout the thesis I adopted the following group of conventions:

", Double quotation marks (around a word, phrase, sentence or a longer extract of speech) signify that these words or remarks were uttered by one of my respondents, or quoted from a primary source, in exactly the form reported (though non-significant pauses and space-fillers are omitted to increase comprehension.

', Single quotation marks are used if there was any doubt about the word-by-word accuracy of a direct quote. This use is rare. More generally, single quotation marks are used in the customary way, i.e. for purposes of emphasis and for introducing a new item; and for paraphrased or summarized material that does not include verbatim extracts. The quotes that are marked R.A. indicate that the source is in a 'reserved appendix'.

As is usual in a university department, authority was vested in the newly appointed Head, Professor J. Young.

The City University annual report of 1969-70 mentions:

"A Learning Laboratory has been established in which the onus is placed on each student to learn at his

own speed from materials recorded on audio-tapes and slides".

(p.27)

The roots of this development can be traced to much earlier dates. The origins of a developing and changing organisation of an innovative nature are most interesting phenomena to observe.

One assumes that if the natural history of an organisation is described, one may be able to trace its small beginnings, the number of participants, the problems it faced, the resources and its limitations, the trial and error procedures for reaching its goals and the changes which took place over time.

Stinchcombe (1969) discussing the "Liability of Newness" says:

"...there are poorly understood conditions that affect the comparative death rates of new and old organisations. As a general rule, a higher proportion of new organisations fail than old. This is particularly true of new organisational forms, so that if an alternative requires new organisation, it has to be much more beneficial than the old before the flow of benefits compensates for the relative weakness of the newer social structure."

(Stinchcombe 1965: p.148)

The study of the history of this innovation is to 'recover', to 'explain' and to 'understand' its object. In investigating the history one may be flicking through a series of 'stills', each of which shows a moment of social time transfixed into a single eternal pose, for each one of these 'stills' is not only a moment of being but also a moment of becoming, and even within each seemingly static section there will be found contradictions and liaisons, dominant and subordinate elements, declining and ascending energies.

Any historical moment is both a result of prior process and an index towards the direction of its future flow. For, while it is possible that entire programmes may disappear, many of their components will undergo modest transmutations, relabelling and realignment and subsequent reincarnations.

This study is delicate; the delicacy resides in the fact that one has to sort out the particular circumstances, those that might make for the success (or otherwise) of the innovation which are inherent or are to be found in that institution and those which either help its possible success or its failure within other institutions.

In other words, there is the question of a circumstance-specific factor and a circumstance-general factor.

The researcher seeks here to document the evolution of one particular innovation at a university and at the same time to illuminate conditions and circumstances associated with pedagogic experiments more generally. The researcher will hope to explore a significant single instance, but one that is representative of others.

Maslow (1965) invited educational researchers to attempt historical studies and appraisal and review of educational innovations.

Educational experience and wisdom is seldom codified, distilled and transmitted; traditional educational research, for whatever reasons, is of scant relevance or use in this respect. If even 10% of the time and other resources spent in innovating was re-allocated to discovering what went wrong with past schemes, this might pay handsome dividends.

The environment - physical and otherwise - is an important element in the changes which took place over the length of time in the history of this innovation (1966 - present).

At one time (T_1) the environment presents itself to the innovation, e.g.:

- (a) Sir Edward Hale and his colleagues have just published the "Report of the Committee on University Teaching Methods", to be later known as "Hale Report". (1964).
- (b) The City University has been granted its 'charter'.
- (c) The Department of Architecture developed what they called an

"Intensive Study" approach.

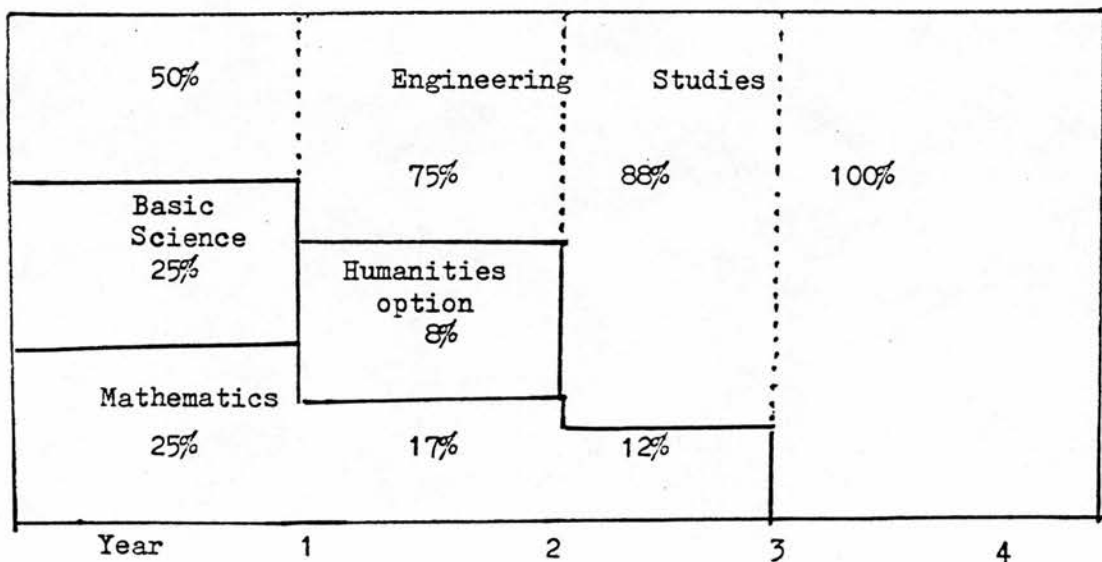
The innovation - mainly in the shape of the teaching staff, process the information and then act at time two (T_2).

Meanwhile the environment changes through its dynamics in so far as it is composed of several interacting components. Consequently the environment may be different at time three (T_3) when the innovation scans again. The handling of processes, changes over time, is an important and difficult methodological, theoretical and practical problem.

What is presented below is a partial history of an innovation in a Civil Engineering department.

This innovation has contributed mainly to one particular degree course (B.Sc. in Civil Engineering), which contains the following components:

The City University B.Sc. Civil Engineering Course



The 'City University' guide for applicants sums up the thinking behind this choice of subjects in this way:

"In the first year the level of attainment in mathematics, physics and chemistry is raised to the standard necessary to deal with the engineering subjects in later years of the course and an introduction is given to civil engineering.

A broad engineering education is provided in the second year and a start made on specific civil engineering topics which are continued into the third year in which civil engineering subjects are taken to the level necessary for the general all-round education of a civil engineer.

In the fourth year, the student reads two optional subjects from those available. This allows him some degree of specialisation in the subject of his choice."

(p. 73).

The innovation under observation has been concerned with parts of the curriculum in the engineering studies, namely:

- Civil Engineering I
- part of the Drawing Office Exercises in Civil Engineering II
- Design of Structures: part of Civil Engineering course taught to the third year.

The Students:

The City University draws its students from Britain (Scotland, Wales, England) and from overseas. In essence, the difference between England and Wales on one hand, and Scotland on the other, derives from the difference in pre-university schooling.

Traditionally, the Scottish Secondary School pupil has taken the Scottish Certificate of Education 'Highers' rather than GCE 'A' Levels. A wider range of subjects is taken both at 'Higher' and at a correspondingly lower level. Hence, Scottish students have not traditionally had training in the basic sciences to a level high enough for first year Civil Engineering.

Whilst some entrants to the Civil Engineering department have

total exemption from the first year basic sciences, others may be exempt from just one or two of them.

The nature of the applicants has varied from one session to the other as well as their numbers. This seemed to be one of the problems the teaching staff had to cope with.

To identify other problems, a detailed study of the history of the innovation will paint the backcloth of this study. The history will be traced to three phases of the innovation's development:

First phase	-	1966-1970
Second phase	-	1971-1976
Third phase	-	1977-present

In the following pages, a series of 'stills' will set the stage. In each 'still', an attempt will be made to identify the following elements as perceived by the teaching staff:

- Firstly - The problem tackled.
- Secondly - Aims and objectives
- Thirdly - Materials and procedures developed to solve the problems and achieve the aims.

The source of information in the early days of development will be the published accounts of the teaching staff from 1966-1976.

Phase I: 1966-1970

All first year students of engineering follow a common course in the subjects of mathematics, physics and general chemistry.

Students also attend a lecture course arranged by the department of engineering in which they have elected to read.

The topic of the innovation at this stage of development is partly related to this introductory course. This was known then as "Study of materials science in relation to the practice of civil engineering."

The problems tackled were mainly concerned with the relevance of the subject matter and the emphasis on the importance of 'fundamental knowledge'.

In the teaching staff's own words, they aimed at:

"The introduction of the study of material science by a convincing explanation of its relevance for the civil engineering. Secondly; that at all times the emphasis should be on fundamental scientific principles (which are unchanging) rather than on specific practical problems (which are transient) or on the mere techniques of solving such problems.

Thirdly, that no artificial discontinuity in development should be introduced between the study of basic principles and their subsequent application in an engineering context."

(R.A. 17)

When Dr. Keith McIntyre, whose training was in applied chemistry was entrusted by the task of preparing "a new course in materials for the first year students" he immediately sought advice from his engineering colleagues. Lengthy discussions ensued, at the end of which two features emerged.

Firstly, to the conventional syllabus, they added such civil engineering studies as were necessary either as an introduction (to show the relevance of a scientific study) or as a conclusion (to demonstrate the application and usefulness of fundamental knowledge).

The treatment was only modified slightly to dovetail with the general physics and chemistry courses, and such integration has demanded and has been given the support of the other departments.

Secondly, the method chosen demanded "a closely integrated and carefully planned course preparation," involving a high degree of co-operation between the lecturers, who frequently presented 'two-man' lectures.

The materials' scientist, Dr. Keith McIntyre, was asking "which properties do you wish to study and why?", and the civil engineer, Dr. Curr .AS in the staff room during the planning stage, was

trying to give an answer, in terms of specific instances which would demonstrate the consequences of failure to apply the science of materials to the use of materials.

The teaching made use of examples both in the form of slides and a historical review.

Subjective staff reaction and favourable student feedback implied a measure of success in this venture, which was therefore extended.

Phase I:2: (1967-1968)

Investigation reports for second year students

The subject considered here is "properties of materials" where Dr. Keith McIntyre invited his students "to select topics from a list of tentative suggestions" with the aim of doing a "project". Students worked in their own time, in an allotted period of fifteen weeks which included one short vacation, and were permitted to form two, three or four man groups although a few preferred to work individually. Reports were generally written, although some groups prepared their conclusions for presentation on television, and oral reports were occasionally accepted in unusual circumstances.

The "projects" were a wide range of possibilities, from investigation reports which covered purely literature surveys, to work which was wholly or partly experimental or even partly design. Examples of these "projects" reported by the teaching staff follow:

(a) Literature Survey:

What pressures are produced by wet concrete on form work, and how similar are the laboratory conditions in the research work to site conditions (particularly with regard to instantaneous deflections of form work and supports)?

(b) Literature Survey and Experimental work:

What is known of the use of glass fibres in concrete mixes?

Could they be used on a short-term basis, to reduce damage to pre-cast products during handling?

(c) Literature and field surveys:

Under what circumstances will scour occur in waste-water systems in high rise structures? What is the easiest way to prevent this?

(d) Purely experimental:

Report on the possibilities of using two glues of differing elasticities in lap joints. to eliminate the high stress concentrations which tend to form at the ends of normal lap joint glue lines. Prepare a programme for future testing.

(e) Literature survey and design:

Suggest ways to improve the dispersion at sewage outfalls, based on a review of the study of jets through dimensional analysis.

In almost every case reported by the teaching staff, the students had had no instruction in the fundamental aspects of the problem they selected and they were encouraged to seek a minimum amount of direct assistance and direction during the period of study. Students displayed enthusiasm and some of them insisted on extending their studies to a greater depth than had ever been intended.

Phase I:3: 1969-1970

The total number of students studying in the civil engineering department of the "City University" varied over the years. Table 5-1a shows the variations and one notes the larger number of students in the early days of the innovation. The large number of students accepted in the first year (one hundred students) represented one of the problems the teaching staff faced in this phase of development.

The varied ability, achievement and engineering experience of these students, coupled with the nature of the subject matter,

Table 5-1a

Academic Session	Total number of students in the Department (a)	Learning Unit location (b)
1968-69		
1969-70		
1970-71	319	Kinondoni Building
1971-72	303	Kurasini Building
1972-73	289	
1973-74	265	
1974-75	261	
1975-76	257	
1976-77	247	Doha Campus
1977-78	258	
1978-79	260	
1979-80	264	
1980-81	278	
1981-82	250	
1982-83	223	

(a) Total number of full-time undergraduate students studying in the Civil Engineering Department of the City University .

(b) Learning Unit location.

presented them with a new challenge. Furthermore, they sensed
"a gap between school and university teaching"
and thought that it was urgent to:

"establish the principles of sound scholarship
that will act as a preparation for the students'
period of study, which should presumably be
expected to extend beyond graduation and even
to retirement."

They concluded by saying;

"From an educational viewpoint the main problem
seemed to be to establish an atmosphere in
which the students were encouraged to think
for themselves." (R.A.19).

Efforts were therefore been made to vary the mode of presentation
of the subject matter in order to stimulate individuals. The
teaching staff were soon to discover that the previous trials would make
a heavy demand on their time, "if any meaningful contact is to be
established with each student."

A short course on study methods was prepared using the facilities
available within the university. The City University annual report
of 1968-69 reported "The television service of the City University
has completed its first year of operation in the new studio."
These facilities had already been used in the Department of Civil
Engineering for tutorial and experimental work in addition to class
teaching. The proposal to use television-based group study methods
was tested through a brief pilot scheme.

This part of the course was offered as an 'optional extra' to
first year students; 75% volunteered for a programme of four
'intensive' sessions devoted to:

"Firstly, learning from lectures - including
preparation and use of notes.

Secondly, personal and group study methods -
where the learner directs the learning process.

Thirdly, learning from practical work including
modelling.

Fourthly, learning by private reading."

All the sessions depended on the use of pre-recorded videotapes displayed on closed circuit television to small groups.

Modifications were planned on the basis of the students' comments and some post-test results.

Using the same style of presentation the teaching staff decided to replace one term lecture course in 'Properties and use of Engineering Materials' by "predominantly group teaching methods." There were 130 students in the class. The subject matter was almost identical to nine technological lectures and supporting tutorials that previously provided the instruction. Much of the preparation for the group scheme was simplified through re-use and adaptation of existing material. To reduce the total staff involvement further, extensive use of C.C.T.V. was planned.

The teaching staff reported:

"It was important that the objectives which have been quickly and rather vaguely mentioned previously should be defined in more detail before any restructuring of the already adequate lecture course took place."

(R.A 19)

The teaching staff declared objectives at that time were:
"that the undergraduate in their department should learn as soon as possible:

Firstly, to express his thoughts lucidly and pertinently when he is required to use the written or the spoken word.

Secondly, to read profitably for himself with a minimum of direction and assistance, technical literature whether in the form of textbooks, research papers or reports.

Thirdly, to derive and formulate the answers to questions of varying complexity without direction.

Fourthly, to take an enquiring initiative, asking pertinent questions without prompting.

Fifthly, to observe intelligently, accurately and promptly

within his chosen field and to assess the value of these observations. Finally, to formulate conclusions and deductions (R.A.19).

The teaching staff described the learning sessions as follows:

"All the learning sessions took a form appropriate to the topic under study, with a general similarity in the pattern of events. The objective was always introduced, justified and explained, and a brief period was usually devoted to examples or to basic instruction sufficient only to reinforce the aim of that session".

The teaching approach of the first 'intensive' is detailed below.

The subject under study was the use of arches in engineering. The session opened with a CCTV recording which contained a certain amount of basic instruction, such as a brief explanation of the basic vocabulary and a description of the forces acting in an arch under load. A number of points were raised almost as rhetorical questions during this presentation and students were encouraged at this time and subsequently to keep a check list of queries for which they required an answer (objective 3).

The groups, with their rough notes, met with a member of staff to discuss note-taking in general and with regard to this particular 'lecture'.

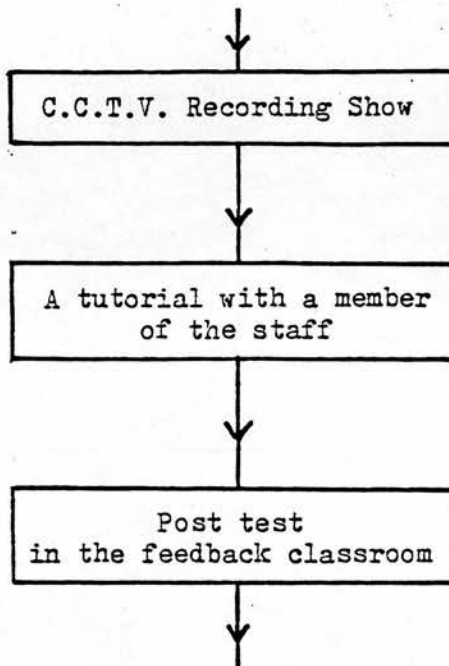
Printed handouts relating to lecture notes and study methods were issued to supplement this discussion; and groups were led to consider the queries outstanding on their individual lists. Some of these were solved co-operatively within the resources of the group. Others would only be resolved by further study or by experimentation. The unanswered queries were dealt with in an open tutorial with a member of staff.

There followed a multiple choice objective test, pre-recorded on video-tape for use in a feedback classroom contrived with the use of inexpensive units made in the department.

Students giving the correct answer were informed of this by a single light in their unit and overall group performances were

recorded by an ammeter in the circuit.

The basic sequence of events could be represented diagrammatically as in Figure



The City University" annual report for 1968-69 reported these changes in this fashion:

"Dr. Curr and Dr. McIntyre made use of closed circuit television in first year to bridge the gap between school and university teaching. More programmes are being prepared for next year and a start has also been made of recordings of standard Laboratory techniques for the third year course."
(p. 21).

The changes which took place so far were in response to specific problems as noted above. This has been recorded by Dr. Curr as follows:

"Naturally no records have been kept of the reasons behind the opinions advanced by staff members during the development process: indeed it is difficult to imagine how any record of this type could have been made.

(R.A.: 7 p. 4).

Meanwhile, Dr. Curr attended a 'U.H.I.S.T.' Summer School, 1969, where several ideas concerning teaching in Higher Education were presented and discussed. These included, the notion of "Educational Technology", the use of tape/overhead sequences, etc. The systems approach and the "Educational Technology" attracted his attention when he expressed his views in this way.

"The teacher who is bewildered by the confusing problems which he must face in choosing his syllabus, teaching methods and teaching media is rightly attracted to a method (Educational Technology) which assists him to make his choice objectively and to validate his decisions later in a rigorous manner."

(R.A. 6 , p. 7).

A shift of emphasis dominated the published literature of the Unit at this stage of development. Firstly, detailed objective lists for each element of the course were issued and according to the staff were also used by students. Secondly, concern for proper validation progressively increased. In the beginning, planning was based on staff discussions. These were supplemented by the study of questionnaires completed by students. Then an increasing use was made of post-testing.

The formal tuition for the first year so far in the history of the innovation included the following styles of presentation of the subject matter: Firstly, four conventional lectures were retained for the first year C.E. course. Secondly, small groups of twelve or less worked together when the subject matter was presented by a C.C.T.V. These included, model testing, directed private study, students' lecturettes, report writing, visits to civil engineering sites, tape-slide instruction and audio-tutorial work in learning booths.

When, in session 1971-72, the course expanded from 3 hours per week to a total of 10 hours per week, Dr. Curr was able to arrange for a careful review of the course revisions which were planned for session 1972-73.

The reasons for these revisions were set down, and were then

appraised independently by six members of staff with first-hand knowledge of the course.

The process of change so far has been gradual and, as Dr. Curr described it, "step-by-step". In contrast, the situation was different for the third year course where a marked change was made without any real transition period (see below, Chapter 6).

At this stage, a young lecturer joined the teaching staff, Dr. Edwin Smith. Although he entered the scene in 1971, he became interested in the 'modern teaching methods' and in order to learn about these approaches, joined Dr. Curr in attending a Summer School at Horsens in the summer of 1971.

Dr. Curr reported:

"This brought a more definite commitment by Edwin Smith, which meant that the Unit ceased to be a one man show". (The researcher's emphasis).

The Unit adopted a new name and came to be known as the 'Learning Unit'. It developed its own 'Logo' which crowned its publications.

In session 1971-72, an old condemned school with small rooms became partly available for the work of the Learning Unit. This school was a mile away from the rest of the department.

This development made it easier for the teaching staff to obtain block allocation of students' time from the university timetable.

Dr. Edwin Smith participated in the next phase of development in what was known as "Engineering Graphics and Design for the second year Civil Engineers".

The problems as perceived by the teaching staff for this class manifested themselves as:

- Firstly : Low standard of work
- Secondly : Slow rate of working, and
- Finally : Low staffing relative to class demand for tuition on problems in tutorial sessions.

The perceived success of the overhead projector/tape approach

persuaded the teaching staff to extend the tape/overhead introduction to the three class hours/week subject. At this stage of development, the teaching staff tried out more open-ended laboratories, induction loops, radio head-phones and a self-marking exercise.

Outside the 'City University', the world of Higher Education went on changing.

The 'Nuffield Group for Research and Innovation in Higher Education' was set up in 1971. Its brief was a wide one: to make a general study of undergraduate teaching in Universities and Polytechnics in the United Kingdom. Teaching was to be interpreted in its broad rather than narrow sense to include curricula, assessment and advising as well as teaching methods.

The 'Anabas' Project, which was part of the 'Nuffield Foundation's Group for Research and Innovation' in Higher Education was based partly in Edinburgh. Between 1971-75 a number of studies were carried out in the project. Dr. Curr wrote a letter to Mr. Sheldrake who was the Deputy Research Director of the Project. The letter confirmed what had been discussed in a meeting with Mr. Sheldrake and welcomed a collaboration with the Anabas Project. Part of the text of the letter reads:

"Professor Young, like myself, will be very pleased if any of the work here in the 'Learning Unit' at 'Kurasini' would make a suitable subject for a study by anyone associated with your team. We would hope to offer every possible collaboration and at this stage can see no possibility of any difficulties arising on our side".

This invitation paved the way for the researcher to visit the Learning Unit at 'Kurasini' from October 19th, 1973, when the 1973-74 "Free Format first year course" was first launched.

The 'stills' which follow will possess an extra detail, namely, the workings of the Learning Unit as observed by the researcher. The viewers can see not only the panorama, but also close-ups of objects within that panorama.

The 'City University' Learning Unit

In a converted school some distance from the main university buildings, the Unit occupied two small rooms, a drawing office and two medium sized rooms. (Fig. 5-3).

In one of the medium-sized rooms a visitor would notice (in session 1973-74) 12 individual study booths each equipped with an individual tape recorder, headphones and a display board. Here, a part-time teaching assistant, Mrs. Williams, stored and issued all cassettes for the tape recorders, printed material and other aids as required. Supplementary space was available in the other medium-sized room called the 'Resources Room' which was used for other activities, gaming, group modelling projects or seminars. The drawing office acted either as the title would suggest or as a tutorial room. The two small rooms were allocated to group teaching.

On examination of a first year student timetable for session 1974-75 (Fig. 5-4) one may conclude:

Firstly, that the first year students (sessions 1974-75 and 1975-76) go to four different locations for their classes.

- 1 - The 'Hammond Street' Building which housed the administration, the Registrar's office and a number of drawing offices and lecture halls.
- 2 - The 'Kinondoni Building', where the Department of Civil Engineering was located.
- 3 - The 'Kurasini Building' where the Learning Unit was housed at a walking distance of 20 minutes from the 'Hammond Street'.
- 4 - 'DOHA' Campus, eleven miles from the central building in 'Hammond Street'.

The 'Newington Building', opened in 1968, was used occasionally by the Civil Engineering department especially when the services of the Television Centre were needed since it is housed there.

Figure 5-2

The location of the Learning Unit in relation to other parts of the University buildings (not to scale) - sessions 1971 to 1976

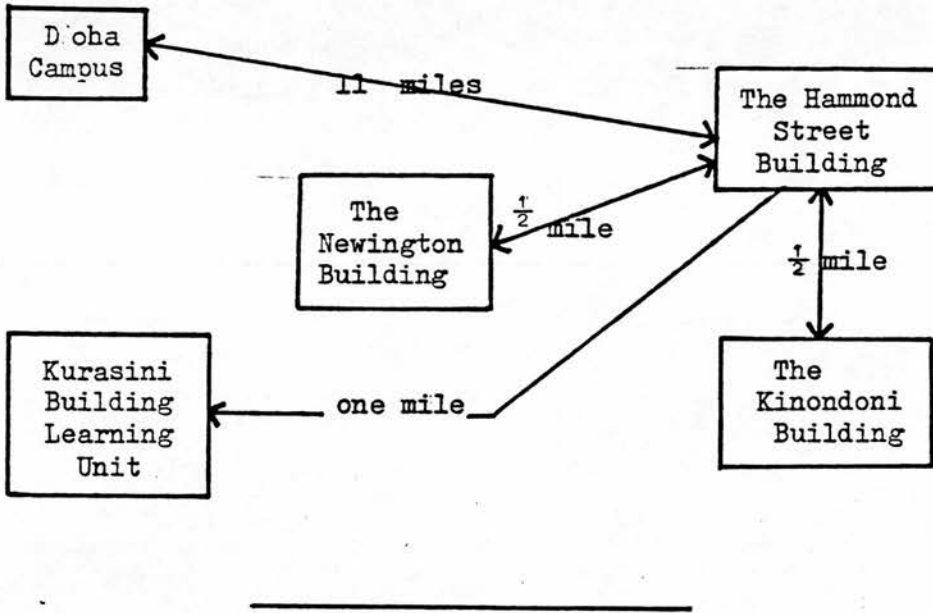
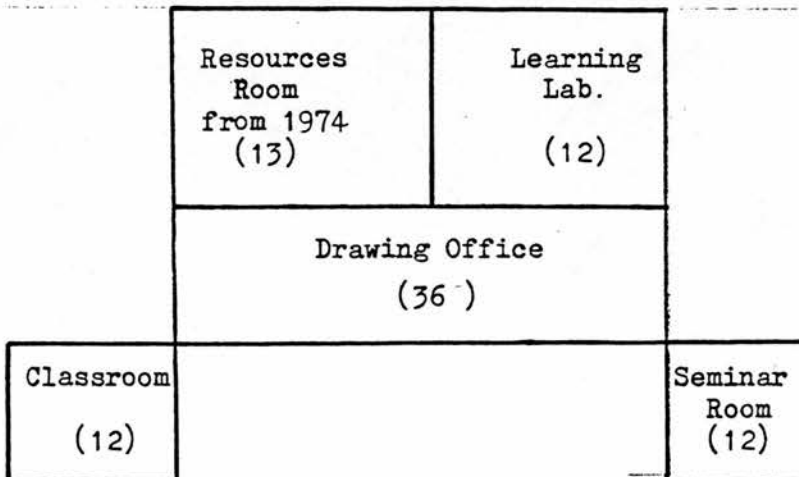


Figure 5-3

The Learning Unit -Schematic Layout



Total number of seatings shown thus = 85 seats

Figure 5-4

Monday	Tuesday	Wednesday	Thursday	Friday
9.00 a.m. Properties of Material	Kurasini Building - see separate Timetable	Maths (Alg.)	Maths (Alg.)	9.30 a.m. Maths
10.00 a.m. Applied Mechanics		Maths (Calc.)	Science (Chemistry)	10.30 a.m. Science Physics
11.00 a.m. Applied Mechanics Tutorial or Design Lecture		Maths (Alg. Tut.)	Science (Physics)	11.30 a.m. Science (Chemistry)
12 Noon FREE		Science (Physics)	FREE	12.30 p.m. Calc. - Tutorial
1.00 p.m. - 5.00 p.m. Drawing Office or Lab.		FREE	Science (Chemistry) 2.00 p.m. FREE	FREE
Hammond Street	Kurasini Building	DOHA Campus	Doha Campus	Doha Campus

FIRST YEAR
CIVIL
ENGINEERING
STUDENT
TIMETABLE
THE CITY
UNIVERSITY
SESSION
1974-75

Name Year Term
 I 1

Figure 5-5 STUDENT TIMETABLE (Group G)

Rooms	1	2	3	4	5	6	7	8
9								
Drawing Office D		S		L*	T		C	R*
Classroom C				S	C		L	T
Seminar S		R						
Conc. Lab CL	R							
Resources Rm. R	O			R	L	C	T	S
Structure Lab SL	C							
Conc. WShop CW								
Pub. H. Lab P	D					L	S	R
Learning L. L	L			T				
Traffic Rm T								
Office O		C			S			C
		L			R	S		C
	S		T					L
	T	T	S	C		R		T
	C							
	R			L				
	6	5	4	6	5	5	4	5

*Available if required by student

Secondly, that the first hour on Monday is closely linked with the Learning Unit activities.

Finally, the first year student at 'Kurasini Building' received a maximum of six and a minimum of four hours of instruction (*Figure 5-5*) (See separate timetable). This amounted to 25% of his total class attendance.

The components of Civil Engineering I are shown diagrammatically in Fig.(5-6)

The Learning Unit activities for the first year dealt with -

- (a) Structure and Stress analysis
- (b) Partly in 'Properties of Material', and partly in the engineering laboratories.

In session 1973-74, the 'Learning Unit' teaching staff and students participated in an important first year course entitled 'A Free-Format course based on pre-recorded Learning Material'. Due to lack of space, this experiment will not be discussed.

In session 1974-75, for the first year class Dr. Curr was joined by Mr. Thomas Hopkins to carry the load of preparing the pre-recorded material for the first year course of 'Structures and Stress Analysis'. Professor Young joined in this activity

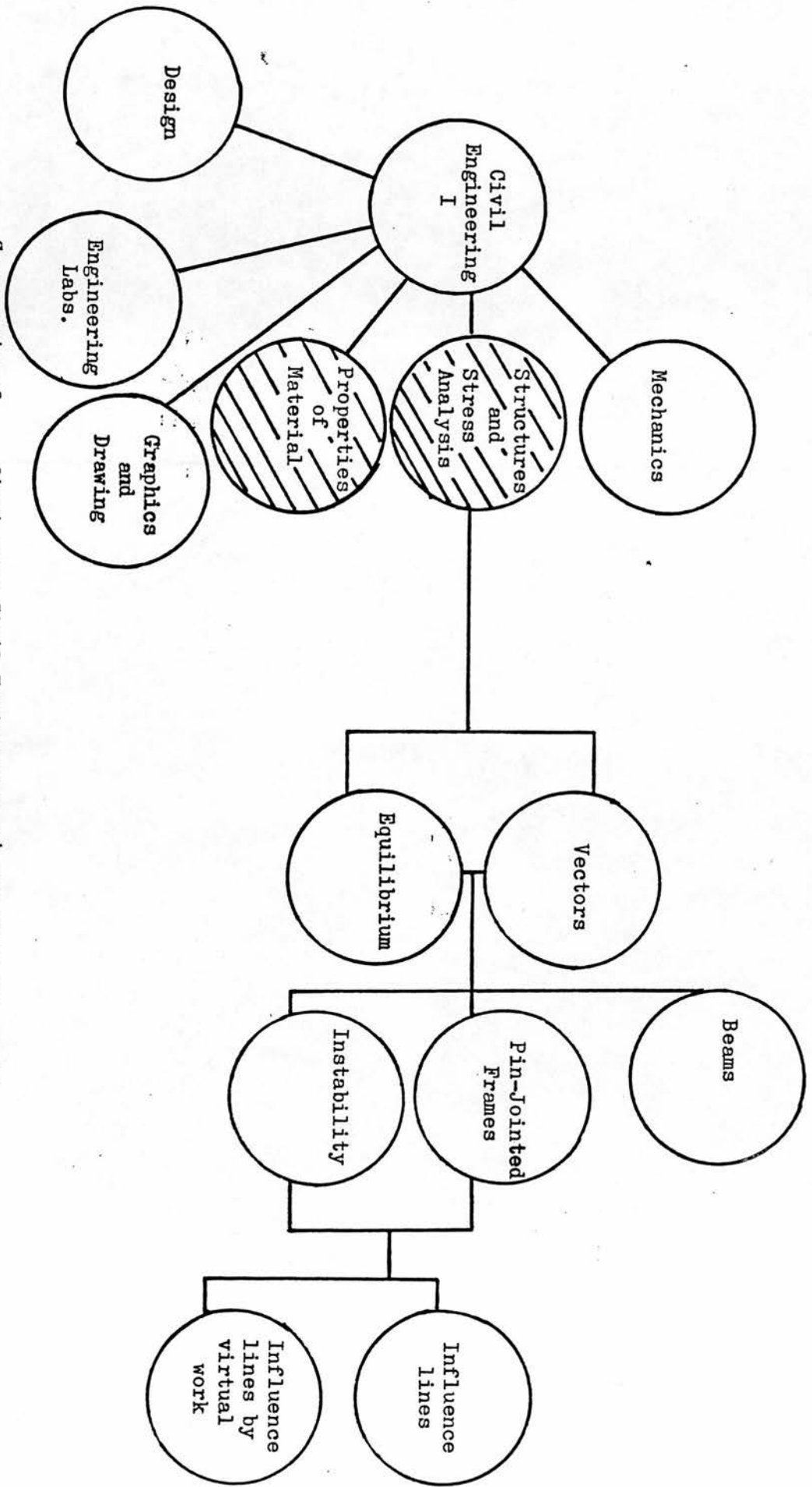
In the following pages I propose to follow the footsteps of a first year student from the first day of his arrival at the Civil Engineering department for his course, "Civil Engineering I". Although the emphasis will initially be on his experiences in Session 1974-75, I shall also include other changes which did take place in the following years.

Many of the details below might prove lengthy, but are important in the light of the discussions which will be dealt with in the following chapters.

Student Grouping

Due to the physical nature of the Kurasini Building, members of

Figure 5-6



Components of first year Civil Engineering at the City University

CI: PROPERTIES OF MATERIALS

Lect 1: Extract Notes

GOALS

5 5x5 15x1

1. BASIC SKILLS

- Note-taking from { lectures, observations, own activities
- Reading from { prescribed texts, handouts, free choice
- Write/talk/sketch to { Describe, Explain, Convince
- Ask for { Clarification, Extension, Discovery
- Think to { Amplify, Criticise, Propose

5 3x5 4x3

2. BEGIN WORK ON

- Structures : Buildings/Dams/Rigs/Bridges
- Containers : Silos/Tanks/Reactors/Bunkers
- Routes. : Pipes/Roads/Railways/Tunnels

5 3x5 3x1

3. MEETING GENERAL NEEDS

- Familiarity with Vocabulary/Practice/Problems
- Basics :- Principles/Theories/Methods
- Reconciling Theory & Practice : (any example)

15 55 30 Totals
100

Pass = 60%?

Figure 5-7 Handout for first year students' first lecture

the teaching staff adopted an "8 group/8 week base" for the optimum use of the facilities.

The University session usually falls into 3 terms of 10 weeks each.

The class was divided into 8 groups of 10-12 students each. In some sessions these groups were 'matched'. The 10 week term included a first week to start off and the last week for exams.

On the first day of the first year in session 1974-75, the students received a lecture on 'Properties of Material' from Mr. Currie where he set the tone for the activities which followed in the whole session. (Fig.5-7) is a handout which summed up the points dealt with in that lecture. This lecture took place at the 'Hammond Street' building.

The Kurasini Building Learning Unit: 'The First Encounter'

The activities which took place on the following Tuesday of the same week in the Learning Unit at 'Kurasini' could be represented by a flow-chart for each group of students. This sequence of events is based on student timetable (Fig.5-5) The main purpose was to familiarize the students with the 'way this Unit works.' Each activity lasted for 30 minutes or thereabout.

Figure 5-8

First Day Activities for first year students in the Kurasini Learning Unit

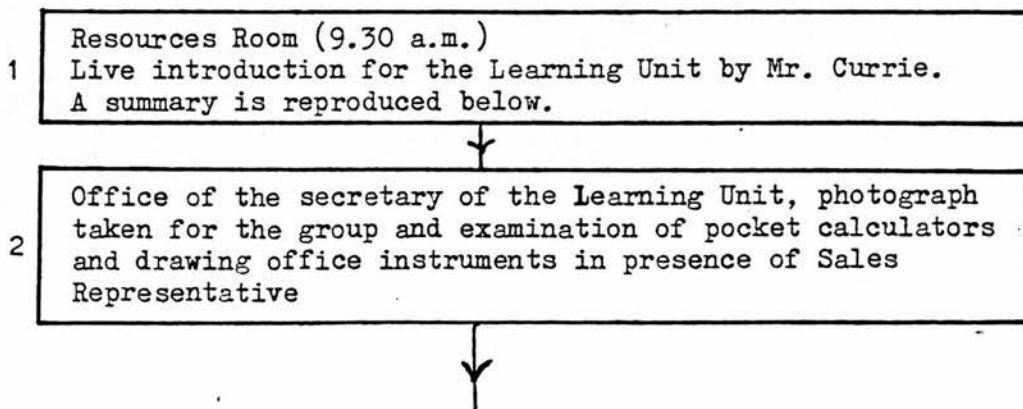
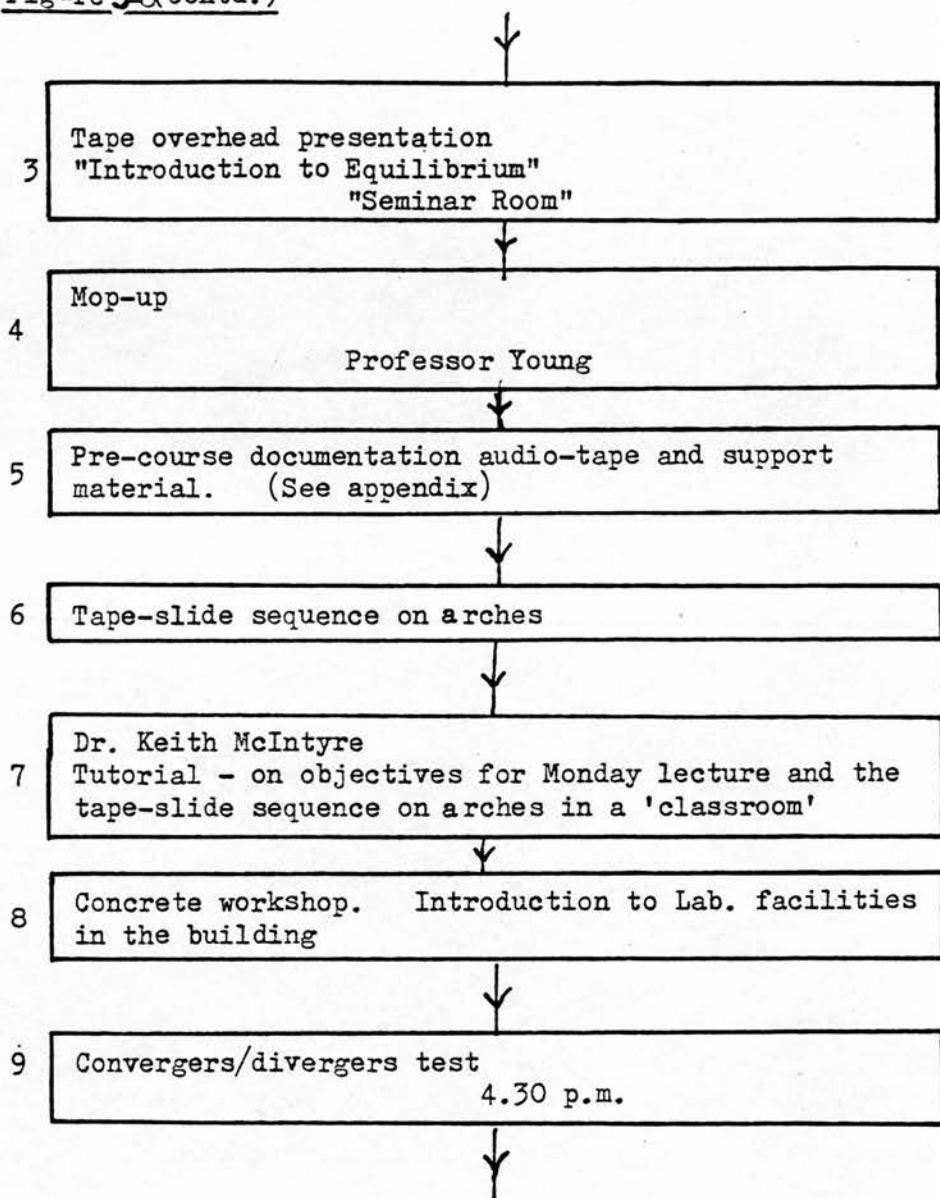


Figure 5-8 (Contd.)



Detail of Activity No. 1 (in Fig. 5-8)

Time: First day at the Learning Unit session 1974-75

Class: A group of 24 students of the first year

Place: Small Drawing Office - Learning Unit- 2nd floor.

Event: Dr. Curr. presents, live, the Learning Unit to the students in the presence of the researcher - activity No. 1 in Fig.

Below is a summary of a transcript of a tape recorded at the 35 minute session. Before the period started Dr. Curr asked a number of students to leave the room since they did not belong to the

groups marked on the timetable. Students were bewildered, since different groups start at different times. Emphases: 'We are different, we are a Learning Unit.'

We do not mind if you "express critical comments". Nobody here is rude to "somebody who's trying to learn". The way it works down here is the students' learning is Number One." Some members of staff do have it in for students. We use objectives - syllabuses are useless. In other lectures, you just try to get notes and go away.

Some lecturers wouldn't take kindly to having their lecturing discussed with them. We don't keep tabs on you if you don't turn up.

Secondly: Pre-recording has advantages: You can make sure it's good and avoid giving "Crummy Lectures." Students can stop it when it's too fast or they need a rest. You don't have to fall behind if you're ill. Don't just take notes - learn as you go along.

Thirdly: Give us feedback: If you can't learn, the instruction is at fault, come and tell us. "If you can't learn from it, I think there's something wrong with the instruction." We won't be rude if you complain to us. "I make you this promise now; that if any member of staff is rude to you because you can't learn or because you asked a question, I want to know." And we won't get back at you in the exams. Go to anybody - Mrs. Williams is a good person to go to. No good going to Mohamed (the researcher), it doesn't get back to us. "If you don't tell me, I won't know. We can't read people's expressions awful well. You don't have a wee light on your forehead that flashes on when you don't understand something." We will use the feedback - we are "morally obliged" to respond.

Fourthly: Accept feedback from us: The staff are there for you - "They've got nothing to do but help you, nothing else to do, very very little in the way of live instruction. And if you don't make use of them, then I think you're dopes." Everyone needs help - "Even the guy who fights his way through a tutorial question and at

the end of 40 minutes he's got the right answer and he thinks "that's great. I'm off. Super, I did it all myself."

Now, he still needs a member of staff, I think because he should go to a member of staff and say "Look, was that really a difficult question? Or did I make a mountain out of a molehill?"

Don't be upset/^{when} they say "Look, I am scoring 15 out of 20 for my drawings, why don't you get off my back?" And basically what you say to the guy - the answer to that is, "Look, because I think you could still get 15 out of 20 but for less work." or "because I think with the same amount of work you could get 17 out of 20."

Some activities aren't compulsory, and in general, there is no register kept on you. If you feel you could miss something, ask me what I think about that.

Fifthly: You are going to be assessed: We are ruthless if you don't hand in course work in time. You can be examined on the communication exercise. We want you to work hard "and so basically you'll find that sometimes we're breathing down your neck a bit..." Without lowering standards, we want no failures - if you can get in - you can get out with a degree.

Sixthly: Objectives have advantages: Objectives tell you what you should be able to do at the end of the day. Without them, you don't know what to look for in a lecture. "I am not setting this up as a legalistic document. It's meant to be helpful." Make sure the objectives are covered and complain if they're not.

Activity No. 2: First year - first day at 'Kurasini Building'

Class: Session 1974-75

Place: Office. Secretary's Room.

Event: (a) Photograph of the group is taken.
(b) Names noted down for easy identification on the photograph
(c) Examination of pocket calculators and drawing office instruments in presence of a Sales Representative.

The students also collected a "wad of handouts" known as pre-course documentation.

Time: This activity lasted around 35 minutes.

Activity No. 3:

Class: Session 1974-75

Number: 12 students

Place: A small room (seminar room) which can accommodate around 14 students.

The room was darkened to allow for the use of overhead projector and transparencies and a tape recorder. The topic under discussion "CI (Civil Engineering One) - Introduction to Equilibrium". Six students started immediately writing down what was projected on the screen and after 3 minutes the number went up to 9 students. Ten minutes later the students looked confused since they did not follow the argument which produced 3 equations and the tape had talked about transparency number 8 which was missing.

Later the numbers for the transparencies got mixed up i.e. while it should read 11 the lecturer said No. 10. That exercise lasted 30 minutes and students just moved on to the next activity. There was no member of the teaching staff present in the room and no effort was made to call anyone either.

Activity No. 4:

Class: Session 1974-75

Number: 12 students

Place: Drawing Office

Event: A tutorial session.

The aim at this tutorial was to solve numerical problems based on the instructions which had been presented in the previous period by means of tape/overhead sequence. In this session also, the teaching staff helped students with difficulties that arose as they tried

to solve the numerical problems on the tutorial sheet. A term "Mop-up" was coined by Dr. Curr to describe this activity. When the students settled down they found Professor Young in attendance to answer their questions. After a few minutes, the Professor started to teach the class (12 students) as a whole, which indicated that the whole group were having the same difficulty. The drawing office is a relatively large room and students could pass through the back and across the floor to gain access to other rooms. The level of noise was high. Later when the researcher went for coffee in the coffee/staff room, Professor Young told him that at least 2 students were worried because they had not done "Statics" before. The problems were difficult for them and went on to say; "If it is difficult for me, it is certainly difficult for them. We certainly throw them at the deep end."

Activity No. 5:

Class: First-year - first day. Session 1974-75

Place: Learning Lab.

Event: Pre-course Documentation - Overview

The student, with "a wad of handouts" and a recorded tape which was heard in conjunction with handout 1/160, settled down in one of the 12 individual study booths, each of which was equipped with an individual tape recorder, headphones and a display board. That meant that the student would hear the tape on his own. The tape lasted around 30 minutes and it is reproduced in full as an appendix to this thesis.

Fig.5-9 and Fig.5-10 summarize the main points on the tape for sessions 1974-75 and 1975-76 respectively as presented to the students by Dr. Curr.

The most important features of the material on the tape are summarized below.

- detailed discussion of the university assessment system; i.e.
 - (a) end of session examination in June
 - (b) 'continuous assessment'
 - (c) course work
- details of the first year subject of 'civil engineering I' and the relation between its different components.
- details of course work requirements and how to submit them, notes on report writing and what the lecturer looks for when marking a report.
- examples of 'objectives' lists and suggestions on how to use these lists.
- emphasis on the need for use of the switch on-off facility of the tape recorder.

Fig. 5-9

Civil ENG I: Introductory Tape 1974/75: 1/160

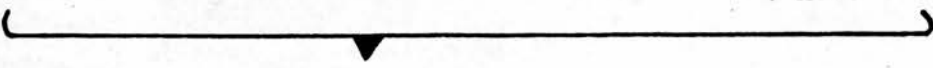
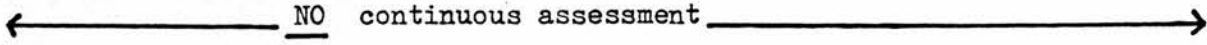
- Purpose:
1. Using Equipment
 2. Regulations, and sub-division of course
 3. Look over Properties of Material pre-course documentation

Requirements:

1. Exam (June matters) 40% = Pass
2. Continuous Assessment: marked exercises count for a proportion of the final exam mark
3. Course work: pass/fail grading only.

Not all classes examined in all of these ways. Individual lecturers announce their requirements.

Sub-sections of Civil ENG I

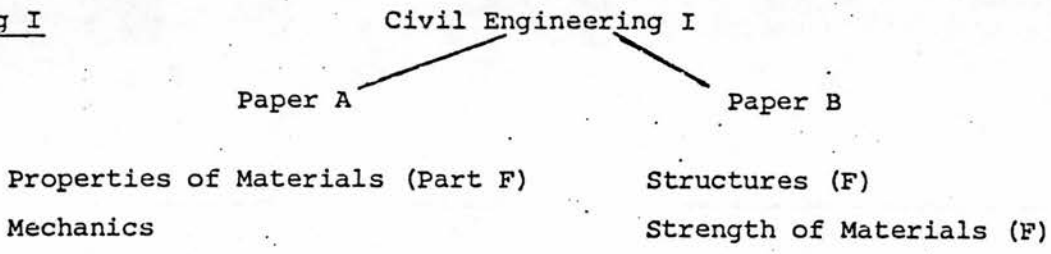
Mechanics (Mr. Ferguson)	Structures and Stress Analysis (Dr. Curr. and Mr. Hopkins)	Properties of materials (Dr. Curr. and Dr. McIntyre)	Graphics and Drawing (Mr. Thomson and Dr. Smith)	Labs. Prof. Young etc.	Design Dr. Smith
Monday - 10-11 11-12	Tuesday		Monday - 9-10 Tuesday - 1 hour	Monday - p.m.	Mon. - 11-12 and p.m.
					
	EXAM + some C.W.		C.W.	C.W.	C.W.
					

1/101

CI : Introduction to Course Arrangements (1975-76)

Differentiate between:	Class Exams.	and	Degree Exams.
	Coursework	and	Continuous Assessment
	Properties of Materials	and	Strength of Materials
	Resit Examination	and	Remedial Work

Breakdown of Civil Engineering I



Coursework Submission

- Time
- Place
- Late submissions
- M/C and other grounds

Correcting Schedule

- 20/20 Perfect work.
- 17/20 Exceptionally good work.
- 15/20 1st class honours standard, at this stage.
- 13/20 2nd class honours standard, at this stage.
- 11/20 Clear Pass.
- 9/20 Pass.
- 7/20 Poor, but within striking distance of a Pass.
- 5/20 Very weak.
- 3/20 Pitiful.

Figure 5-10 Main points of pre-course documentation tape over view
Session - 1975-76

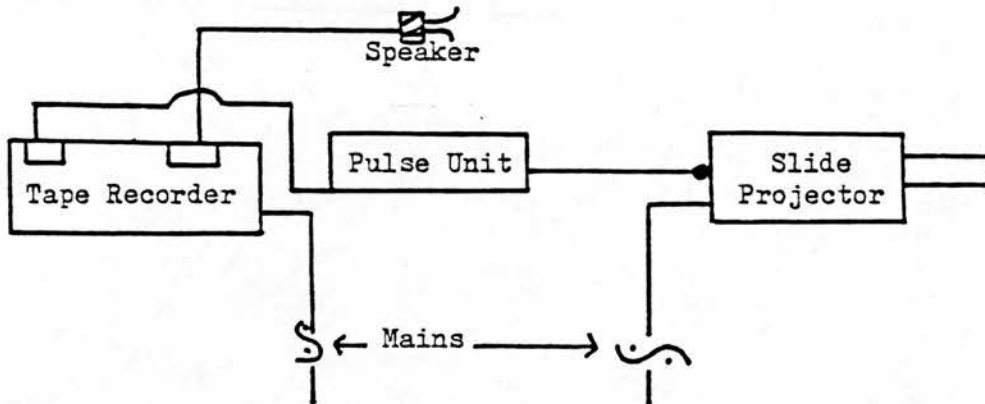
Activity No. 6:

Class: Session 1974-75

Place: Small room i.e. Seminar Room with a capacity for 12-15 students

Event: A tape-slide sequence on arches

The equipment (see below) was already set up in the small room when the students arrived. This consisted of a tape recorder, a speaker, a pulse unit and a slide projector.



The pulse unit made it possible for the slides to change in conjunction with the recorded text. The subject matter on this tape was part of "Properties of Material", part of 'Civil Engineering One'. No teacher was present.

Activity No. 7:

Class: Session 1974-75

Place: Small Room i.e. Traffic Room

Event: A discussion with Dr. Keith McIntyre

The declared aim for that activity was to discuss the objectives of the Monday lecture and to mop-up any questions on the 'arches'

sequence which had been seen by the students a few minutes before. The researcher was sitting in the room among the 12 students whom he had joined after the day started.

Dr. McIntyre who was constantly "smoking", started off by saying that the aim was to develop "an environment of education", that is "the student should learn for himself, think for himself, find his own limitations and while talking to his neighbours find out the advantages other students have over him." Then he invited the class to read the list of objectives which they already had from the previous day for the following five minutes with the aim of starting a discussion amongst the students. Then by enumerating the different objectives he encouraged the students to ask him questions, e.g. "Are you happy with the term 'Vaults'?" Answer, "I missed out the Vaults, carried away by the beautiful pictures," came the answer from one student. What is meant by "Reinforcement?" What is the difference between "English bricks and Scottish bricks?" And why? No answers from the students. Dr. McIntyre went on to say "We are trying to develop inquisitive minds here! We are trying to develop techniques, ask upstairs, it is not my job to develop this here."

"Structural form is dictated by the properties of material used. These may be available as natural resources. In case of shortage of these natural resources, you have to cope with the new material available. A professional engineer is a person who thinks from basic principles" At the end of the session students went to another small room where Mr. Hopkins stated that the Learning Unit system had been complex for some students and that it would be some time before they "settle in." He suggested that from the following week there would be an hour for each activity rather than the half-hour. He suggested that students would be able to stay late - till 5.00 p.m. and that they would be able to use the Learning Unit "at any time."

Later on, Dr. McIntyre told the researcher that the group of students he observed were not as active as other groups. He went on to confirm that earlier groups were asking all sorts of questions, "right, left and centre."

Activity No. 9:

Class: Session 1974-75

Place: Medium sized room - Resources Room

Event: "Converger/Diverger" test.

The member of staff in charge of this activity was Mr. Hopkins. He addressed the class by saying that Dr. Curr was interested in "How people learn effectively?" and added that there were two manners of learning, "convergent manner, more to the point" and "divergent manner, which is different manner of learning." He went on to say that "There is no real difference between CON/DI" and "There is no comparisons when it comes to exams." After distributing a sheet of paper with the following text typed on it:

"A reinforced concrete water tank sits on an exposed hillside. It leaks, and we do not know why. All that we do know is that water is being lost somehow.

Write down as many possible explanations of this difficulty as you can think up in the time available. Exclude no possibility that comes into your mind, even if it takes the form of vandals carving their initials too deep in the concrete."

Mr. Hopkins asked the students to write their names and to write down the reasons they thought of and added; "The number of reasons is not important."

Summary of the History of the Development of the 'Learning Unit' and its Context:

When the City University, previously a Technical College, became a University in 1966, members of the teaching staff from within the Department of Civil Engineering responded to the new role with a number of attempts to revise teaching methods and syllabi.

The 'Properties of Material' courses for first and second years were reorganised to achieve a number of new objectives. Closed circuit television programmes were introduced to "establish the principles of sound scholarship" amongst the students and to improve on their study methods.

The same medium was used for certain items of group work. Project work of varied nature was introduced to first and second year classes. Over several years, these innovations became part of a trend to ensure closer contact between lecturers and students.

Educational Technology and Systems Approach were employed to "assist the teacher to make his choice of his syllabus, teaching methods and teaching media objectively and to validate his decisions later in a rigorous manner."

The concept of using pre-recorded instruction to free the lecturer for contact with the students led to the fabrication of 12 study booths equipped with cassette tape recorders, but practical and organisational problems, mainly where group timetabling was concerned meant that the results were not encouraging. Due to expansion within the department the lecturers involved in this work were rehoused in an old converted school some distance from the main university building with several smaller rooms. The innovators were provided with accommodation which lent itself admirably to the adoption of a timetable in which several small activities were permutated.

This development made it easier for the teaching staff to obtain 'block' allocation of students' time from the University timetable.

A new style of teaching strategy was planned for the third year 'Structural Design' subject, with group activities supported by pre-recorded instruction in place of conventional tutorials.

The expansion of the resource collection and associated administrative work-load required the appointment of a part-time 'Organiser' in the autumn of 1972.

The teaching staff began to structure the learning resource material according to a standard pattern of options. The topics were broken down into small 'blocks', which were later amalgamated so that a block would cover a week's work. The blocks were numbered to indicate in which order they should be tackled, while teachers'

decisions usually governed the order in which topics were studied.

Each session the new group of first year students had come to accept group timetabling and a standard package of learning material which was prepared to offer the student what might be called a "Standard Pattern".

The flowchart below indicates the essential inter-relationships between the various "teaching/learning" activities undertaken by the student passing through the syllabus.

The Initial Instruction

The initial instruction is usually a group activity. It is the commonest instance of introducing a new material for the group. In the third year it can be a live lecture for the whole class. For the first and third year student it may take place in a small room for groups of students (8-12 students) where the subject matter is introduced via a tape/slide or tape/overhead sequence in the absence of a teacher.

For each section of the syllabus, the student will have available to him a list of objectives which are clearly listed in a statement which begins 'After this period of instruction the student should be able to

The student may also receive a sheet with a number of numerical problems to be tackled after the instruction is completed. Materials for group activities are usually laid out in the appropriate room ready for use by the group timetabled for that hour.

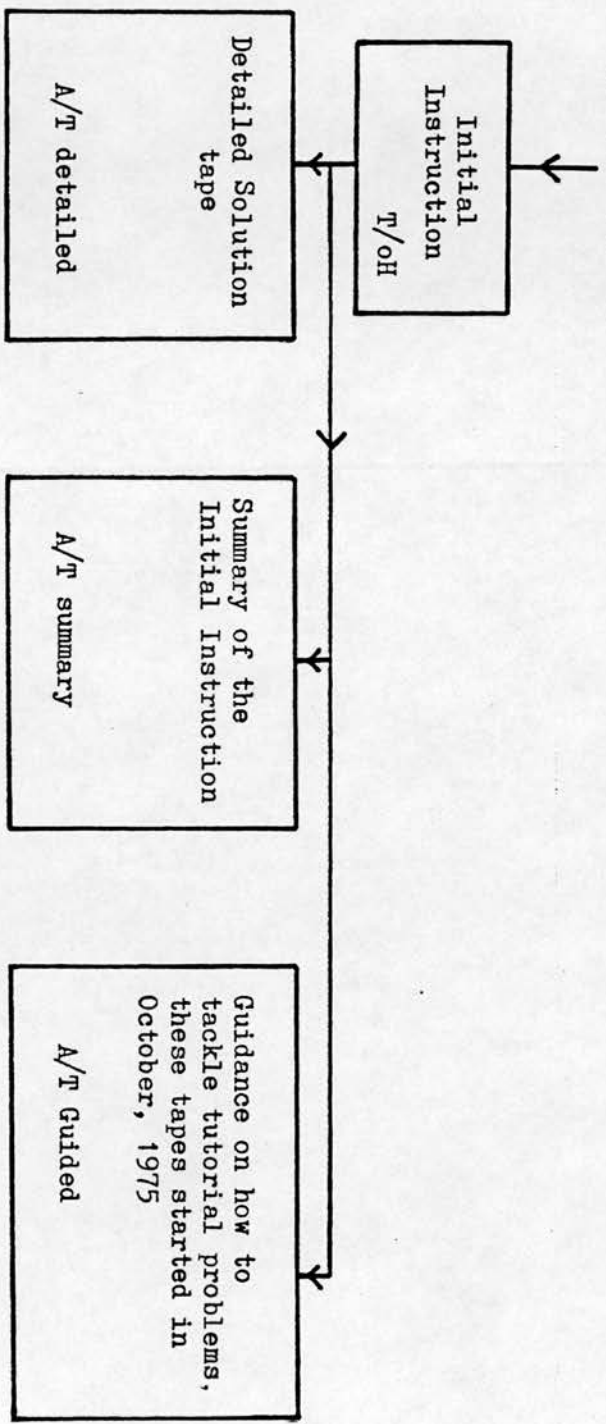
The Follow-up

After completing the basic unit of initial instruction, the student will have available to him a 'summary tape' which is a brief and condensed resumé of the main teaching points of the initial instruction, the main points of the summary tape will also be provided on a 'handout'.

Figure 5-11

The standard pattern of using the learning material

1973-1974-1975-1976



For the 'tutorial' problems, the student is provided with a solution sheet supplemented by a recorded commentary on the process of solving these problems in great details. In session 1975-76 a new version of the 'solution' recorded tape was introduced under the name "Guided Tape". This was officially described as "Guidance on how to tackle each question."

A summary of the audio-tapes developed and on offer between 1971 and 1976 is shown below:

Figure 5-12

Descriptor	Style/approach of material
Initial Instruction	Main-line teaching (group).
Summary	Review of main teaching points.
Detailed Tutorial	Complete worked solutions to tutorial questions.
Guided Tutorial	Hints on how to tackle each tutorial question.
Self-Marking	For drawings or tests, to enable the student to form his own assessment of his work or on a practice examination paper.
Remedial (mainly first year course)	To assist those who had difficulty with the subject when they first encountered it.
Revision	A review, for those who already had instructions some time before.

(R.A. 2 , p.10)

The 'block' of instruction may also contain an item which has been included to 'enrich' the appreciation of the topic, and so may be of interest to some students before or after the initial instruction and tutorial.

The resource material in the Learning Unit is constantly under review. New tapes are added during the session and many others undergo major revisions during the summer vacation.

Learning Unit Staffing Levels

Learning Unit activities on the staff side, include the following:

- (a) Production of pre-recorded materials and multi-media sequences.
- (b) Teaching commitment; live lectures.
- (c) Supervisory duties; these include supervision of drawing offices, tutorial sessions, laboratories, discussion groups, open-ended activities.
- (d) Supportive and technical activities, these include secretarial assistance, resource management and help in the production of audio-visual materials.

In session 1973-74 the Unit was staffed by:

Dr. Curr and Dr. Edwin Smith who prepared and produced resource materials, gave some lectures, tutored in the Unit and directed courses. At the end of session 1973-74, Dr. Smith left the Unit.

Professor Young and Mr. Edward Tyler were occasional producers of resource material and Mr. Tyler supervised and marked some of the Drawing Office exercises. Mrs. Williams was responsible for the day-to-day running and administration of the Unit.

One junior technician helped in preparing resource material for the Unit and its staff. A full-time Secretary was available for all secretarial work. Tutorial assistants (12 hours per week) helped with students' learning difficulties and tutorial problems.

A rough proportion of working/teaching commitment, time-wise for staff in the Learning Unit, is summarised below:

Session 1973-74

Table 5-13

Name	Title	Time commitment to the Learning Unit
Dr. Curr.	Senior Lecturer	90%
Dr. Edwin Smith	Lecturer	90%
Mr. Edward Tyler	Lecturer	90%
Dr. Keith McIntyre	Senior Lecturer	20%
Mr. Thomas Hopkins	Lecturer	100%
Mrs. Williams	Organiser	100%
Junior Technician		80%
Secretary		100%
Tutorial assistants with varying commitments		12 hours/week

Learning Unit-based courses for sessions 1973-76

First Year

- (1) 'Structures' Course: This course formed about 20% of the total Civil Engineering Course for first year students.

In session 1973-74 the course director was Dr. Edwin Smith, when the aim of the course was;

"To permit each undergraduate a fair measure of participation in the planning of his own individual study programme."

The scheme was known then as -

"A Free-Format course based on pre-recorded learning material."

(2) 'Properties of Material' Course: This was based on two hours of conventional lectures per week. There was an examination at the end of each term and course work had to be handed in as part of the overall assessment.

In the Spring of 1975, the Nuffield Foundation awarded the leader of the 'Learning Unit' a small grant to support the experimental development of a 'course without a syllabus'. In session 1975-76, a group of 12 first year undergraduates (an experimental group) were given the freedom to select the content of one of the first year subjects - 'The Properties and Use of Civil Engineering Materials' - which had previously been allocated two hours per week if conventional lectures and tutorials were used (see above).

The course became known as:

'POMAS' - 'Properties of Materials: Alternative Syllabus'

Second Year

(3) 'Engineering Graphics and Design': This course was based on three class-hours per week.

Third Year

(4) 'Design of Structural Elements': The 'case study' detailed in Chapters VI and VII is concerned with:

The third year course of 'Design of Structural Elements'.

Analysis of the raw data of the different case studies have shown that the third year course is the most striking example of the effects this innovation had created on the department and the reaction of students to their learning experiences. Other reasons for the choice of this case study to report here is that it has been quite popular with many innovators due to the low capital required initially to start it. Hence, the large number of cases reported in the literature (Chapter 2).

Learning Unit: Further Administrative Details

Loans for Home Use

Students may borrow tapes and print (but not slides or transparencies) for use at home. Recordings can be copied on to the student's own tapes or returnable deposit of 50p can be paid for the loan of one of the Unit's tapes.

The fast-copier machine available in the Learning Unit can produce two copies from one master tape within 2½ minutes, copying both tracks in mono-sound and erasing the previous recording in one operation, after which the tape is automatically rewound.

Tape Utilisation Cards

Students using audio-tapes within the Unit are asked to fill in a tape utilisation card (with their name, the date, time on and time off) for each tape used.

"Post-mortem" File

A file is kept for each item used in any course to record students' comments, any difficulties experienced when running the materials and errors, ambiguities, which must be corrected or alternatives to be made before the material is used again during the next session. The file is reviewed and the necessary action taken during the summer vacation.

Tapes

The Unit uses both C60 and C90 cassette tapes, A4 size paper, quarto size overhead projector transparencies mounted on cardboard frames and 35mm colour slides in glass mounts (held in their appropriate sequences in Carousel slide magazines).

Equipment Costs and Staffing Ratios:

Dr. Curr , in a major statement, noted -

"The first eighteen months in the life of the Unit as an entity involved the staff (which initially only consisted of the writer) in considerable development work. This was disproportionately high in relation to an established steady-state condition. Nevertheless the capital cost of the special equipment which was purchased was written off against the reduced labour cost in staffing drawing offices and tutorials after about two and a half years of use."

He goes on to confirm -

"The question of costs is a confused one, for what is educationally best is not necessarily the cheapest, or vice-versa. Fortunately the writer feels that he has avoided this discussion meantime by maintaining the overall cost of instruction within the level of conventional teaching elsewhere in the same department."

(R.A. 12, pp. 511-512).

CHAPTER VI

Innovations in instruction in higher education arise mostly out of some perceived sense of the inadequacy of existing arrangements. An innovation is a break with routine and habit. Only when one embarks on a new venture does it become evident just how much of our academic life is underpinned by tradition and quite how much momentum have established practices. Many of the early difficulties in embarking on an innovation are rooted in the absence of precedents or in the application of traditional (but inappropriate) models, and the absence of precedents gives rise to anxiety.

If innovative attempts, such as the learning Unit, are characterized by what March and Simon (1958) call unprogrammed activity then uncertainty as a variable is more potent and the incidence of uncontrolled outcomes is greater than in traditional programmes. When Dr. Curr deviated from the conventional wisdom of lecture plus tutorial, drawing office exercises, laboratory experiments and text books as central means of instruction, then major questions arose for which there were, at most, incomplete limited answers.

Each instructional method has its advantages and disadvantages. Strong points of personalized systems of instruction include the development of students' self-study habits and the teaching staff's opportunity to respond to individual needs through tutoring and regular testing for mastery. A principal disadvantage is the procrastination problem.

The lecture method has well known advantages, as well as short-comings. Its fixed pace and schedule generally assure that students will complete course work 'on time'; it can usually accommodate large numbers of students; its costs per student are relatively low, and it can provide reasonable access to senior teaching staff who function as motivators and positive role models. Among its shortcomings are that students' achievement may be highly variable, that students' deficiencies may accumulate over time and have serious consequences later in their careers, and as under graduate numbers have grown in

in the past few years lecture classes have become increasingly less personal.

Members of the teaching staff in the Learning Unit, as summarized in Chapter Five, have been experimenting with a variety of instructional methods towards what amounts to a 'hybrid instructional system' or a 'blend'.

In this chapter, the perceptions of the teaching staff of the third year course 'Design of Structural Elements' will be examined. Chapter seven discusses the students' views of the same subject and details their comments on the experience.

In chapters three and four (above) the researcher indicated how the ethnographic approach attempts to study the totality of the phenomenon (i.e. the Learning Unit) in greater depth in its natural setting, to understand it from the point of view of those involved in its activities, and to deal more with reasons, motives and perspectives.

Following this approach, then, the researcher examined, interview data and Learning Unit documents and other sources to identify the actors' own perspectives.

The analysis adopting the ethnographic stratagem of progressive focusing, aimed at the discovery and refinement of the research hypothesis as it developed. Research in all styles is carried out in the context of knowledge which is taken for granted. Observation involves selection and interpretation of the relevant while the irrelevant is discarded, even where tape or film is used, the recorded material will be selective. The analysis led to the categories which are represented by the sub-heading in the text of the chapter. The framework developed in (Fig.6:3) from detailed analyses of the interviews is used to show that the extracts prescribed are related to the main concerns of the informants, yet ordered to offer coherent pictures of the innovation in relation to the previous studies reviewed in Chapter 2.

This framework allows us to consider the innovator's perspective in terms of the following components.

- a) Belief system, philosophy, aims, learning models.
- b) Procedures, course design, organizational issues, and

c) contextual issues and constraints in relation to the intended outcomes of the innovation.

One of the strengths of the ethnographic research method adopted is the concern with whether the results of this study can be generalized. Ecological validity which has to do with generalization to other conditions (i.e. settings, causal factors, researchers, measures of effect) invited the researcher to focus on the context of that particular setting.

This appears as an introduction to chapter (6) and concludes the analysis under the heading "The Learning Unit and its environment: an alternative conceptualization".

But let us start with:

A Word of Caution:

The Learning Unit of the City University is several years old now. It does not exist as it once did. The physical environment has changed, so the teaching staff, the style and performance. An examination of this physical and social environment follows:

VI: (1) The Learning Unit and its Environment:

The Learning Unit's social as well as physical environments had a number of parts. Each of these parts was a miniture social system in itself. These parts had interdependencies

Footnote:

A note on presentation:

In indirect speech, the pronoun 'you' has been retained where used by the speaker. This besides giving a certain sense of immediacy through retention of more of the original version, also avoids some of the confusion which might be caused by the over use of 'they'.

Certain colloquial elements of the original language have also been retained. In the following pages, contrary to what has been mentioned on page (78) earlier, commas rather than dots have been used to separate fragments of speech in the paraphrased version. This is simply for the sake of tidiness.

amongst themselves as well as with the Learning Unit. One can conceptualize the Learning Unit's environment in terms of ever-expanding concentric circles of social systems as shown in (Fig.6:1). Right at the centre one can identify a 'Kitchen Cabinet' consisting mainly of Dr. Curr and Mrs. Williams.

The relevant publics, as parts of the social environment, expand to include the local and national educational establishments, as well as the professional audience that reads the professional journals.

One can discriminate between the members of the teaching staff of the civil engineering department those who take an active part in its day-to-day running and those who are physically removed from its environment.

In this chapter we examine first the views of the staff and students who were immediately involved in the innovation. But we must also consider the ways in which other staff conceived of what went on in the Learning Unit. It was many and sometimes different things to individual members depending on their involvement with the Unit.

The views of staff not immediately involved are detailed in Chapter 8 and they will show their attitudes that reflected their own personal beliefs about engineering education. Learning Unit students report on their perceptions of their experiences in Chapter 7 but we begin with the perceptions of the staff most closely involved.

The teaching staff perceptions:

VI (ii) (a) A model of practice:

The Learning Unit, like any other organisation exists in an environment from which it receives its resources and to which it distributes its products. It operates according to an explicit or implicit definition of its role in shaping its graduates.

In an interview on May 6th, 1976, Dr. Curr responded to the researcher's request to comment on the Learning Unit's

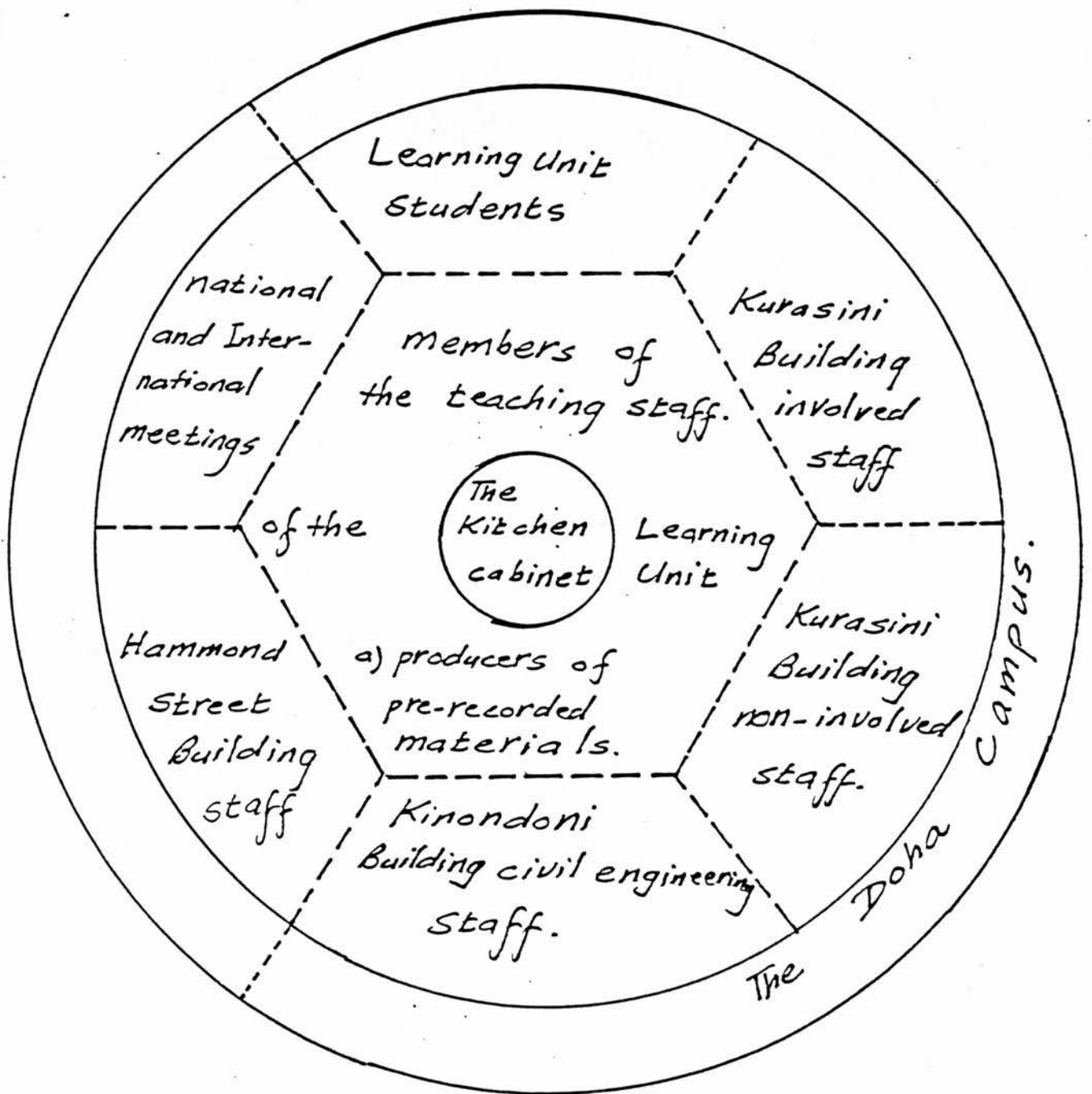


Figure 6:1 The multi-faceted environment of the Learning-Unit.

model of educational practices by saying:

" ... Well, if you want a model for our practice, I would say that we're like a factory that has to make products and sell them or it won't stay in business. So our first priority is to carry on offering students an education and a training and stay in business. And if we want to produce a good product, then we have got to try and improve it. And obviously you look for improvements in the process. You've got feedback coming back from the students and elsewhere - if you like, from your 'customers'. You've got feedback coming back from a number of places. I think you've got to try and be objective about weighing up that feedback and try to do something about it. At the same time, it's possible that you could make a completely different product. And one has got to move with the times and try to advance".

In examining the conceptual model used by the leader of the Learning Unit, whether it was an approach to systems design, a formalist, an heuristic or an *ad hoc* approach, the researcher's focus will be on recognising the underlying assumptions, categories and conceptions.

In Chapter five members of the teaching staff and Dr. Curr had elaborated in detail on aspects of the aims, procedures and outcomes of all the innovations in which they participated. The following discussion adds to these details.

Studies conducted on engineering education (Walsh, 1980) identified three major goals that are meant to promote technological, inter-personal, and social-technical competencies in engineering students.

The achievement of technological competence requires the mastery and retention of science and engineering facts, principles, theories and analytical skills; the development of synthesis, design, modelling and problem solving skills and the development of implementation skills for converting knowledge into action.

Inter-personal competence requires the development of the cognitive, affective and behavioural prerequisites for working with others to perform a task.

Among the skills required are communication, constructive

conflict management, inter-personal problem solving, joint decision making and identifying and accepting multiple perspectives.

Social-technical competence requires gaining an understanding of the complex interdependencies between technology and society, of the influence of technology on individual and collective behaviour and on the natural environment. Essentially, this competence involves approaching technical problems from a wider perspective that encompasses historical, social, psychological and philosophical viewpoints.

In the light of this discussion, it will be interesting to examine the declared educational objectives for the City University Civil Engineering undergraduate course [Fig.6-2].

The emphasis in this list of objectives is on the technological competences, although the first objective refers to a communication skill which can be seen in part as an inter-personal competence.

The social-technical competences are missing from the list.

Of course many innovative objectives are taken to have a rhetorical as much as a pedagogical function. In examining the activities of the Learning Unit it will be necessary to keep an eye open for the correspondence between objectives and the actual syllabus content and instructional methods adopted.

Curriculum questions are complex practical questions but often depend on important theoretical assumptions. The researcher thus aimed at an examination of the aims, ideologies, learning models and assumptions that underlie the Learning Unit policies. This implies that the innovator needs to expose his own pre-suppositions and assumptions and to reflect upon the meaning of education for himself and others. The researcher sought the meaning that education had for the innovator, and his relations with the other people who share the process by an examination of the metaphors he used. The use of terms like 'structure' stems from the technical application in civil engineering. Its usefulness

Figure 6:2 Educational objectives for the City
University Civil Engineering Under-
graduate course

OBJECTIVES

It was important that the objectives which have been quickly and rather vaguely mentioned previously should be defined in more detail before any restructuring of the already adequate lecture course took place.

The writers require that an undergraduate in their Department should learn as soon as possible:

1. To express his thoughts lucidly and pertinently when he is required to use the written or the spoken word.
2. To read profitably for himself, with a minimum of direction and assistance, technical literature whether in the form of textbooks, research papers or reports.
3. To derive and formulate the answers to questions of varying complexity without direction.
4. To take an enquiring initiative, asking pertinent questions without prompting.
5. To observe intelligently, accurately and promptly within his chosen field and to assess the value of these observations.
6. To formulate conclusions and deductions.

The writers believe that the subject matter around which these skills are developed is of relatively minor importance, as there is ample opportunity elsewhere in a four year course to acquire the fundamental engineering knowledge required by a graduate. The value of using material relevant to the student's own subject is to ensure a high level of motivation.

in this primary domain leads to its metaphorical transfer to other domains. An uncertain and obscure area (i.e. education) is construed in terms of one both familiar and apparently similar, for example a factory and its products.

The usually quite unconscious infiltration of these metaphors into our 'language in currency' can have fundamental effects on modes of thought and feeling within a culture.

At about the turn of this century, the need for mechanization attracted scientists and engineers from a variety of disciplines whose interests covered some aspects of the work process. As a result, work study was initiated. As knowledge and understanding were accumulated and systematized, those who were engaged in such research institutionalized and professionalized their efforts under the name of industrial (or production) engineering. Thus industrial engineering provided the intellectual fuel which powered the process of mechanization. In the late thirties, the inter-disciplinary activities of scientists and engineers resulted in what came to be known as operational research.

In this field workers adapted available scientific concepts, methods, techniques and tools to their tasks, and improvised some new ones. The whole conception is now often referred to by social scientists as the 'machine theory of organization', or 'rational planning'.

Human behaviour can only be properly understood if it is seen in its context - a context made up of history, culture and situation. Dr. Curr as an engineer was familiar with all these 'models' and it is reasonable to assume that his belief system has multiple origins.

In the Learning Unit, as in many reform-orientated organizations, belief systems or ideologies are a major element.

Ideologies have important functions in mobilizing energies for high investment in organizational activities. They also, have important dysfunctions in being difficult to manage and in screening out important pieces of information about organizational and environmental realities.

Another aspect of ideology is that it serves as the group's *raison d'être*. One way of analyzing the ideologies of an organization is through the critical examination of evidence such as the point of view of the leader, the stated purpose of the organization (aims), the end result of the organization activities (outcomes) and the organization's own structure (procedures) as an embodiment of the ideology itself.

The outcome of the activities of members are seen through a screen which filters their understanding and knowledge of their world. In particular, the interpretation of their aims and the procedures they are likely to select can be seen to be orientated towards the prevailing interests and concerns and towards the contextual issues and constraints [Fig.6:3].

Dr. Curr's point of view had a number of elements and each element had a series of components.

In the light of this framework, Dr. Curr's belief system will be closely examined.

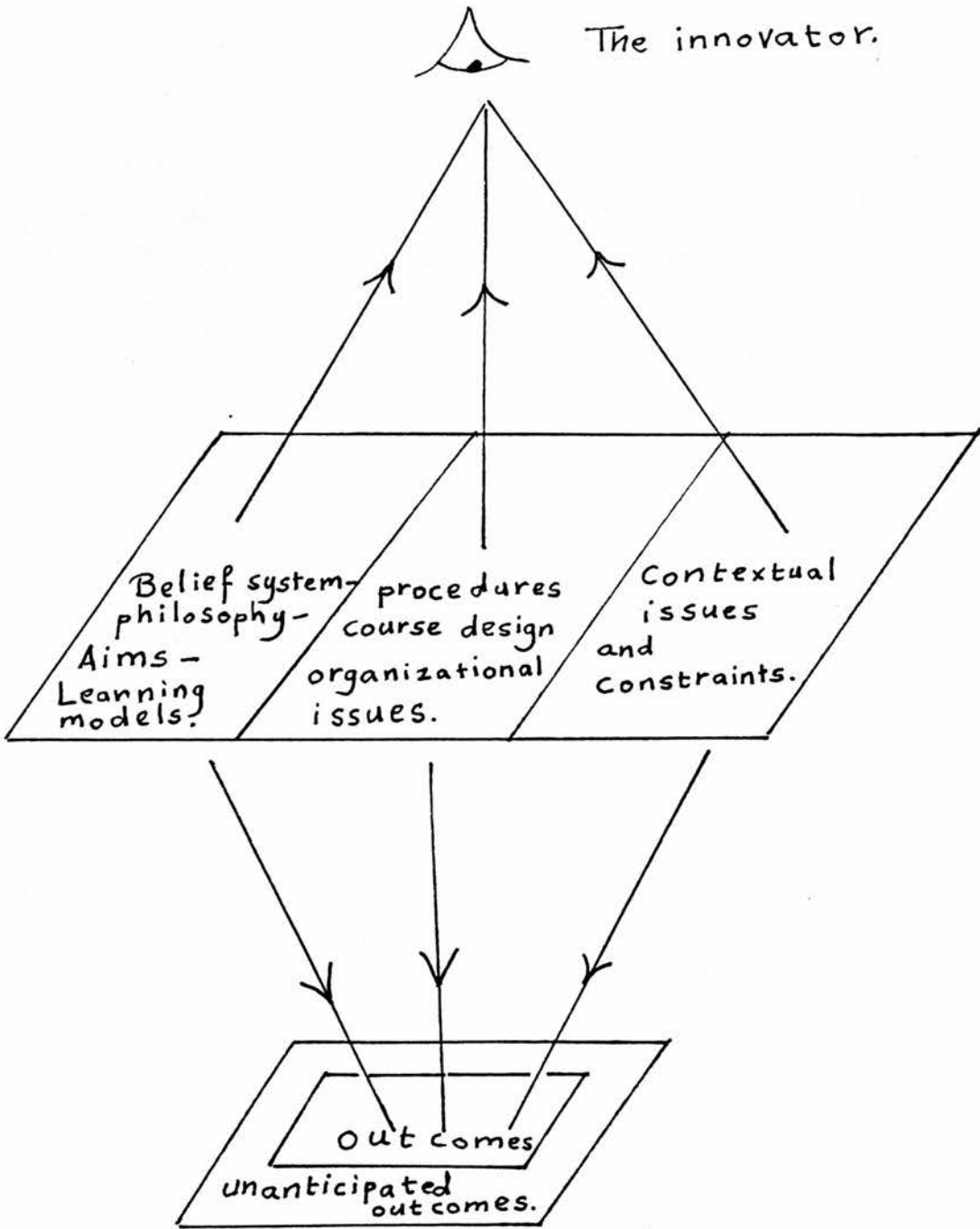
A translation of this point of view in concrete procedures in the third years 'Design of structures' will form the bulk of the analysis in this chapter. But, one would start by an examination of Dr. Curr's perception of a competent civil engineer to explore his underlying beliefs about engineering education as a basis for understanding the interventions he chose.

The characteristics of a good civil engineer

The researcher enquired from Dr. Curr, on two different occasions, what he thought were the characteristics of a good civil engineer.

Dr. Curr believed that both theory (basic science) and practice (practical experience) were taken to be necessary for the production of a competent engineer.

"An engineer is a man who reconciles theory and practice. He has to make decisions where he has to use a judgement based on incomplete knowledge"



(Figure 6:3)

The innovator's perceptions, an analytical framework

He went on to say that, "A good engineer is one who likes being competent". In response to the researcher's question, Dr. Curr defined this competence as being able to do those parts of the job which can be clearly defined. The engineer should be able to do that effectively and efficiently. He should be resourceful in new situations, responsible in coping particularly with the type of situation that he had not faced before, and in adverse situations. He saw a specific role for the university in this direction.

VI:(ii)(b): The role of the University, aims of civil engineering education and how achieved:

Dr. Curr thought that the University has a responsibility to supply basic academic training and to set that in the marriage of theory with practice.

His belief system encompassed three aims, these were:

- (a) To provide a 'blend' of basic knowledge and enrichment materials for student learning.
- (b) To improve effectiveness and efficiency of both teaching and learning in the Learning Unit, and
- (c) To evaluate results.

VI:(ii)(b) 1: The 'blend':

In his subject, Dr. Curr would try to provide a mix of open-ended activities where higher education objectives could be achieved together with highly structured basic information to satisfy the subject content objectives. His aim was that the student should have a 'balanced blend' of these ingredients.

"Because the end-product is only as good as what you feed into the sausage. I mean as good as the meat and bread that you put into the machine".

He also saw that the product is improved through the amount of development work he was putting into his courses and by

offering students 'options' he was producing a "much richer end product".

VI: (ii) (b) 2: The three E's:

Another aim mentioned in the first interview was that he wanted to improve the effectiveness (he seemed to mean cost-effectiveness) of the various individual processes in his work in the Learning Unit - like marking scripts and giving feedback to students. The main objective was to develop a way of teaching students as efficiently as possible. 3E's, effectiveness, efficiency and economy dominated his thinking at the time.

His search for an effective method of teaching to help students master the subject content led to the introduction of the pre-recorded instruction. For him, this meant a much more efficient use of student time and the learning resources available. He exposed another aspect of his belief of students' learning processes when he noted that at an elementary level and an intermediate level, in his subject, most students were inadequate thinkers. He thought that the only way to make them dissatisfied with their progress was by making them work against the clock. He thought that many students would be satisfied by doing a three-hour job in ten hours and that was terrible. He affirmed that a student must learn to get rid of the wooliness in his thinking and gave an example of his own style in doing things.

"I know that one of the wise things to do is to look for short cuts and to get oneself organized for a particular job".

He confirmed that these were things he wanted the students to learn as well as how to do 'influence lines' and 'bending moment diagrams'.

In May, Dr. Curr noted that some of his colleagues' approaches would be to lead the student gently in the first three or four weeks of the first year. He did not believe in that at all.

"I think that people normally have to ascend steps and then go along plateaux, in their progress. Now, whether the step is at the beginning or at the end is often relatively unimportant. And what I would do when a student comes to work for me is, I would like him to see the standard that we were looking for from the beginning... I would want him to realize he was going to have to work hard".

It may be helpful, here, to consider briefly, Dr. Curr's statements, in relation to the current conceptions of learning and to several other logical questions.

The concepts of learning can be characterised by two approaches: These are cognitive approaches to learning organised around concepts like 'meaning making', 'selective attention' and 'internal model making'. These concepts clash with the earlier emphasis on behavioural objectives, programmed instructional material and mastery testing by objectives tests.

Is the provision of pre-recorded instructional material a better and more efficient way of teaching the same thing?

Is learning from pre-recorded material a demanding medium of learning? Does it guarantee the student's engagement in active, monitored learning?

To consider these questions let us first consider what can be seen as a continuum of student learning experiences which runs from interaction with recorded material at one extreme to independent interaction learning at the other. Steps along this continuum can be described as follows. Firstly, a student may be required to recognise the information presented to him. Secondly, he may be required to recall the textual information in their verbatim or transformed verbatim forms. This interaction involves only a superficial engagement of the student with the material. Thirdly, the student may be called upon to reconstruct concepts or principles. Fourthly, the student in this type of interaction is involved in a prolonged activity and is directed towards 'getting a feel' of an idea, developing a sophisticated level of pattern-recognition or developing a sense of strategy. In this type of interaction the student is involved in such activities as

discovering principles behind simulations, developing a 'feel' for diagnostic strategies, problem-solving using classical techniques and the like.

Fifthly, the student works in an extremely 'open' field of inquiry. He is not working towards solutions within the known structure of the discipline. The knowledge he needs to acquire is, for much of the time, dispersed or 'raw' or without continuous text book structure. Largely - though not completely - it is his own choice as to what to look up; what to seek help with; what to include and exclude. The interface between knowledge and the learner is untidy; the opportunities for confusions, blind alleys and disappointments are legion. The student's progress is often slow, taxing, potentially frustrating but also, if successful, highly satisfying.

Now is it possible to locate any of these 'types' of student learning experiences in the Learning Unit along this continuum?

Answers to some of these questions will emerge when we examine students' perceptions of their experiences, but it is worthwhile to consider this continuum in relation to Dr. Curr's position when he embarked on evaluating his activities.

VI: (ii) (b) 3: Educational experimentation and evaluation of instructional activities:

In October (1973), Dr. Curr noted that 25% of the undergraduate teaching was presented to the students as pre-recorded instruction. He needed evidence of its effectiveness. He set out to obtain evidence, following the lines of engineering practice, he was familiar with from his own professional career.

In considering which line of innovation to follow, Dr. Curr indicated that: "tape-slide will be poorest, because it tends to press on relentlessly, and the student is reluctant to interrupt it, partly because the machine is doing that". He suspected that the audio-tutorial would be slowest, because there was no incentive for the student to be efficient in his

method of studying, he can double back and repeat to his heart's content, so although he will learn, thoroughly - but slowly. He expected the tape-overhead to be the most efficient, because the learning-time would be less and that, on the whole, the group would tend to learn about the same amount. Dr. Curr's immediate concern, as mentioned above, with the effectiveness and efficiency of the use of the pre-recorded material suggests a concern with mainly the communication of distilled or pre-packaged knowledge that would be presented in an orderly progression. None of the issues mentioned above seem to attract his attention.

The impact of this belief system and the procedures it generated on other parts of the course will become apparent as we examine the perspectives of the students and the other members of staff.

First, however, we need to focus attention on the third year course of "Design of Structural Elements", where a translation of this belief system into concrete procedures is analysed.

VI: (iii): The Third Year course of "Design of Structural Elements"

Dr. Curr perceived a number of problems for the third year class. In summary form these were:

- (1) Different rates of progress by students (the student-pacing problem or efficient use of time).
- (2) The lack of mastery of subject matter content which manifested itself in high failure rates and poor standard of drawing-office work (i.e. efficient use of learning resources).
- (3) Difficulties in worked examples classes due to wastage of constantly repeated introductions and supervisions (i.e. efficient use of time, material, and human resources), and finally:
- (4) Low contact between the teaching staff and individual students. In Dr. Curr's own words:

"I have always loathed the feeling that a number of students are all frantically waiting for me to come and help with their difficulties. It makes me rush every piece of personal tuition in a worked example class. I have also felt it wasteful to reflect that many explanations were given many times in an afternoon, generally less expertly at the beginning and the end of the period. Audio-tutorials seemed a good way to resolve both problems".

A central problem in educational innovation has been that of developing goal taxonomies to be used as devices for curriculum design. The role of evaluation would then be that of simple comparison between goals and outcomes. Bearing this in mind, one would discuss Dr. Curr's adopted methods to cope with the third year course problems. This discussion will highlight the following dimensions.

- (a) Rationale and origins of the change.
- (b) Teaching-Learning strategy.
- (c) Instructional decision making and prescription, organisational patterns and use of facilities.
- (d) Evaluation and outcomes.

VI: (iii) (a): Rationale and origins of the change

In the past, the third year 'Design of Structural Elements' course was largely the responsibility of a single member of the teaching staff. Although there was a course examination, there were no clear objectives. The content was decided by the department at the broadest level, the details being determined by the 'course teacher'. When Dr. Curr decided to plan an 'improved version', he had in mind all the different elements of the belief system mentioned above. He needed to develop a mechanism to translate these opinions, attitudes and beliefs into a social reality.

His interest in effectiveness and efficiency was a concern with predictability, reliability, accountability and control. Management by objectives and "socio-technical design" appeared to be a suitable method of achieving his aims.

in an interview with the researcher Dr. Curr recalled:

"In 1969, I went to lecture training school and 'met' objectives, and I came back and I tried to replan my courses based on objectives. Probably went overboard for it".

Concepts of 'mastery', 'pacing', 'educational technology', 'programmed learning' which were fashionable at the time concentrated his mind on a specific course of action. He went on to say:

"In another University Grants Committee Workshop held in May 1971, I met 'Strum and Ward' who were large frame-programming men from the United States. They put the idea in my head without specifically trying to redirect me, that the bits of the British engineering system that they were most critical of were the drawing office and the tutorial. The more I thought about it the more convinced I was that that was correct".

The audio-tutorial approach was discussed in that meeting and although he read Postlethwait's book, he decided that it was not possible to do it in Kinondoni Building.

The move to Kurasini Building with its small rooms made it possible for him to try tape-slide sequences for remedial teaching. Dr. Curr's first priority was to arrive at a list of objectives for the course and to plan a new 'improved' version. The curriculum objectives were expressed in behavioural terms delineating precisely the substance of the educational programme, the skills and knowledge to be learned.

In course documentations [Appendix 6.1+2] Dr. Curr pointed to the students the advantages of these objective lists and his expectations of how students would use them.

VI: (iii) (b): Teaching-Learning Strategy:

Dr. Curr divided the subject matter into units (packages) and sequential development was carefully planned. He had a very tight control on the definition of content and the manner of learning [Appendix (6.2)] Dr. Curr was convinced that the communication of information is made more effective by

the use of structural resource material. The focus on 'structure' as a metaphor lies with the solid and (apparently) permanent buildings in our cities. The steel frame of every new office block reaffirms that 'structures' are unyielding and designed to last. The emphasis then is on foundation details (basic knowledge) which must be learned effectively, so that developmental analysis and synthesis can subsequently evolve. This initial teacher-communication of basic information would be followed by conscious consolidation and active reinforcement. Dr. Curr emphasised this sentiment when he noted that the basics must be taught:

"or even in certain circumstances being spoon-fed. Because spoon-feeding could be remedial. It could cover a mistake. Teaching would be efficient because it would save time for more worthwhile activities".

The 'tool kit' for this engineering knowledge was arrived at through a specific instructional strategy which was based on the use of combination of methods, media and organizations. The new format of the third year subject consisted of: Firstly: two live lectures, one hour each at the Hammond Street building given usually by Dr. Curr. The lectures content was organised for the students by:

(a) statement of the lecture objectives [Appendix (6.2)] and a handout with main points printed on it.
(b) A summary tape and a summary sheet which were a brief and condensed resume of the main teaching points of the lectures. Both (a) and (b) were prepared by the lecturer. A follow-up to the lecture to consolidate the learning was a sheet of tutorial problems to be tackled after the instruction was completed. For these tutorial problems the student had available to him a solution sheet and a detailed solution tape which contained complete worked solutions to tutorial questions.

In session 1975-76 a new version of the 'solution' recorded tape was introduced under the name of 'guided tutorial' and had been described as 'hints on how to tackle tutorial questions'. Secondly: five hours, on average, of activities at Kurasini Building on Thursdays (details of students time-table, the

time-table for the whole session are shown in [Appendix (6:3+4)]. These activities included (a) working in the booths in the learning laboratory with audio-tutorials. (b) Drawing office design exercises, Dr. Curr following programmed-learning principles, split the drawing office exercises into shorter exercises. The initial instructions for these exercises were presented in the standard 'Kurasini format' via tape-overhead transparencies sequences to a small number of students.

His belief in consolidation of learning immediately after initial instruction came to light when he commented on the sequence of events leading to the drawing-office design exercise by saying:

"We have followed the basic principles of elementary programmed learning, in the sense that the student has learnt something and he has then consolidated that learning by doing it himself ... and hopefully by understanding or remembering what he's doing".

Teaching laboratories were part of these activities. Thirdly: A number of open-ended or 'enrichment' activities were included in the syllabus 'to cover aspects which are difficult to cater for in conventional teaching practice. Gaming is used to develop an appreciation of the behaviour of trussed structures; a simulation is played out to demonstrate the interaction of responsibilities in a construction contract'. (R.A.20, p.338).

In session 1974-75 the enrichment material included three tape-slides sequences 'Production of Concrete', 'Distribution of Concrete' and 'Form Work'.

Two reports were to be submitted. The first was prepared after attending one of the winter series of meetings organised by the local branch of the Institution of Civil Engineers. The second report was on crack width criterion selection that was described as a 'one-hour group activity with no preparation required'.

The pre-recording of instructions was meant to free the lecturers from live teaching duties and hopefully increase their contact with the students.

Fourthly, a new system of assessment was introduced. This was known as 'the package test'. (See course regulations [Appendix 6.5]).

Dr. Curr perceived this 'blend' of instructional activities as a suitable means of achieving a distant aim - the production of an efficient and competent civil engineer. The main objective was to develop a way of teaching students as efficiently as possible. The improvement of teaching efficiency became his main '*raison d'etre*'.

A much clearer picture of the Learning Unit practices from the teaching staff perspective will emerge when we examine further:

VI: (iii) (c): The instructional decision making and prescriptions, organizational pattern and use of facilities:

A history-less, near-autonomous, innovative organisation like the Learning Unit faces immediately a continuous series of decisions concerning 'problems of the moment'. In this area Dr. Curr was firmly in control. He served as instructional designer. He wrote the lectures, course documents, lecture objectives, tutorial problem sheets and solutions. He also recorded audio-tape for detailed solutions and guided tutorial tapes. He prepared introductions for the drawing office exercises and some of the introductory material for the 'enrichment activities'.

Two lecturers and two postgraduate students were available to answer questions in the learning laboratory in what was known as a 'mop-up', and for drawing-office supervision.

Mrs. Williams, the organiser, made sure that the tapes and hard-ware and the handouts were in place when and where they were needed by students and the teaching staff. She also acted as a 'feedback' channel for Dr. Curr.

The Learning Unit staff had been recruited by Dr. Curr by what could be termed "selective recruiting". The criteria for selection could be ambiguous, since the nature of the roles

are not clear. In his first interview with the researcher Dr. Curr identified two types of activity for the teaching staff; those who produce material and those who use these materials. A third group would be "those who are interested in open-ended activities". Dr. Curr noted:

"I like to pick a research student with the right kind of personality and give him real authority".

He briefs him - suggests ways of using the material - then keeps out of the way, unless anything goes wrong.

"It all goes well, provided you pick the right man".

The selective recruiting, indoctrination and the sharing of key experiences were seen by Dr. Curr as important elements in creating a unified group and that would give the Learning Unit a special identity.

The Learning Unit being housed at the 'Kurasini Building' away from the main department gave it the status of a 'protected subculture'. Dr. Curr was free of many organizational constraints. He was able to set his goals and almost all of its procedures.

The success of the enterprise, in the eyes of the participants and the significant others became the *sine qua non*.

Hard work and 'work beyond the call of duty' became the participants' top priority.

Dr. Curr (October, 1973) recalled that the people in the Learning Unit were very loyal to him. Everybody in the Unit worked hard. Everybody in the Unit had to get used to working hard. Not that he asked them to. They were keen. Mrs. Williams is 'fantastic'. She did not really work part-time. He did not know why.

Loyalty is an important dimension for the creation of a new organization, but limited resources, new goals, new roles to be defined, lack of teaching experience, new organizational patterns such as working in a team, unclear authority structure, more extended activities including outside presentations

all present the innovator with heavy demands for resources and time. Dr. Curr rejected any aspect of bureaucracy and emphasised egalitarianism. He felt that he and his group were working for a higher purpose, a performance beyond the requirement of ordinary duty.

In October, 1973, Dr. Curr noted that the Unit was not organized like a normal University department. The fact that he was senior lecturer only meant that he got paid more. He added that Mrs. Williams was really a technician. They operated on a 'commune' basis. Everything had somebody in charge of it who ran it in his own way. He noted that he was surprised that outsiders thought he was in charge. He said that there was a different responsibility structure in every activity, because they existed informally, without official recognition or financial backing.

The researcher would disagree with this claim of 'egalitarianism', since the course has been presented to both course tutors and students as almost totally defined. The discussion about the innovation was almost entirely concerned with the process of getting the co-operation and backing of the tutors and the authority and nothing else.

In terms of class organization Dr. Curr noted that for the second and third years, the class was divided into eight groups. They could cope with 96 students, but only 70 were admitted to the course at that time. So they had only six groups in the third year. Terms were ten weeks, but one was for getting warmed up and one for examinations. He found the 8 week/eight group base handy, if the order of taking materials was flexible they could take them in different weeks. Some materials were sequential, others not.

Dr. Curr emphasized that the Learning Unit situation was not free and easy. He thought of himself as a disciplinarian - did not like people talking in his lectures, would not mark papers handed in five minutes late. But he operated by the same rules himself - he would get marked work back to the students promptly so they get feedback. The extent and nature of the students' learning experiences can be seen in terms of pace of learning and requirements for mastery.

VI: (iii) (c) 1: Student Pacing

Ideally, in a personalised system of instruction format, students can adjust their pace according to their needs, abilities and outside demands.

However, the Learning Unit programme for the third year had a fixed duration for the following activities:

- (1) The live lectures.
- (2) The audio-tutorials: if used in the Learning Laboratory these were usually time-tabled for an hour.
- (3) The group tape/overhead introductions for the drawing-office exercise.
- (4) The drawing-office exercise.
- (5) The package tests.

Dr. Curr justified these practices in terms of achieving greater efficiency. "In my experience, the only way to make students more efficient is to make them work against the clock, particularly in the drawing-office. They complain bitterly, and then after about six or eight weeks their efficiency improves, not because they are working hard, but because they are working more purposefully".

Mr. Tyler (June 1974) who supervised the drawing-office exercises for the subject, noted that it was better to keep the students working against the clock provided you briefed them well. A lot of the students in the first group for the drawing exercise wasted 45 minutes, then worked non-stop for the remaining one and a quarter hours. They just sat and chatted about it. They felt they had plenty of time. One week when he forced them on to it, he said "By ten minutes past the hour you should have the outline drawn and you should be starting to fill in the column spacings". They had completed the drawings that time. But, he affirmed, they must have the information at the beginning. They tended to get into quite difficult situations. They got confused and ended up getting irritated and the class tended to rebel. But provided that they had all the relevant information there was a lot to be said for chasing them as far as time was concerned.

Mr. Tyler would not say that students were 'over-worked' in the Learning Unit. There was no more work than there used to be. In the past, they would go home and spend three or four times as long on an exercise as they did in the drawing-office. When he, as an undergraduate, got drawings, he spent a lot of time on them at home, a staggering number of hours if you totted it up. Now they were making the students work fast and that was it over in the day. They did not have to go home and spend three nights on it. So they were not overworked in 'Design'.

On the same point, Dr. Curr's views were that students were tired at the end of the day because they were 'inefficient'.

Another aspect of students' experience, i.e. the mastery of course content attracted the attention of Dr. Curr prescriptions as shown in the following section.

VI: (iii) (c) 2: The Mastery Requirements:

The mastery requirement is perhaps the most distinctive feature which University teachers take to identify the superiority of new teaching methods over more traditional ones. In the Learning Unit the course regulations indicated that students must satisfactorily complete the work of the course which consisted of the following components:

- (a) Drawing-office exercises.
- (b) Five package tests or a degree examination.
- (c) Submission of two reports, and finally,
- (d) Study of a small amount of 'enrichment material'.

It is important to note that a 'satisfactory completion' of these elements requires not only correct written solutions to the numerical problems but also the ability to demonstrate 'complete understanding' and not merely rote or algebraic understanding of the material. The Learning Unit knowledge was presented in a formal, tidy and sequentially coherent way designed to facilitate rapid mastery of fact, concept or technique.

The drawing-office exercises were perceived by the teaching staff as the milieu in which the components of engineering education were fused. They provided the combination of 'theory' and 'practice' of 'science' and 'practical experience' which were together taken to be necessary for the production of a competent practitioner.

Dr. Curr, appealing to his pre-teaching practical experience as a site engineer and design engineer, concluded (May 1975) that he did not believe in independence in pace in the drawing-office, hence the time limitations. He thought that there was a major difference between his and the average University approach with regard to the 'Design Exercise'.

"The average University approach is to convince the students to design (e.g. a footbridge) so that it is safe, in conformance with the codes of practice, to draw it so that it is an accurate drawing of the item and to produce a nice neat drawing. Now, I am not concerned with that. For my money that drawing is a communications of information", and concluded by saying "What we must try and do is, we must seek a drawing which meets the customer's requirements as well as mine as much as possible".

The question of how neat and complete the drawing-office design exercises need be was commented upon by Mr. Tyler, drawing-office supervisor (June 1974). He said that the best drawings from the students were without a doubt those which were virtually complete. They were produced by those people who had been working. They were neat, tidy and precise. And the people who had been taking their time, going around chatting, produced drawings with no sort of coherence or proper draughtsmanship. One cannot help but feel that there was a difference in emphasis between the tutor and the instructor in this particular instance.

VI:(iii)(c) 3: The Package Tests:

Students mastery of subject content was tested regularly through the package test. Dr. Curr (1975) stated that:

"One of the most challenging tasks facing the educationalist is the demand to develop a pattern of examination which will assess accurately and appropriately the knowledge, skills and professional attitudes which are described by the course objectives ...

The writer employed continuous assessment, an optional 'package test' system in which the student presents himself for testing every five weeks, and a general switch to open-book conditions of examining which has been found elsewhere to reduce pre-test memorisation and anxiety during examination without otherwise affecting academic performance". (R.A.12 pp.361-362)

An example of the package test is shown in [Appendix 6 (7)].

The time allowed for the first four package tests is usually one hour with a 15 minute allowance for reading time. The fifth package test lasts four hours. In defence of this practice Dr. Curr (May 1976) stated: "The point is that I am using the package tests to try and make a point which I very fervently believe in. That is, that I believe that inefficient thinkers, in an engineering context, first of all are unemployable and secondly, if it takes you four pages to do what it takes me one page to do, then you're likely to have four times the mistakes that I have, even in terms of simple mistakes. Probably more because you are probably getting tired".

Comparing the degree examination with the package test system, Dr. Curr (December 1975) contended "In the degree examination system, it is possible to miss out large chunks of the syllabus in your coverage. You can't afford that in the package test system".

"In the degree examination, very often students are not starting to cram the knowledge in until three or four months after they took the instruction. And their initial grasp of it, which admittedly they're going to forget and lose, is inevitably, I think, going to be weaker than an initial grasp that comes when you consolidate it at the time".

Another important advantage of the package tests, as perceived by Dr. Curr was that they gave students feedback and: "The second most valuable thing about them is that it

gives them an incentive to work, and therefore they do work steadily through the year".

Feedback in form of 'comments' and analysis of results were a common feature after the package tests.

The recent research on student learning shows how university teachers play an important part in forming students' perceptions of what is required and what is important in any course, and it is this as much as their style of presenting the subject matter which influences what and how their students learn. One source, amongst others, of this information (i.e. requirements and importance) could be gleaned from the course documentations and the written feedbacks.

In a letter addressed to students which prefaced the course documentations Dr. Curr stated emphasising the 'blend' notion:

"DO NOT regard the objective lists as the equivalent of a complete syllabus. There are other activities in the course, such as tape/slide sequences and drawing offices. Each of these should also contribute something to your overall design ability and experience. And you will also be consolidating your knowledge and experience, leaving you able to cope with more complex problems. So in the tests and exams you may well be asked questions which demand more of you than the separate skills and abilities described on this list. i.e. Lecture objectives".

[Appendix 6-1]

An insight of the nature of questions in the package tests emerged from 'comments' on package tests; December 1974 when Dr. Curr mentioned:

"In all honesty I cannot fault the paper; it was straightforward, simple and elementary. Admittedly the bias to descriptive questions was strong, but many of these were taken directly from tutorials or from class work exercises. There was one completely 'surprise' question (3c), but it was only worth 2 marks: otherwise not even a trick question disturbed the pattern. Either the teaching, the pre-knowledge, the studying effort, or the marking or a combination of these - must have been at fault. I am still not clear in my own mind which I should blame".

[Appendix 6-6]

Several points in these comments enable us to identify certain policies of the Learning Unit teaching staff.

First, marking has always been adjusted in relation to the number of attempted questions in the paper.

Dr. Curr stated in the same 'comments':

"The average 'non-attempted' marks total for the first 20 students was 6 marks. The paper was therefore taken out of a possible total of 94, and the top student scored 80%".

One also identifies a clear emphasis on the differences between the learning expected in different subject areas, i.e. descriptive and numerical learning tasks. This hint will be discussed further when the researcher examines students perceptions in Chapter 7. Students were encouraged to give brief answers and were always reminded of the distribution of marks. In the 'comments' of Package Test (3) February 1976, Dr. Curr stated:

"The average mark was about 47% and the distribution of marks was as follows:

under 30%	10
30-34%	7
35-39%	3
40-54%	22
55-59%	5
60-74%	9
75% and above	4

With the exception of the number gaining less than 40%, the distribution seems more reasonable than in the pervious tests.

Of the 22 students previously having an average of less than 40%, 9 passed in this test, 5 having marks of over 50%, bearing in mind the understandable variability of a 1-hour paper, and the generally favourable effect of drawing marks, the prospects for a negligible entry to the June examination are much more promising than in December".

[Appendix 6-8]

The last sentence in these comments served as a constant reminder of the stick 'the June examination' as opposed to

the carrot of the 'package tests'. It is worth noting from the figures provided that 70% of the students obtained less than 54% of the total marks. Students' use of the pre-recorded material occupied part of Dr. Curr's attention. The feedback was a two-way phenomenon, for Dr. Curr saw it as part of his need for empirical validation and optimisation of course organization, content, strategies and media to suit his original plan. In the following section one would examine :

VI: (iii) (d): The innovations, evaluation and outcomes:

Every educational activity has an outcome, but the problem for educators is how to appraise the relationship between educational activities and their intended outcomes.

The educational researchers who espoused the quantitative methods implied reductionism and the use of formal or mechanical models which embody assumptions about chains of causality. Dr. Curr tried to explain students' behaviour from the outside as a detached observer. He liked to find out how long it took them to settle into a pattern of work. He noted that the third year students seemed not to settle until the second package test. Dr. Curr (January 1974) reported that:

"It takes two 'feedbacks' from tests or exams before a class settle into the new study methods required".

He employed Mrs. Williams to find out the pattern of use of the pre-recorded tapes when she commented that students did not really settle to a proper pattern for the first term. It took them another half-term to settle down. Then she found that the marks of the ones who were taking summary tapes before or instead of detailed tapes had, surprisingly, gone up. She was trying to pick out how many people were using the tapes just once, or not at all, or irregularly, etc.

She noted that the detailed tapes were the ones that were taken most. The summary was a consolidation of the material so if they wanted to recap on it, they could take a summary.

"But everybody at the beginning takes 'detailed' and then one or two start to use summary, then more and more people use it, then it falls off at the end of the second term, where you find people using summary in preference to detailed or with detailed, whereas they did not touch it in first term".

The interaction of students with the learning material will be better understood when we get to know their perspectives in Chapter 7. Dr. Curr tried to relate students' use of pre-recorded material to some of their psychological features. He has been giving a 'use of objects' test to undergraduates for a number of years to identify the divergers and convergers. He found impressionistically, that divergers liked a different style of tutorial instruction from "the average engineering student". The divergers wanted short answers, wanted to set the pace, to ask questions in an order that seemed illogical, went away satisfied when the teacher was trying to summarise the ground covered. That left the normal lecturer feeling dissatisfied. 'Diverger' students did better when they were invited to interrupt.

Convergers tended to come to you with the wrong difficulty. The teaching material was in a linked chain, and they failed to identify the step which was causing trouble.

In his search for a 'pattern' of use of the pre-recorded material, Dr. Curr tried to relate the converger/diverger dimension, as defined by him, to the use of summary/detailed tapes and the student obtaining a high or low marks in the package tests.

Dr. Curr's interest in the effectiveness of the pre-recorded material and its effect on student learning reflects the wide spread belief among innovators that the only way to get valid information about the quality of curricular material is to try it out, in some more or less organised way, on the students they were meant for. This proposition has seemed so self-evident that it has almost never been questioned. Here quality was redefined as 'effectiveness' and effectiveness was reduced to the achievement of pre-set objectives as the following discussion entails.

The researcher asked Dr. Curr to comment on the outcome of this innovation in May, 1976, and October, 1973. A summary of these follows. In October, 1973, Dr. Curr concluded that:

1. 'Students say that they prefer the new instructional approach.
2. The failure rate has been cut.
3. The lecturer's attitude towards the new approach is that it is a better way for him to teach his subject.'

In January, 1974, Dr. Curr, in a major statement to a national body (R.A. 7 , p.13) noted the following improvements:

1. 'Dramatic improvement in drawing-office work.
2. Enormous reduction in routine tutorial problems.
3. Reduced staffing requirements.
4. Opportunities for enrichment work with more advanced students'.

He cautioned that none of his team was qualified to assemble educational evidence but they had data to support their beliefs that:

- I. 'Failure rates have been reduced.
- II. Group-paced instruction is quicker, for the same learning, than individually paced instruction.
- III. Audio-tutorial learning is quicker than learning from a programmed text.
- IV. Individual differences in learning vary with the method and media.
- V. It takes two 'feedbacks' from tests or examinations before a class settle into the new study method required.'

He identified what he termed "unanticipated outcomes". "I thought that we would have problems from splitting our learning tasks into sections, and structuring the learning. But subsequent performance on open-ended work seems to have improved considerably". Comparing students' performances, he noted that 'second-class' groups scored lower marks relative

to the 'firsts', than might be expected, although the firsts were admittedly higher than before.

In the same document, Dr. Curr (January 1974) noted that they still had other grounds for concern or dissatisfaction. In summary form, these were cost-effectiveness, comparative studies of group and individually paced learning and "the cost-effectiveness of 'professional standard' visuals". The second area of concern was, "The need, if any, to offer media/learning paths to suit the individual and the problem of advising the individual how to make this choice". Thirdly, the need to ensure student independence in learning from structured materials.

In May 1976, Dr. Curr focussed on three areas where he felt the advantages were most evident.

Firstly, better performance in the drawing-office exercises and quality of work when he noted that the change to the new system began to pay off "hand over fist". Secondly, they increased the amount of pre-recorded material and that meant more options for students. Thirdly, in the early days they had catered for differences in learning pace of their students, but at the time of the interview they were more aware of other differences in the student population.

Other members of the Learning Unit staff added their views in judging the Learning Unit outcomes.

Mr. Hopkins (February 1974) thought that students did like the 'Kurasini' method better. He knew because some of them said so. Presumably the ones who did not like it did not tell him, so some of them might not have liked it. He advanced the use of the 'programmed learning method' as the reason for this. He noted that we all like to be led. It is easier that way - not attractive to be faced with a set of amorphous notes and a few questions in an examination at the end. The definite programme to follow must be one of the attractions, but the students had not said so in so many words. They had academic objectives and they had exercises to complete and laboratories to do. "It is a programme in which they can see and feel they're progressing".

Mr. Goodman (December 1974), a demonstrator, noted that most of the tapes were very explicit and that the tedious part

was taken out. Lecture notes were handed to the students so that they could be elaborated on, and they did not waste time writing. Instead, someone was telling them useful information. If they wanted to add details to the handouts, it all added to the knowledge.

Mr. Tyler (June 1974) concluded that the Learning Unit provided the student with better information and with more information. These were the two services it provided, and went on to say: "We're molly-coddling students upstairs, to a certain extent". Some of the information that he had to look for as a student was given, but some of the information now is information that his class had not looked out at the time. The design course for him was simply not as comprehensive.

Another feature which facilitated the Learning Unit's operation was the small-group feature.

Mr. Goodman (a demonstrator) noted that the class is split into nice handy-sized groups, which is what teachers have wanted to have for years - small classes, better attention. This way you could do it. There were groups in various places and two or three members of the staff could be devoting their attention to individuals especially if the maximum size of the group was ten or twelve. His own experience, as a student in the Learning Unit, had been that after two or three weeks in the group he got to know everyone else and he never felt shy or frightened to ask any questions. He was not afraid to ask a stupid question in the drawing-office tape-overhead introductions, even if people laughed. They were his friends anyway.

The picture presented by the drawing-office supervisors is revealing. The relationship between student culture and staff members perspectives was seen as complementary. The two were portrayed as mutually re-inforcing. The demonstrators treated students as 'junior colleagues'.

Mr. Hunt (February 1974) described the Learning Unit's atmosphere as being very friendly, more like the atmosphere of a drawing-office where you were in a section and you would go up and ask the section leader if you had problems. He

confirmed that students helped each other as well. They discussed the problem with each other, which he likened to the situation on site or in the contractor's office.

Mr. Tyler, commenting on students' motivation, contrasted his days as a student with the Learning Unit situation by saying that the only carrot in his day was the degree at the end of the course. You carried on regardless, because you wanted to be a civil engineer, but it was like a mill, the lecturers came in, talked for an hour and disappeared until the next week. He concluded that the enthusiasm from the teaching staff at 'Kurasini Building' helped to motivate students.

One of his duties in the 'Kurasini Building' was to supervise the teaching laboratories. He noted that he would have liked to do a lot more in the laboratory but there were practical difficulties. These difficulties involved preparation and technicians' time as well as lack of space. He thought that it was a good system to have research, projects and practicals in the same place, and some times at the same time. But the planning had to be quite precise. It was very worthwhile, even for first and second years to see, for example, a concrete beam behaving semi-elastically. He thought that was a lot better than a description in a lecture.

Other aspects of the Learning Unit outcomes can be traced to a number of the following features. In summary form these are the visibility of the Learning Unit in the City University and its surrounding environment. This led to the increase of the frequency of visitors and through the wide publicity it acquired public recognition. Award winning generalized staff excitement which in turn produces job opportunities for staff, recruitment of new personnel, and finally the diffusion of the innovative ideas of 'pre-recorded learning'.

The researchers' frame work (figure 6 :3) comprised of an examination of a filter of three dimensions, the belief system, the course design and organizational issues and the contextual issues and constraints. The analysis that follows completes the circle when Dr. Curr identifies issues and constraints in the context of the Learning Unit environment.

VI: (iv): The Learning Unit and its Environment:
An alternative conceptualization:

Innovators, in the past, have paid far more attention to the individual student in his learning situation than to how the technology affects social structure and how it might be integrated into the organizational framework of departments or university.

It has to be realized - although it rarely is - that methods of instruction cannot be considered in isolation. They are intrinsic to particular forms of social organization and are linked to long-established systems of mutual expectations, professional rules of thumb, and implicit patterns of social interaction.

It follows that a change in the scheme of instruction will cause ripples, if not waves, that have effects far beyond those the educational technologist may have envisaged.

In the following section the Learning Unit environment will be examined from the point of view of Dr. Curr, this examination will be contrasted later with other members of the teaching staff outside the Learning Unit as they identify their perspectives in Chapter 8.

Dr. Curr (January 1974) indicated that the department was run by Professor Young and had a departmental staff committee which, by ordinance, must meet at least once a term. This committee had no power to promote educational development. Subject courses, he added, were organized by the lecturer or lecturers concerned, who were responsible only to the head of department.

Innovations were frequently, but not always, discussed in the departmental committee, and the initiative towards integration of courses generally came from the Professor. The potent force of the Professor guaranteed plain sailing in troubled waters in the history of the Learning Unit. Dr. Curr (January 1974) recalled that there had been no formal proposals, but the Professor saw the draft of the detailed scheme and approved it in principle. Subsequent steps were discussed with him, and modification or approval given verbally. Dr.

Curr (May 1976) thought that it would be fair to say that he had had no positive encouragement whatsoever from the City University administration. He had never had any money from them and recalled examples of visits to the Unit when the educational development sub-committee was invited to the Unit and they showed little interest. He concluded by saying: "I think probably apathy is the most effective word to describe my relations with the administration. Its the most honest one really. And as a result of their apathy, I've become upset on occasions, and when I've become upset then sometimes they have sparked back. So probably when I've crossed swords with the administration its because their apathy had upset me, and perhaps they don't even understand, that, that might be something there would upset someone. And that just about sums it up".

Smith (1971) identified several variables which are useful in the analysis of the Learning Unit's environment. These are:

- (a) Complexity: this dimension extends from heterogeneous (high complexity) to homogeneous (low complexity).

A highly complex environment probably entails the development of multiple goals, multiple activities and multiple faces and facades.

Dr. Curr, as leader of the Learning Unit, had to allocate resources and time for the large number of presentations, workshops and national and international meetings he attended and in which he read papers and gave presentations.

Dr. Curr (May 1975) justified these activities in the following terms: "The public lectures have a number of functions ... First of all, its good for us to be invited to things that matter". Secondly, "Its stimulating for the people who go, in the sense that you meet interesting people who ask worthwhile questions". He added, "I believe its worthwhile occasionally for the people who are in the Unit to see that we can do something that's quite good. That's why I try and put as much effort as I do into some of the paper presentations, although if you look at it carefully you'll see that in fact we put a lot of effort into some, and for others we shuffle stuff about, or don't put the same effort in".

"Now, its important for the people in the Unit to realise that when we try to do something well, there's not many people in the ordinary educational conference who are producing a much better presentation than we do. I think a lot of them produce papers where the content is much more worthwhile, but we're in the business of presentation". He concluded that this was good for the morale of his team.

Thirdly, "It is a lot easier to get money to go for a conference if you've got a paper in".

Fourthly, "Its a very good experience to have to write something up because it highlights the things that you don't know, the omissions, the weaknesses in your argument and so on".

Fifthly, he felt that, on occasions, he was able to push points of view that other people in the conferences had not expressed and that might have had an effect.

(b) Supportive-non supportive environment

i.e. (Supportive-Neutral-Hostile)

The supportive-non supportive variable interacts with other dimensions. Within the University some parts of the environment were strongly supportive while other parts were less supportive. Dr. Curr (January 1974) noted that within the teaching staff in the civil engineering department one can identify two groups. Those involved in the Unit were enthusiastic, very hard working and had a striking loyalty to the venture as a team effort. Those outside the Unit had varying reactions.

The Professor supported any well-thought out scheme, and discussed its viability only after a pilot scheme was run. He was consistently sympathetic to requests for equipment, unusual time-tabling or variations in subject content.

"The other members of staff have mellowed somewhat since the publication of a paper describing the Unit in a professional journal. But at the warmest reaction is still a benevolent neutrality, although this is a marked improvement after the petty criticisms, obstructiveness and subversive opposition

which we encountered in the early days".

He added, "Two factors would explain this (very human) opposition: the feeling that a desire to change teaching methods implies a criticism of conventional methods used by others, and reaction from students asking, 'Why don't you use audio-tutorials as well?'"

He wondered if they had not (fortunately) been 'exiled' to a distant annexe, they would have had sufficient enthusiasm to survive the initial backlash. The Learning Unit students, noted Dr. Curr, were very supportive and their reaction was very favourable.

(c) Stability: stable-transitional-dynamic.

In January 1974, Dr. Curr indicated that the department would move to the new campus at Doha in 1976. He expected the Learning Laboratory to continue in a modified form, but he could not hope that the remainder of the experiment would survive, due to the small number of allies he had, unsuitable accommodation and acute competition for restricted facilities. He thought that such a reverse would likely lead to loss of staff.

In December 1975, Dr. Curr indicated, in anticipation of the move to the new campus, that he had remade almost all his basic tapes. By the time of Easter, 1976, "I will have remade virtually all the material that stands against my name in a better quality and with more options". He added, "I want my material in such a form that ... no matter how they muck me about at Doha ... I can run. In other words, I want to be in a little water-tight compartment, so that no matter how I get pushed about, ... I don't face disaster".

The Learning Unit's new environment displayed a number of changes in staffing and physical location and that had major impacts on its operation.

In short, one may argue that the Learning Unit as a new type of organization involves new roles, new social relationships with new types of rewards and sanctions. The multi-faceted environment and the need to establish new types of linkages with the environment of the University administration,

the members of the teaching staff outside the Unit, the students and the professional world outside the University meant a high cost in time, worry, conflict and temporary inefficiency.

Chapter Six

An analysis and summary:

Instructional designers and teachers use various means to help students achieve specific objectives. These means include the provision of instructional material through which the learners can interact in appropriate ways. Such interaction involves the processing of information so that key elements of the material may be encoded, stored in the memory and retrieved. If the materials are indeed appropriate, the result is successful learning and retention of information in such a way as to facilitate acquisition of permanent capabilities that may be exhibited as new performances.

Some students achieve the desired instructional objectives when given only reading material; others may require a detailed list of behavioural or performance objectives or other cues to guide their study efforts. Still other students may benefit from various study aids that help them to identify and attend to the most relevant items of information, to interact with such information to encode it for future retrieval and to practice retrieval in forms comparable to the performance expected in later recall or transfer situations. Thus, student/learning material interaction is an important issue in the design of innovative programmes. In Chapter 2, a detailed discussion of a hierarchy of curricula moving towards individualisation led to a model of individualized curriculum and instruction (Fig.2.3).

In this chapter the researcher developed a continuum of student learning experiences when using the pre-recorded material, this runs from passive interaction with the pre-recorded material at one extreme to independent interactive learning at the other. Details of this continuum are summarized in the chapter in form of a series of questions. Elements of these experiences have been displayed in student learning in different degrees and emphasis in the case study under examination. i.e. the third year course of "The Design of Structural Elements".

In this chapter the focus is on the conceptual model of

the Learning Unit and its context. The Learning Unit as a dynamic entity brings to mind the oriental fascination of boxes within boxes, each box trying to shape the next smaller one. Or the idea of systems within systems mixed within vision of tangled webs rather than orderly, concentric patterns. The Learning Unit story policy was generated over time where Dr. Curr's own personality and agenda interacted with earlier policies. His belief system has multiple origins. As an engineer he persisted in the belief that choices should be made on rational thought processes with 'Management by objectives' and 'military training' models dominating the scene. The factory and its products have been taken as a rational model of the processes of higher education. Development through feedback was much prized. Here the objectives to be reached and the tasks to be performed were taken largely as given and the organization was regarded primarily as an allocation problem. Dr. Curr controlled all aspects of the students' learning experience. He ignored the conflict between the much prized values of a society where independence, leadership, long-time perspective etc., were highly valued and yet placed the students in an organization in which they were required to be simple-minded, passive, dependent and have a short time perspective.

The students' experiences in the University has been teased apart - what was intellectual and what was not intellectual, what was cognitive (subject content aims) and everything else (higher education aims, practices of the civil engineering profession, skills and attitudes etc.) were separated. These two would add up or multiply together to produce the better performance of a fully-functioning civil engineer. The reader is reminded of the notion of high quality meat and bread to produce a better sausage. The search was for the most efficient method to master clearly pre-ordained objectives. The subject matter and the drawing-office exercises were divided into shorter parts or exercises. The live lectures were organized for the student by the teacher by providing him with a statement of the lecture objectives, a summary tape and a summary sheet which were brief and condensed resumes of

the main teaching points of the lectures. The tutorial problems were 'worked out' in great detail by the teachers in what was known as 'detailed audio-tutorials'. These tapes were available (summary and detailed) for borrowing and taking home. In this resource-based unit at that time Dr. Curr ignored the enormous individual variations between different learners, he catered for the rate (freedom of pace) and place of learning but did not pay much attention to the previous general and specific experience variation in interests, in curiosity level, in self assurance, in the degree to which the individual takes intellectual risks, in his ability to maintain concentration and in his need for personal contact. Such individual differences are complicated, and their effects on learning and on intellectual and personal development are still little understood. But they are issues of which many teachers - if only intuitively - are often acutely aware.

It is also disquieting to realize how overwhelmingly educational technology in the Learning Unit so far has concentrated on formalized factual instruction, and to realize too how the nineteenth century 'mental drill' of question/answer/feedback framework was so widely employed.

One reason one could suggest is that many innovators easily slip into a way of thinking of their course as something akin to a 'treatment', which can be given to a student to produce an improvement in his educational condition.

There seems to be the implication that all learning is a process to be minutely analysed by the innovator, split into tiny pre-processed pieces and fed to students according to a carefully controlled schedule involving feedback and rewards at appropriate times. One can identify a number of implicit assumptions in this way of thinking. Knowledge and understanding are seen as fairly rigidly structured and acquiring them is done through a rational piece-by-piece process. A typical analogy for learning or teaching seen this way might be the building of a house. The structure consists of bricks of knowledge and skill which are laid on top of each other in a carefully planned way (with interconnecting conceptual beams and rafters). And the builder works towards a finished

product - the house (i.e. perfect understanding of the selected course material on the part of students, as demonstrated by their passing suitable criterion referenced tests). To do this the builder follows a pre-arranged plan specifying in precise detail all relevant aspects of the intended edifice. Once built the house remains (given occasional maintenance) a permanent, useful structure. Thus we have a 'static' model of knowledge and an approach to teaching and learning as a 'closed system'. Now, one readily concedes that this kind of approach has its uses where teaching is aimed mainly at the efficient acquisition of skills or accumulation of facts. However in universities one would suggest that we are far more concerned with developing the conceptual framework which students bring to bear on the subject matter. To think properly about content knowledge requires going beyond knowledge of the facts or concepts of a domain. It requires understanding the structures of the subject matter. This includes both the substantive and the syntactic structure. The substantive structures are the variety of ways in which the basic concepts and principles of the discipline are organized to incorporate its facts. The syntactic structure of a discipline is the set of ways in which truth or falsehoods, validity or invalidity are established. When there exist competing claims regarding a given phenomenon, the syntax of a discipline provide the rules for determining which claim has greater chance of being accepted.

A syntax is like grammar. It is the set of rules for determining what is legitimate to say in a disciplinary domain and what 'breaks' the rules. Students (see Chapter 7) expect their teachers not only to define the accepted truth in a domain but also to explain why a particular proposition is worth knowing and how it relates to other propositions both within the discipline and without, both in theory and in practice.

One would suggest that the analogy the teacher adopts will offer quite different implications for him as to how he might arrange his teaching strategy and it offers quite

different implications with regard to the motivation of students. The emphasis in the case of house building is on plans devised by another expert. The laying of the first brick may seem to students to bear little relation to the position of the chimney stack. And the house is unfit for use until it is completed.

The psychologist George Kelly (1955) suggests that the development and improvement of our concept or construct system is the basic purpose of thinking and that the desire to form ever more effective construct systems is the most powerful human drive, since it is through such development that we gain power over our surroundings. Bearing in mind the control-freedom continuum suggested above the innovator fails to recognise how much autonomy the student loses as objectives become more precisely defined and learning is organised into carefully sequenced tasks and sub-tasks and when the problems are solved in great detail on the 'detailed tapes'.

The possibility that the learner might exercise some initiative in the cognitive organisation of the content has almost gone. Dr. Curr, in anticipation of how students would react to the teaching package as a whole must have had a strong model of a few of the Learning Unit students. He viewed them as 'inefficient', 'not ready to work hard' and must learn the innovator's 'short cuts'. He often proclaimed that student learning is identical to ascending steps and going along plateaux in their progress and whether the steps are at the beginning or at the end is often unimportant. Furthermore, instead of empathising with students when reading course material he used himself as a measuring instrument.

When a concept or a problem is familiar to one person, the preliminary thoughts of another meeting it for the first time will inevitably appear haphazard and scrappy. Using Kelly's construct system one notes that the development of a new system of understanding is not accomplished easily or comfortably. A change in any fairly basic construct will, he suggests, have implications for many other connected constructs (in a similar way to the widespread effects of a

disruption within an ecological system) and such a change will therefore only be considered by someone on a very tentative exploratory basis. By implication we may take it that acceptance of a new construct system introduced by a teacher proceeds on the basis of cautious negotiation; feeling out; withdrawing to consider, even retreating to safer 'known' views for a time. No matter how logically and clearly a new construct system has been presented to him, a student will need time to try out if he is going to internalise it rather than simply commit it to rote memory. Dr. Curr's emphasis on time control is contrary to this understanding.

The implication of such a view is that the primary aim of teaching is to encourage the student to venture outside his customary construct systems. He must be attracted to the preferred construct system, be able to see some possible advantages in it and feel safe in trying it out a little at a time, returning to familiar ground when he feels unsure. He needs to be able to move between levels in his system as he works, sometimes working on the details and at others taking an overview of where he is going, so that he can weigh up whether he is getting a better view of the world from where he has got to than from where he used to be.

The Learning Unit policies, as detailed by Dr. Curr, seem to contradict such a view in many ways. The general policy of initial instruction (in the lecture hall, the introductions for the drawing-office exercises via tape/slides sequences) to be followed by a reinforcement (audio-tutorials and the drawing of the design exercise) followed a stimulus-response-reinforcement model. Surely, that would not draw the student in and invite him to become involved in the process of extending his understanding, the innovator needs to be very sensitive to the students needs and to negotiate very delicately with the base ideas from which he started. Neat, self contained teaching materials are not, one would suggest, a way of succeeding in this. And, ironically, the more neat and convincing the innovator's approach the more threatening it is and the more difficult to assimilate (see Chapter 7 below).

Highly packaged teaching approaches tend to work at one level only and to lead the student along a chain of sequential steps to a point far from his existing construct system. The student may be impressed, he may even rote-learn the steps, but he is unlikely to be able to work out the implications of the proffered constructs for the purpose of his own thought processes. To ask students to use the teacher's 'short cuts' is asking them to learn how to manipulate formulae successfully and this is certainly helped by taking the 'house-building' approach and the 'cook-book' approach. The trouble with knowledge acquired as bricks (by rote learning) is that it is inflexible and does not generate new knowledge. If new constructs have no point in the existing concept structures on which they can be grafted, they are dead ornaments. New ideas can be a serious challenge to a whole range of constructs that students have been using to conceive of events generally. In the first instance this may lead to a regression in performance, as their previous constructs become uprooted and new constructs take their place. In fact it may take months or even years before a serious transformation is accomplished.

The rich understanding of the expert can never be mistaken for the relatively poor understanding of the fast talking. Nor is it even fixed in time. The understanding of a 'Bending-moment-Diagram' by a first year student will be different from that of a third year student and different again for a member of the teaching staff, and how many members of the faculty will understand 'B.M.D.' today exactly the same way they did five years ago?

Let us now return to the question of what constitutes competence in a discipline. Even if we accept the more sophisticated interpretation of understanding in which each concept is seen not in isolation but in a context of considerable complexity, our picture is still incomplete.

The expert in the subject matter does not only understand, he uses his understanding, and he analyses, investigates and evaluates in a manner which is highly characteristic of his discipline.

Examination of the Learning Unit policies, as detailed

in Chapter 6, do not provide any evidence where students are required to develop such competences.

Now, our searchlights will zoom on another policy of the Learning Unit, i.e. the Learning Packages:

Dr. Curr, (see Appendix 6-5) divided the subject matter in self-contained sections to be studied over four weeks and an examination to be held on the fifth week for two and a half terms of the academic year (Appendix 6-3). The question of each package test covered the content taught in the four preceding weeks (Appendix 6-5). What one worries about is that the Learning Unit students get flooded with new impressive knowledge week after week, which does not accumulate into new meaningful understanding. However effective the learning event of the package there is little incentive to continue processing and integrating the ideas. Past learning, one suspects, has to be ditched to make way for new matter. Possibly it is revised for the examinations but is lost for ever as the next year starts. In fact, since the packages tend to be written in discrete blocks, this may discourage students from building of concepts from one package into the next. This is directly related to the need of maintaining students level of interest or motivation. Students need to feel they are getting a better grip on understanding significant aspects of their world. Dr. Curr disagrees with this view (Chapter 6 above) but students perceptions of this area are most illuminating (see Chapter 7 below). Another aspect of the 'Learning packages' approach is the use of 'objectives' Lists. The packages have been written with lists of objectives in a format very close to that proposed by the original behavioural objectives model (Appendix 6-3). In the original model objectives aimed for the over-simplistic rigour needed for purposes of before and after testing. What purposes are they now intended to serve in the Learning Unit? Several possibilities spring to mind.

One of the merits claimed for objectives is that they encourage innovators to clarify their thinking as to the aims of the course, so as to avoid logical inconsistencies in the course and to discourage the inclusion of material which is

not strictly relevant to central teaching purposes. Now, one finds any call for conceptual clarity and relevance in teaching material highly praiseworthy. But is the drawing up of behavioural objectives the most effective way of striving in this direction? Why should innovators not state their aims from their own points of view, in course content related terms, thereby revealing their true purposes, instead of cloaking them in the course of the usually very artificial process of translating them into rather impersonal sounding 'students behaviours'? (Appendix 6-2). Surely it would be easier to communicate in the direct language of personal intentions, rather than through an abstract and idealised model of 'the student'. Is there not inevitably a need to revise constantly any list of teaching aims that was drawn up prior to the attempt to execute them? Is there not always a dialectic between intentions and practical outcomes?

An emphasis on precise formal statements of objectives suggests the rigid 'house-building' model of teaching systems and learning processes. One would suspect they lead to the superimposition of a new 'official curriculum' which claims to be studentbased but is, in fact, as far from the 'hidden curriculum' of what students learn as the old one was.

Whether or not behavioural objectives are a useful aid in course construction will continue to be debated. What then is the reasoning behind including them for students as part of the course material? (Appendix 6-2). One finds that these lists of objectives difficult to comprehend before one has read the course material and grasped the significance of the terms used. Indeed, one thinks that some students may find objectives rather worrying, since they usually offer little advice as to how one might ascertain that one had reached the suggested standards. Far from suggesting 'negotiation' with new ideas, they imply indoctrination. Lists of objectives seem to take the initiative for determining learning goals away from the student and in breaking the learning process into a set of relatively routine accumulations of skills and knowledge, the excitement is driven out of the subject matter and attention is focussed

on formal aspects of learning - a sure recipe for surface learning. When students draw on a variety of sources, using a range of media, then it is most helpful and reassuring to the student to have some means of checking that he has grasped the main points that were intended. However, he needs this at the end of the package's work rather than the beginning, by which time the language and concepts of the subject should, one hopes, be more familiar so that highly condensed statements of the general aims underlying the choice of material ought to be more comprehensible. Students' use of objective lists (Chapter 7) is a good example of the contrasting perceptions identified in this thesis.

Before leaving the area of behavioural objectives, one would like to tackle the whole notion of whether the kind of approach that Bloom and his associates (1971) have taken in defining objectives is a useful one. One doubts whether the suggested dichotomy between cognitive and affective objectives does more than remove innovators even further from the idea of addressing other humans in a meaningful way where students should be treated in a complete and holistic way. When the educational innovator follows Bloom's cognitive objectives one fears that the dominant paradigm of 'building a house' still plays a major part. In this model, thinking processes are still divided up into building blocks (bricks) which can be mastered in succession. One can see a fundamental difference between Bloom's first three categories, knowledge, comprehension and application which are essentially content-centred for which the concept of content-mastery has some meaning and his second three categories, analysis, synthesis and evaluation which are essentially process-centred. These demand an educational environment where students are invited to exercise these processes. Dr. Curr might have deprived the students from these activities when he organized the lecture material by providing the students with summary sheets and summary tapes. He also provided students with 'detailed' tapes where problems are 'worked out' in great detail, a good invitation

for students' dependence on teaching staff (see Chapter 7 below).

Another important aspect of the Learning Unit policies is the assessment of student performance known as the 'package tests' and the 'comments' which followed each test. The performance of students in different tasks in the course has always been related by Dr. Curr to an anticipated result of the degree examination. That gave the 'Design of Structural Elements' a 'bench-mark' status. Dr. Curr, here in agreement with the psychometricians, has taken as a starting point the essential importance of valid prediction of future performance. The researcher may accept that this kind of validity has its value, but one believes that equally important is validity of learning experience itself. There is some doubt whether these two concerns tend to work in compatible directions. Here, one would support the argument that the very things which seem to be recommended for improving reliability of assessment are those which seem most alien to the notion of the lecturer responding meaningfully and personally to the student. The functions of assessment as part of a dialogue between the student and the teaching system do not apparently conform to Dr. Curr's objectives. His efforts in the direction of reliability involved giving students a number of short well-defined tasks rather than a general instruction to 'discuss' a topic (Appendix 6-7). One further note on assessment in the Learning Unit is the question of 'Feedback'. The stimulus response learning paradigm indicated the importance of that rule. However, one feels that a more important aspect of script marking is the extent to which it provides a personal response to the students' work.

The insights the students gain through the relatively spontaneous reaction of another to the ideas he has developed in a reasonably substantial piece of work, seem to the researcher as potentially a good deal more valuable than comments produced in general terms (Appendices 6-6 and 6-8). Reading these comments raises the question "Who are the clients"? A careful examination of these comments shows that the innovations clients are not, as is sometimes claimed, the students,

but the innovator himself. His efforts are in the direction of shifting the spread of the grades of these package tests (Appendix 6-8). One thought that the role of the lecturer is to act as a familiar land-mark in unexplored territory, an identifiable point of synthesis within the confusion of new subject matter and the student would be encouraged to strive towards the land-mark seeking ways that will lead him to examine his approach to study and to explore for himself ways of developing it. The lecturer can help to make the possibility of change unthreatening. But the student is the one who should take responsibility for any change, since learning to learn will continue all his life and sooner or later he will need to be able to develop new approaches for himself. The 'comments' which followed the package tests do not feed in that vein. There is a talk about 'trick' questions and 'descriptive V_s numerical questions' (Appendix 6-6).

Evaluation of the innovation:

The innovation has been judged as being a success by Dr. Curr since:

- (a) the students improved their learning efficiency as seen by their productivity in the drawing-office exercise, by the cut in failure rate and by the students preference for the new teaching method.
- (b) The teaching material (the visible product) has been increased in size and purpose. Accordingly, claims Dr. Curr, more 'options' were available for students. The teaching staff felt that the new teaching method suited their subject and their needs.

It is interesting to compare these statements with the evaluations of Kulik et al. (1979) as quoted in Chapter 2. Kulik and associates concluded that:

- (i) Audio-tutorial instruction had a significant but small overall effect on students' achievement in College courses, and:
- (ii) It had little effect on withdrawal rates or on student

course evaluation. Mintzes (1975) (as quoted in Chapter 2 above) concluded that many of the evaluation results of audio/tutorials "have thus far been disappointing".

It is interesting to note that similar criteria have been used by Dr. Curr of the Learning Unit and the scores of innovators, examined in the meta-analysis of Kulik and associates, to judge the success or otherwise of their innovations. In Chapter 6 above the researcher indicated that a central problem in educational innovations has been that of developing goal taxonomies to be used as devices for curriculum design. Dr. Curr identified a number of problems in the third year course and developed the means to solve these problems. Therefore, the role of his evaluation was that of simple comparison between goals and outcomes. But the pre-recorded instructional materials are not simply an alternative delivery system. The use of alternative means implies that different ends will be achieved.

He believed that the only way to get valid information about the quality of curricular material is to try material out, in some more or less organised way, on the students they were meant for. Hence the repeated change of the pre-recorded material and constant demand for time and resources. In his published reports, the success of the innovation was based on students' achievement, but examination of the Learning Unit practices of assessment as shown above casts doubt on that claim. Dr. Curr's interpretation of information available from package test results has been slanted in line with his prevailing interests and concerns. His concern with improving performance on tests and his guiding model of the learning processes combined to make the evaluation of the innovation self-fulfilling.

The second claim mentioned i.e. the improved learning efficiency of students as seen by their productivity in the Drawing Office exercises will be examined carefully in Chapter 7 where a different perspective will be available.

As in most curricular innovations a whole curriculum becomes problematic for its practitioners once the technological application is under way. The pre-recording of instruction would call for the study of the learner, his needs and processes

and their aims in the same way demanded on the 'interaction continuum' detailed above. But Dr. Curr searched for a 'pattern' of use of the pre-recorded material and tried to relate the converger/diverger dimension as defined by him to the use of summary/detailed tapes and the student obtaining high or low marks in the package tests. In Chapter 6 above, the researcher warned that in examining the activities of the Learning Unit, it will be necessary to keep an eye open for the correspondence between objectives and the actual syllabus content and the instructional methods adopted. Dr. Curr believes in the characteristics of a good civil engineer, noted above, receives little attention in the 'continuous assessment' system adopted.

In Chapter 4, the researcher emphasised that it is hard to do systematic research, especially research about people, without disguising from oneself the assumptions implicit in one's decision, first to collect and then to analyse one's evidence in one way rather than in others. If the innovator is concerned with the distribution of the examination marks obtained on the package test, every effort will be spent to achieve that aim. But, students enter university with contrasting orientations and conceptions of learning which are likely to affect them in their initial approaches to study. Students have individual purposes in relation to their academic work and these purposes affect their study strategies.

Students' perceptions of the same experience are detailed in the following chapter (Chapter 7). Students were interviewed at different times and in different sessions. Post-graduate students were asked to comment on their experience in the civil engineering department in general and in relation to the activities of the Learning Unit if they experienced it. The date of the interview and session is given in brackets with the student's initials.

CHAPTER VII

7:1 Students perceptions: An analytical frame work

Research in the Learning Unit, as detailed in Chapter 6, dealt mainly with students' academic performance.

Most of the research was similar in character to the industrial research designed to improve the efficiency of some production processes. Dr. Curr put forward the following questions: Is the educational job getting done? Are students learning? How much? Has the failure rate been reduced? Is group-paced instruction quicker for the same amount of learning than individually paced instruction? Is audio-tutorial learning quicker than learning from a programmed text? How many "feed backs" from tests or examinations are experienced before a class settles into the new study method? Are the teaching/learning activities in the Learning Unit cost-effective? What can be done to reduce the costs? etc.

These are serious questions, of course, but they are the lecturer's questions.

In this chapter we shall look at the students' experiences from their point of view.

Individual students have intentions, purposes and emotions and also skills, abilities and talents, all of which influence their reaction to the Learning Unit. This presents us with a problematic situation. Because students' idiosyncratic patterns of behaviour vary as they always do, the researcher is faced with an additional set of problems. One way to deal with this problem is to try to identify, at a macro level, students' goals as they evolve through their interaction with their environment, explicitly in formal statements, and implicitly when students establish their own informal structures.

Taylor (1983) reminded us that students have individual purposes in relation to their academic work and these purposes affect their study strategies. Students monitor their performance in terms of their own goals, as well as the

perceived requirements of the teacher, department and institution. Entwistle (1985) has commented that:

"The focus of students' attention is not simply on the task in hand, but on a penumbra of personal and contextual influences".

Students have more than one orientation and have access to different perspectives. But, students are different and some have limited approaches to studying, as has been indicated in Chapter 2. They also develop in their sophistication as learners over time, and at any stage of the course some are less developed than others. Furthermore, certain aspects of course design constrain students in their learning.

To cope with this web of complicated influences, the interview data was carefully analysed to develop a framework which could simplify this complexity. By applying a rigorous qualitative analysis, the students' responses were grouped into a number of categories. The intention was to understand what the students were expressing, irrespective of what words or examples they may have used.

Starting with a comparatively large number of categories the researcher gradually refined these, arriving at a smaller set of categories that might finally be difficult to collapse further. Thus the use of extracts from the interviews was rather different from most interview studies; the quotations were not just presented as interesting comments introduced almost incidentally, but rather they exemplified the defining feature of the categories identified. Hence the variations of these comments which identified students' perceptions of the learning experiences and their concern. The framework shown as Figure 7.1 provides an order within which to introduce the interview data and the interpretation of it. This framework is intended to suggest that students' intentions, motives and direction and quality of effort - what has been described in Chapter 2 as their approaches to learning - are filtered through their idiosyncratic perceptions of meaning and relevance. It is crucial to recognize that perceptions

are essentially individual, depending on the students' own ways of interpreting elements in the environment.

The analysis in this section will determine, in general terms, students' objectives.

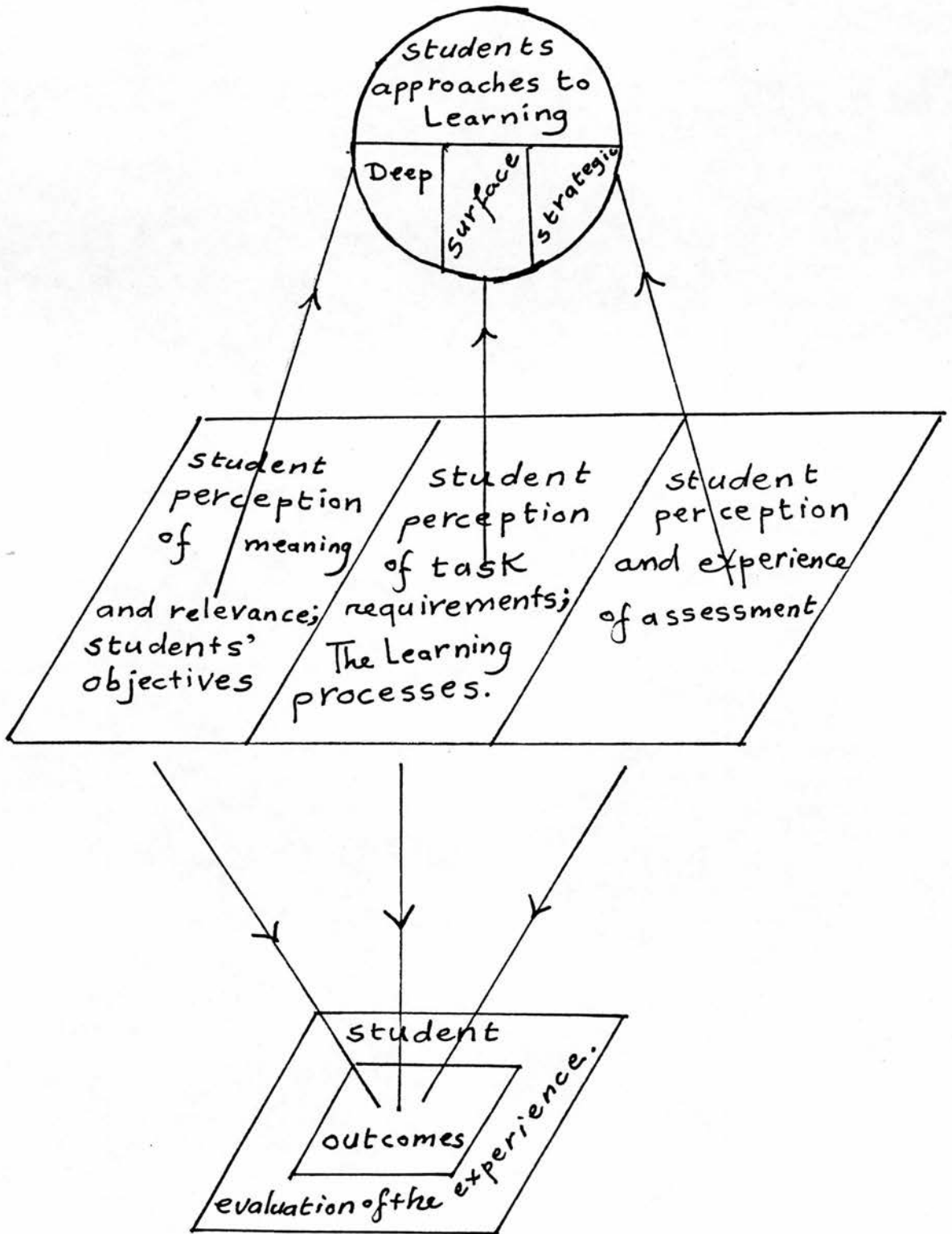
It will be suggested that students' perceptions of task requirements are filtered through the departmental support they receive in the shape of (a) the learning material, (b) study skills support, (c) freedom in learning and the work load. These elements will be clearly defined when the students' learning encounters in the Learning Unit are examined. The assessment procedures and students' perceptions of this experience filters through students' intentions to maximise grades. It seems that this is influenced by the subject methods, modes of enquiry required and the kinds of knowledge, skills, attitudes or other outcomes demanded. Students' evaluation of the learning experience and perceived outcomes concludes the framework. The analysis which follows is developed along the lines mentioned above and falls into four sections:

1. Students' perceptions of meaning and relevance of their experience at the City University.

2. An examination of students' experiential encounters in the lecture hall, their use of the audio-tutorial tapes, the experience of producing the design in the drawing office, the open-ended activities and the practical work.

3. The analysis of the package "continuous assessment" method will examine: (a) the assessment task complexity and the predictability of its requirements; (b) students' concern about the 'weight' given to the results of the package test; (c) the assessment task and its distribution over the whole session; (d) the package test task time and its limitation where the students will discuss the practice of "insurance policies" and fairness of the assessment system.

4. Students' evaluations of their learning experiences conclude the analysis.



(Figure 7:1)

Students' perceptions, an analytical framework

7:2 Students' perceptions of meaning and relevance:

Students in the Learning Unit, it turns out, see their world in a changing perspective. How to climb the distant mountain may be the ultimate goal, but how to make their way across the swamp they are floundering in now and over the steep hill just ahead engages their immediate attention. Before spelling out all the "worth-while" things students should be doing, it is necessary to examine how the various concepts of "worth" have already been incorporated into their value system. It will be suggested that students' own personal goals determine the particular learning strategies they adopt. Their perception of meaning and relevance can be gleaned through the comments individual students made when asked about their perceptions of a "good civil engineer".

7:2:(a) Practical experience of students:

Few students have had practical experience and when this took place it was on a building site or in a civil engineering office, sometimes to do non-civil engineering jobs. D.O. (session 1973-74) who had worked during the university's vacation in an engineer's office recognised the relevance of what they do in the course.

"If anything, we have a better theory background than many of the trainees, who had better drawing backgrounds and turned out lovely neat drawings". M.J. (graduate student) who had worked on site in vacations during his undergraduate years, commented that it was mainly site-technician-levelling, setting up shuttering. He had never been in a consultant's office. There was no design work. The site brought his university acquired knowledge into perspective, and it started to become relevant. He began to realise what the lecturer was talking about and what the limitations were of design calculations. He began to realise that the refinements that they were taught were just not necessary. One could see the method in which the fine limits they designed

to were out of proportion to the methods of construction. He has seen civil engineers on site telling labourers "What to do, in a bossy way". The labourers resented that sort of treatment.

So, what makes a good civil engineer?

7:2:(b) Perceptions of a good civil engineer:

D.O. (1973-74) noted that a good civil engineer liked to work from first principles right through a topic, not start half way and only do half of it. "I think that will make me a better engineer".

"Anyone can solve problems using a list of formulae given to you. Only an engineer knows why ...". "I think that is the difference between a technician and a professional".

Other skills mentioned by D.O. (1973-74) were the ability to think for oneself and justify one's actions, and probably knowing how to use a library as well.

A.M. (1973-74), a student with previous experience in a civil engineering office, noted that the good civil engineer is not necessarily the man who comes away with the best degree. A good civil engineer is someone with plenty of experience and sense and practical knowledge learned on the job. "Theoretical engineers are no good on site, because they do not understand the problems you can come across". He went on to say "Dr. Curr is a good engineer, because he was basically a site engineer, and then a design engineer, now a lecturer. So he can give you all the insights and not just the theoretical information".

When the researcher repeated his enquiry of 'what makes a good civil engineer?' in session 1975-76, new elements were mentioned by students. R.M. and J.S. (June 1976) noted that a good civil engineer is someone who designs safe buildings and is economic at the same time. But economics should not come first. "We should not have big ugly buildings detracting from the environment. If you go for economics at the expense of safety, you are a bad civil engineer". R.M. went on to say that the engineer attains certain skills in the course

of his career. He begins to get the feel of what he is doing, knows before he starts a calculation roughly what the answer is going to be.

S.J. (May 1976) who had not worked in the field, found it difficult to answer the question. He thought that a good civil engineer should think ahead and should think about practical aspects as well as theory.

Moving on to the students' perceptions of the institution itself, they were asked about their initial decision to study there.

7:2:(c) Why the City University?

The choice of the City University by the students was investigated by the researcher when A.M. (1974) indicated that he believed that the best engineering degrees could be obtained from technical universities. D.O. (December 1973) thought that since the City University was initially a Mechanics Institute, famous at the beginning of the century, the graduate would have a better chance for a job with the City University degree. He also mentioned that he was able to get in because there was no 'O' Grade Language requirement for entrance. He thought that some of the courses were geared to get you jobs, more than for your own fulfilment.

In session 1974-75, the researcher interviewed several students to find out their reasons for choosing the City University as a seat for their studies. Several reasons were presented - these were, no language requirement, the fact that it specialised in engineering, the City University location in 'Glostrup' city being a better environment than 'Herlev' where the other similar university was situated. A student who visited the New Campus at 'Doha' thought that it was a modern university. Some students chose the City University because it was nearer home and because they had local connections. Others thought that the City University had an extra year for people bad at mathematics. A number of students accepted the offer to come to the City University

because no other university made an offer. Now students' choice and expectations from the City University comes under closer scrutiny when they discuss their perception of the courses they received in their third year course, before focusing on the third year "Design of structural elements course", the main subject of this thesis.

7:3 Perceptions of the courses at City University:

The researcher asked the Learning Unit students about their perceptions of their university courses. Many of the degree courses include a component of supporting or related studies, often taught by staff from departments other than the one which had initially recruited the students. In each case, the teaching of supportive or related studies is done on what is termed a service basis. Examples of these subjects in the City University were Mathematics, Physics, Chemistry, Industrial Organisation Electrical Instrumentation, and Humanities options in the second year.

The quality of the experience offered to students varied according to the enthusiasm and commitment of the particular staff undertaking the teaching.

To some extent the professional (engineering/service) subjects distinction is linked to the students' perceptions of future careers. For example, for the majority of students the 'service courses' segment of the course, even if it is only a few lectures per week, is seen as something of a 'chore' to be endured and got through. The engineering subjects are seen by students as heralding more 'exciting' and rewarding work - 'real' engineering. Students retrospective views of their service courses display this attitude.

M.B. (a graduate student interviewed 1973-74) recalled "as an under-graduate, I decided that the less important parts were simply those outwith the field of civil engineering proper, e.g. 'Law' and 'Industrial Organisation'. They were connected with civil engineering but not so obviously as were 'Theory of Structures', 'Hydraulics', 'Soil Mechanics',

'Design' and 'Mathematics'. These were the essential tools of a good engineer - you had to know the basis of these subjects. The others you could pick up when you left although it did help to have a basic knowledge of them before then. There were some subjects - 'Theory of Structures' and 'Soil Mechanics', which would be difficult to pick up, difficult to understand on your own. So they were better taught at university to quite a high standard. For example, just a basic understanding of 'Industrial Psychology and Economics' was sufficient at university because you could expand upon basic knowledge of these more easily than the theory".

M.K. (third year, 1973-74) mentioned that the optional 'Industrial Organisation' would help the students when they went into the field - "how to behave with people, how to control them".

D.O. (1973-74) mentioned that 'Industrial Organisation' was not taken seriously, considered a waste of time. In his third year he began to regret this feeling and that he had not made more of the chance. "It was not explained at the time why we were doing it". The same was true with Electrical Instrumentation. It was "just thrown in, no attempt made to justify having to take the course".

(D.C., December 1973). A.M. (1974) also remembered this course as very difficult, but irrelevant. A lot of people had to repeat a year for that. "The department has now fixed it (1974), so that the work is toned down and incorporated into another subject".

Supplementary studies in mathematics and physics were included in the course. Mathematics as a supporting subject was found to be least successful when taught and examined as pure mathematics without any attempt to use numerical examples from the students' main area of study - even when there were opportunities to do so. R.V. and C.G. (May 1975) thought that they needed mathematics, but not three years of it. C.G. thought you did not learn anything to do with civil engineering in mathematics. The students treated the mathematics lectures as a joke. B.M. (March 1974) added

that the small science course at the beginning of the third year were more useful than the whole first year 'physics' and 'chemistry'. G.M. (third year, February 1975) thought that there could have been more actual civil engineering in the first year. Mechanics was known from school, mathematics made sense in the first year, and some of the chemistry was relevant, but not much. Physics was totally irrelevant. It was orientated to school leavers in first year, mainly continuing the school subjects they had been doing. But, in fact, nobody understood the physics. He wanted to have more practical material in the first year - actual civil engineering did not start until the second year or even the third year. "Physics was so irrelevant. It was not even basic physics. It was the stuff people doing the physics degree had".

This points to the limited extent of liaison between the 'service subjects' staff and the engineering department's teaching staff. This led to (see above) the failure of the engineering students to see the relevance of the service subjects in their courses, with the result that the quality of work produced was not high. As indicated above, it was not always certain that the aims of these courses had been explained, or were understood by the students. The very distinction in the formal curriculum between 'professional' and 'non-professional service' studies served to perpetuate and strengthen such a view. Training appeared to follow a simple logic from 'basic science/pure theory' to 'practical experience', employment and experience after graduation. Lecturers themselves tended to reinforce this perception amongst students once they embarked on their first year.

Having seen how the students viewed the institution and their courses, we can now move to their perceptions of the third year course of 'Design of Structural Elements', in which the Learning Unit was particularly involved.

Here the analysis starts with students' perceptions of task requirements and outlines students' learning experiences in different locations and encounters.

7:4 The Kurasini Building course of Design of Structural Elements

7:4:(a) Students' Perceptions of the task requirements of their learning experiences

The third year students arriving at this transition point in their courses at the City University are faced with a number of decisions.

The following sections deal with the nature of these decisions and perceptions and with the students' individual and collective solutions to their various dilemmas.

The students progress enmasse through a uniform series of classes in their first two years at the university. After the completion of the third year, the students' career paths diverge. A range of possible experiences opens up and students are called upon to exercise choice in constructing their own courses and career paths. The process of student choice is based principally upon student performance in the examination and the perceived chances of obtaining jobs after graduation.

Those responsible for policy-making in civil engineering have begun to question whether the time taken for basic training is too short. The purpose of this basic training is no longer seen as the production of a competent engineer, but rather as providing a general, introductory foundation on which a specialist, vocational training can be built in an area of engineering practice. In the process it seems that the courses have become overburdened with course content, with implications which the students pointed to in the interviews.

The students perceived their third year experience at Kurasini Building as requiring very hard work and as very demanding throughout. This perception had a great influence on their understanding of task requirement.

A.M. (1973-74) recalled that students had to work extremely hard, in the third year more than other years. B.M. (1973-74) found that they were hard pressed throughout the third year, "but the day at 'Kurasini Building' is the

worst, nine to four or five, working pretty hard all day. People do not work at night, they are so tired". A.M. (1974) mentioned that most people worked in the university till eight or nine most nights during term, and longer at exam time. That was just to complete the recommended work and the tutorials. "If you feel you have to do any extra work, that is even more time. Didn't make married life very easy". His wife did not appreciate how much work he had to put in, or at least, did not like it.

R.M. and J.S. (1975-76) thought that "because of the way it is taught 'Design' stands out, makes you spend more time on it". "If every subject was taught like that, it would be no use, you just could not do it". But J.S. would not like to do 'Design' as conventional lectures and class tutorials. It was a hard subject and so much volume of work you could not do it conventionally or, if you did, you could not cover the same number of topics. Dr. Curr presented the 'Design of Structural Elements' as the major bench mark in the development of the student's career. R.J. and J.S. (1975-76) remembered "Design is a really heavy subject, an exceptional subject, you can't talk about it in general terms".

B.M. (1974) mentioned that the subjects at Kurasini Building were the most important for engineering. Dr. Curr stresses this. Third year gives a good grounding, as everything is covered. The fourth year will elaborate on principles learned in the third year".

B.D. (fourth year student 1975-76) remembered Dr. Curr in that light: "We had him in first year and we had him in the third year and he put the fear of God into us in the first year. You come in from school as green as the hills and the first week in he gave us a book title. He told us to buy this book and read it by the afternoon, a couple of chapters and everyone was reading this bloody book and ever since then you've just tended to respect him". "Some people still dislike him intensely. You either like him or hate him".

G.M. (1974-75) remembered that Dr. Curr was the one that seemed to be in charge all the time. In the first lecture, about the second hour of being at university, he came in and

started talking, it seemed informal. Then he stopped, and asked why no-one was taking notes. "So this was our first impression of Dr. Curr being a kind of fellow not to miss on all the time - everything he says, you have got to listen to, and you have got to be wide awake". And at Kurasini Building it was the same - "everything there was examinable", nothing just for 'interest', "everything was compulsory". "There was no choice". It seemed that lack of freedom of choice of learning style and content had been established early on. What students' activities actually involved was as follows:

(1) The Lectures:

Two live lectures every week with Dr. Curr.

(2) The Design exercise in the Drawing Office:

Once every week - a drawing office design to be done by the student on a Thursday and the rest of Thursday is taken up with follow-up of the two lectures.

(3) The follow-up:

The follow-up could be in three forms. Firstly the student could borrow a 'summary tape', which went over the main parts of the lectures again and listen to that. Secondly, the student could borrow a 'detailed tape' which gave a very detailed solution to the tutorial problems which had been handed to students before. Both these tapes were supported by handouts. A whole number of numerical problem sheets were given out at the beginning of each term in session 1977-78. 'Guided' tutorial tapes appeared in circulation in the session 1975-76. These guided tapes guide the student through the numerical problems of the tutorial problem sheets. Thirdly, 'enrichment material' - a small amount of tape-slide sequences where the students could listen to illustrated lectures presented by the lecturers of the civil engineering department.

These were to provide background information to certain processes like 'The production of concrete'.

'Wind Loading', and 'Form Work'. The set of transparencies for this sequence was complemented by a slide of a well-formed female.

In earlier sessions students learned some applications of their theoretical knowledge by playing a 'civil engineering game' called 'Load'.

In addition to the learning resources mentioned above, there were also human resources that included: a) the instructor, b) demonstrators, usually a post-graduate student or another lecturer in the department, and c) fellow students.

The following sections will describe in the students own words the strategies they developed for coping with the lectures, using the materials, and interacting with the tutors and with one another. It is important to build up a picture of how the students deal with the learning material in the different contexts provided by the lecturers. It will then be possible to understand the innovation from the students own perspectives.

7:4:(b)(i) The Lectures:

A.L. (June 1978) commented that in the lecture, we had in front of us a wad of notes which gave us the basic constituents of the various codes of practice we had to learn for 'Design of Structures'. We had to design according to a statutory code of practice. In the first term, we covered B.S.449, which is the steel-work standard. And what Dr. Curr did was, he would give us the notes at the beginning of the term and say "well, here is all you'll need to know about B.S.449, but I am going to explain the parts as we go through the code of practice to make us familiar with the various values and their implications". In the second term, he did exactly the same thing by giving us a wad of notes, but this time one called C.P.110, which means Concrete Practice 110 - that is for reinforced concrete - and that guided us through various rules of how to construct columns".

Researcher: "What do you do when you sit in the lecture hall? What do you personally do?"

A.L.: "Well, as I say, you have the wad of notes in front of you. But the wad of notes is not completely comprehensive. Some of the implications of the formulae and the derivations of the formulae that we have on these notes are not absolutely clear. And so, as the lecturer is illuminating these, we can just scribble little notes at the side of our wad of notes, so that we would know how to apply the code of practice".

The handouts for the lectures were available for most of the sessions, except for the first term of 1974-75 when students had to write their notes from the board and R.J. (1974-75) noted that the student would then be struggling if he missed a lecture. D.O. (1973-74) mentioned that students looked up to Dr. Curr and respected him. They did not exactly fear him but they were freer with other members of the staff. They are not so friendly with Dr. Curr. "He is always right". "Every time he puts an argument forward, he is biased one way or the other. He is not conscious of it but if you do not agree with him, it is difficult to argue against Dr. Curr". A.N. (1973-74) noted that Dr. Curr was a very good lecturer. "He really shouts out an emphasis. Stresses main points and is very quick. His lectures keep you on your toes".

For the Learning Unit students, one of the overwhelming problems they faced in the third year was the sheer amount of work which the teaching staff expected them to cover and digest. Dr. Curr gave lively and confident presentations, repeated unclear points, stressed, summarised and 'shouted emphasis', related material in his lectures to his industrial past experience and was humorous on occasions. Students on their part intended to maximise their grades by an identification of the most important parts of the lecture and marshalled their limited time to produce the greatest perceived "pay-off". One unanticipated outcome of this is greater and greater dependence on the teaching staff as detailed in the following quotes:

M.A. (1973-74) prefers Dr. Curr's lectures "because you can understand his lectures without any other book-work. There is a very heavy work-load, so you want to get away with as little additional work as possible in each subject. Doing reading possibly ensures that you see all angles to problems, but I would rather get it in the lecture material (as is the case with Dr. Curr's lectures) and in that way save time. I feel the work-load we get is extremely heavy".

G.M. (1974-75) mentioned that for Dr. Curr's course, books recommended were "British Standard Book" and one on Steel Tables. "But I do not feel that there is time, if you are doing work with Dr. Curr, to read through the books he recommends and his notes, and do his tutorials and then try and find other books as well. There is not enough time to do that, otherwise you tend to do nothing else but work for Dr. Curr".

A.M. (1973-74) recalls "You know the lecture better because of the summary tapes and the audio-tutorial. Going to the library is not really necessary for 'Design', mainly codes of practice". The books were expensive and so it was good that Dr. Curr gave them printed sheets. The students depend basically on the lecture and the support material from the tape-recordings. R.V. and C.G. (1974-75) noted that "Dr. Curr put things on the board, but you could still take your own notes. These are little extra points that you want to remember". They just copied straight from the board, "clear methods - A,B,C." An image of mechanistic use of teaching material. Furthermore it seemed that the domains of students problems were not the world of design of steel structures but the world of the teacher setting the examination questions. This is evident when D.O. (1973-74) noted "If Dr. Curr says something, and he is going to mark a paper, you do it. You know, if he suggests something, 9 boys out of 10 will put it down on paper because Dr. Curr is marking it. They will not have thought why you do it, Dr. Curr will have had reasons. But because Dr. Curr suggests it, it's maybe worth another couple of marks, therefore you put it

down, even though you may not understand anything about it".

7:4:(b) (ii) Asking questions in lectures:

Researcher: "Do students ask questions in the lectures?"

Lecturers style seem to influence students attitude towards this when J.S. and R.M. (1974-75) recalled that "Dr. Curr comes in to his lecture and gets started right away". P.P. (January 1977) commented that right through the year Dr. Curr was always trying to give the impression that "here was speed, here was efficiency". He rushed through his lectures, and he was always shouting. He gave handouts so it was not difficult to follow, except that he rushed the explanation that he gave on the blackboard. S.J. (1974-75) gave a similar impression of these lectures when he recalled: Dr. Curr's lecturing style was to bounce in, did not start off slowly, started off at full belt. He gave a rough summary first with rough notes on the board of what he intended to do. Then went over it again. S.J. tended to take notes from the board to add to the summary sheets, and to his full notes. Dr. Curr would always stop and ask if there were any questions. "Now our class tended to be one that didn't ask many questions, and I think this put him off slightly". "People thought that he went so fast that they did not sufficiently understand what was happening to ask questions". S.J. found that he could ask a certain number of questions "but I would have to think about many other things first before I would ask questions". Particularly with steel design, you had to study the thing in detail before you grasped it, before you could significantly ask proper questions.

B.D. (fourth year student 1975-76) noted that 75% of the class have never spoken up at a lecture, whether to say they do not understand or something is wrong. "There is obviously a resistance to speaking up. They are not used to it".

7:4:(b) (iii) The lecture objectives

Dr. Curr in his introductory notes to the course, prepared a list of objectives for the lectures. He went on to remind the students, "These state the type of work I think you should be able to perform within a few days of the lecture, once you have had the chance to go over the notes and perhaps to seek out the explanation for points which puzzle you. So you should be able to use each list of objectives, before and during a lecture, to assist in your note-taking and in the 'learning attitude' which you adopt to each part of the lecture. They will also help you in your revision by reminding you of basic tasks which you should certainly be able to perform".

The researcher asked students of sessions 1974-75 and 1975-76 how they used these 'objective lists'. The following responses represented what was common among the students.

C.G. and R.V. (session 1974-75) noted that objectives told you what you should be able to do at the end of the lecture. Dr. Curr said in his first lecture, "If you know where you are going, you will get there a lot quicker". But they never looked at objectives, "Well, I look at them when he gives it out, have a quick look at it, but I tend to find that supposing he does pick out 8 points, I do not learn those eight points, I just try and learn everything". "The objectives are in the lecture notes, and the one time you look at those is when you are revising for exams and then you do not look at the objectives, you look at what he actually says in the notes". They might be helpful after they graduate when they are doing design and come across problems. "Just have a quick glance to see what they say, but you never really use them for anything apart from that".

J.S. and R.M. (session 1975-76) saw them as just setting out the things that Dr. Curr thinks you should be able to do once you have finished the lecture and tutorial. "The theory is that you go back and see that you can do every one of these". R.M. does not think he ever did. There

was also a sheet for the whole year given out at the beginning. R.M. glanced at them occasionally, but never bothered reading objectives, then notes, then objectives again to see if he could do them. S.J. from the same class said that you were supposed to read them at the lecture and say "Well, whenever I come out of the lecture, I understand this, and this is what the lecture is basically all about". You should be able to look at them and give answers, but very few people used them in this way.

This is a clear example of contrasting perceptions between the lecturer and students. Objectives were not seen as important, or valuable by the students in spite of the respect, and awe, they had for Dr. Curr. The introduction of the pre-recorded material in the Learning Unit must have shifted students' judgements of the efficacy of the various means of content delivery. And these judgements need to be seen in the context of their more general perceptions of what good teaching involves.

In Chapter 2 we saw that students perceptions of "What makes a good lecturer?" depends on their own conception of learning and how this is being facilitated.

The students conception of 'good teaching' can be seen perhaps more clearly in their responses to the question, "What makes a good lecturer?" These comments form a background to understanding students' reaction to the pre-recorded material.

7:4:(b) (iv): The perceived characteristics of a good lecturer:

D.O. (1973-74) noted that the lecturer must explain why he is doing something - he may say, for example, "In 5, 10 years' time you are going to be doing this". They had done maths for three years and were only then beginning to realise why they had done it. Quite a few lecturers couldn't set their thoughts down in logical order, they jumped about, there was no continuity in the lecture notes taken. Quite a few spoke too low and wrote too small; they now remedy

that by shouting out at them, but they would not have done so in the first year. Some were boring speakers, more interested in their research. "They are just lecturing because it gives them plenty of free time. Lecture notes not properly prepared, mistakes in them".

"Mr. W. knows his stuff, but he pitches it too high and so is a bad lecturer. Also he does not set lecture-notes out properly. He talks in figures with very little English in between. It is difficult to take lecture notes in his class and difficult to keep up. He thinks everybody should be as intelligent as him". B.M. of the same class (1973-74) remembered Mr. W. as a lecturer who knew what he was talking about, but could not put it across to students. A.M. (1973-74) thought that "Mr. W. is a very assertive man". "He can't follow why you don't understand he can't understand why you do not see a certain angle to a problem". "His notes do not fall together properly; they are slightly vague. You have got to keep working at it. Always at the end of his lectures he works through an example which gives you a chance to correlate all the information, but sometimes it is difficult to follow during the lecture, therefore there is extra work, reading".

A.M. prefers Dr. Curr "because you can understand his lectures without any other book-work". He noted that "Mr. Y. is difficult to follow and obtain relevant information from, because all he does is talk to you". Whereas Dr. Curr "writes notes on the board and gives you time to take notes if you wish". Mr. Y. just left it to them to take notes on what they wanted, "which is not something we're used to as engineers. We are used to taking formulae down off notes and boards - processes and things like that".

O.D. (1973-74) noted that there was a low standard of lecturing in other departments. The mathematics is directed to mathematics students, not to engineers, and some of it is above their heads. They are groping. In session 1974-75 the researcher repeated his enquiry of the perceived qualities of a good lecturer. Then G.M. commented that "you cannot really judge a lecturer until he sets an exam". "His

lecture might be good, and yet he might set questions on things that he had not really stressed in lectures ...Don't want to have to take down every word. You wouldn't understand it then, you have to go over and over your notes". Mr. W. was "very good, because he was very methodical. He explained everything that he did. Didn't assume anything". "But some boys don't like him".

G.M. (1974-75) did not rate Mr. Z. very highly. "His lectures are just disjointed facts". His overhead slides seemed to belong to different lectures. For revision G.M. had to memorize everything that Mr. Z. said. "There was no methodical way of going through it". "Mr. N. is boring, monotonous voice, he doesn't stress anything. Nothing he says seems to be important, - all coming out in the same detail, you are supposed to understand everything, and yet you understand nothing".

The characteristics most often mentioned in these quotes can be summarised as follows:

- (i) How competent and well-prepared staff were;
- (ii) The lecturer's ability to pitch material at the right level;
- (iii) The pace is appropriate and there is a clear structure in the subject matter, and
- (iv) The lecturer's ability to anticipate potential difficulties and to keep good relations with students.

We now turn our attention to the students' experiences in the Learning Unit itself. What features of the learning materials provided, and of the ways they are expected to be used, are picked out by the students - and how did they value the experience both in preparation for the exams and as part of their training as an engineer?

In Chapter 2 and Chapter 6 an "interaction continuum was introduced which ran from interacting with the pre-recorded material at one extreme to independent interactive learning at the other.

Focusing on students' reports of their use of the pre-recorded material, the researcher will show how the students

became dependent on the teaching staff and how question spotting (i.e. "Cue-consciousness") was widely practised.

7:4:(c)(i): The tutorial problems and the use of audio-tapes:

The students receive a number of problem sheets which cover the work to be done on steel work for the first term and similar numbers of sheets for concrete. The type of questions asked is illustrated by A.L. comment (1977-78) "On a tutorial sheet you probably have seven or eight questions. You might be asked 'here is a multi-storey building. Its self-weight is so many thousand tons, or whatever. Its base columns are such-and-such a size in reinforced concrete'. And you'd be asked, 'How much reinforcement has to go into each of these columns and where would it be positioned?'. And then part b of the question might be 'Would you use high-tensile steel or a normal steel for the reinforcement?' "

Researcher: "When you go to the Learning Unit to solve these tutorial problems what do you personally do to solve them?"

Student A.L. (May, 1978): "I generally attempt the tutorials in my own time".

Researcher: "When?"

A.L. (May 1978) "At home, well I'll be honest, I did the tutorial in my own time and then came in and did the detailed tape and listened to see whether my solutions were correct, and if they weren't, to put right the bits that I'd got wrong. But then, after that, I tended, as work pressure began to build up, which it certainly did, especially in second term, what I tended to do was to borrow the tapes from the L-U, which you can do ... so I used to borrow the summary tapes and the detailed tape. And then take these home, and over the weekend I would sit at home and listen to a summary tape and then attempt the questions one by one; listening to the solution on the detailed tape immediately after I'd done the

question, so that any mistakes I made in that question I wouldn't repeat in succeeding questions".

Researcher: "How long did you spend on the summary tape, at home?"

A.L. (May 1978): "I might listen to it through twice, which might take me an hour".

Researcher: "And the detailed tape, how much time did you spend on it at home?"

A.L. (May 1978): "For some of the tutorials it could take me as much as two evenings".

Researcher: "How many hours each?"

A.L. (May 1978): "Say 3½ hours each".

The use of the summary tapes and the detailed tapes by students played an important part in their strategy to cope with the heavy load of the course content.

The researcher had been told that it took two feed-backs and two package tests before the students fell into a pattern of using the audio-tutorials. The students' use of this resource was very illuminating.

R.M. and J.S. (June 1976) indicated that they just listened to detailed tapes in first two terms. "Spend 50 minutes or an hour", went home, tried the tutorial on their own. Generally they did not try it before listening to solutions. R.M. did not get on too well that way. So, in the third term he mostly listened to summary tape, and that explained it again, just like listening to the lecture again. But with the earphones on, he listened more intently, so that explained it quite well. Then he would take the detailed tape home, and try the tutorial at the same time as listening to it, i.e. "You try it, get stuck, listen to a wee bit, go on again. But it took a lot of time, at the expense of other subjects". 'Design' got an unfair share of his time.

R.M. and J.S. (June 1976) never went to the library to check a point in Design. If something was unclear, R.M. would go and see Dr. Curr; J.S. tended to see other people in the group first before going to Dr. Curr.

Students' dependence on the teaching staff is very

evident here. Furthermore, it was very common for students to make little use of text-books and to depend solely on solutions provided by the 'detailed tapes'. Students' dependence on the teaching staff reinforced the covert message that the lecturer is the expert and font of all knowledge, and that students should refer to him when they have problems. The detailed tapes were used as a surrogate lecturer and in cases of difficulty students would consult their friends first, since the lecturer is also the assessor of their performance. The students' dependence on the teaching staff can also be seen in relation to their practices in the Drawing Office. In response to the notion that students were dependent on staff, Dr. Curr decided to introduce what was known as 'Guided tapes' in session 1975-76. These 'Guided tapes' were meant to guide the student through the numerical problems of the tutorial problem sheets. Students' responses to this innovation is detailed below when B.T. (1975-76) noted "Don't really know what Dr. Curr is trying to do with the new guided tapes". J.S. (June 1976) never listened to guided tapes. "It guides you through a general example. Never listened to it much either, two or three times only". "In the third term there were only three tutorials". R.M. ended up with all three detailed tapes to do the week before the exam. But he had the three tapes, so it did not worry him too much. He spent two or three days before the final package test just doing 'Design'. P.P. (January 1977) noted that most students just forgot about the guided tapes and tried to do the problems themselves. "Very often they did not succeed, because the problems were very tough. So you just listened to that solution tape (detailed tape) and went on solving them and trying to understand. The tape with the solutions was very detailed. The lectures and handouts were very condensed. And Design is difficult, there are so many codes of practice, that you can easily go wrong when you do the tutorials".

Many students just took the detailed tapes and went through the solution and never really attempted the questions on their own.

As indicated in Chapter 6, the detailed solutions of the lecturer, which were more neat and convincing, made the learning material more threatening and more difficult to assimilate. The students opted for an easy way to cope with this learning task i.e. listen to the detailed solutions. But there was a price to be paid.

B.T., a graduate student (1975-76) noted: "You are just going over it. And when the exam comes, the position is O.K. - you have done the tutorials, but you have not attempted any questions. You may not pass the exam without the help of detailed tapes". So he stayed away from it, and did the questions himself before listening to the tape. A.N. (2nd term, week 6, 1973-74) thought that the tapes were an advantage - he took things very steadily, you could immediately stop and go back if you didn't understand a point. "If you don't understand you can go and see him, but it usually works very well, just with the tapes".

The researcher asked students if listening to the detailed tapes represented any challenge to them and if it required them to think when studying the material. He also enquired if they saw any other advantages in this teaching method.

A.N. (1973-74) replied: "You can stop and think, or just see what is happening. You have your notes in front of you, you can look up equations and see where he gets things". But "He might be just sort of feeding you information, rather than you thinking about it, and try and find out for ourselves. We might learn to understand it a bit better". O.D. (1973-74) noted that people get a personal touch from hearing a voice rather than looking up a book. But he thinks you get a limited answer". No bits and pieces thrown in, as when reading a book. "When you are reading a book you have got to select it yourself". "In Kurasini Building, the limited answer is there for you, you do not have to work for it."

Researcher: "Do students have to listen to the summary and detailed tapes?"

O.D. (1973-74): "The lectures are such that you are

almost forced to come down here and listen to the tapes if you want to solve the tutorial questions". The alternative is the library. "It is much easier to come down here and be spoon-fed by the tapes". "By spoon-fed I mean its given to you". "Certain things are missed out in the lectures, don't know if it is deliberate, maybe he remembers things as an afterthought, but you have to go to the tapes to get them". He had not used the tapes since the first package test. Then he was relying on them heavily, and decided this was a bad thing. Dr. Curr made it sound so easy. In his lectures, he came in and put down the details - "This is how you design something". He also said why, but that was of secondary importance. "But I believe that should be the primary need of the lecture - to tell you why you do something ... If you know why you should be able to design a way how to". Now he uses books, finding out why, trying to work towards Dr. Curr's idea of doing it, using the books.

S.J. (1975-76): "You had to listen to details and be guided because there were wee points on the tapes which weren't covered in the lectures". "And so, to a certain extent, you were blackmailed into it. Some people didn't use them and it later backfired a wee bit".

B.T. (a graduate student who experienced the Learning Unit in session 1973-74), recalled: "You know Dr. Curr always tends to digress a little, and he would come up with two or three additional facts which might not be relevant, but you would think at the time that they might be useful, or he might be hinting at something".

A good example of cue-consciousness.

M.J. (a graduate student who experienced the Learning Unit in session 1971-72) noted: "You get the tutorial problem sheet handed out during the lecture period, and you do this, and if you have any problems you go to the tape. Even if you don't have any problems its worthwhile to see, because in 'Design' there's no one way in which a problem can be tackled, generally" He went on to say that

he did the question himself at the beginning but he found that it was a bit difficult, because you wasted a lot of time thinking about things you were not sure of. He found it was better if he tackled the tutorial with the answers.

O.D. (1973-74) recalled that his third year was the only year in which they had to think for themselves, but even then they were kept within strict bounds. "We've got a time factor, and thinking at the moment is a luxury".

One of the most valuable features of the research method adopted in this thesis is that it gave the students a chance to speak freely and candidly about their experiences. In the quotations below, students justify their behaviour in using the tapes the way they did.

A.N. (1973-74) repeated the reservations about 'thinking' but considered that it was minor. "If you had to battle through the tutorial you would appreciate it more. But there's so much other work. There is not time to attempt the tutorial, so you just go in and he is feeding you, he is taking you through the process. Its just like he was doing the questions for you, you know? So you're not really thinking in that respect. But I find that I probably understand it once I've seen how its done". "If you come up against a different sort of question though, you might be lost. Because you have done it through his way and performed the rules of that one question, and there could perhaps be similar questions that you might not be able to do". But still he supported the method wholeheartedly because "he is giving so much stuff. You would not get through the subject in any other way".

M.B. (as graduate student, February 1974), who experienced the Learning Unit's audio-tutorials in its 'infancy' recalled that they were told at the time that the student could work at his own rate. But when they did it, they could not work at their own rate really, they had to work at the rate at which the tape was recorded. They were allotted one hour only and needed much more time. "You do think when listening to the tapes, in respect of particular problems. You don't just sit and accept everything. You are doing a certain amount of

thinking".

But he did not find the system suited himself. He preferred the normal tutorial where "if you asked a lecturer about a problem, he would ask you a question to force the information out of you. A tape can't do that". He went on to contrast the normal tutorial session with his experience with the use of audio-tutorials. You could sit and think when you had a tape, but if there was no-one around immediately to ask what you were thinking about, it would just go out of your mind - you would dismiss it. In traditional tutorials, the lecturer could hint at the answer or ask you a question to make you think for yourself more.

Students had a variety of other comments about the tapes in general, as well as some more specific comments on why they took the tapes home.

S.J. (1975-76) noted that the "summary tapes were a big help". His plan was to read through his notes, then go through the summary, then go through notes and summary together, condensing notes to what he wanted. Then go through the problems. Here we have a good example of students' intentions. Starting with a fairly high level of initial organisation, S.J. clearly intended to seek a full understanding of the course material, thus displaying what, elsewhere, has been called a "deep approach to learning". His superior end of session results supports this interpretation.

This is one indication of why students differed both in the way they used the tapes and in their evaluations of their utility. Had it been possible, in a more systematic way, to identify the intentions of the students in relation to the learning material, it would have been possible to explore this relationship more thoroughly. As it was the suggestion emerged only from subsequent literature and in the analysis of the data.

Generally the benefits of the tapes were seen as making life easier for the students implying a surface or surface strategic approach being dominant.

M.K. (1973-74) noted that "Tapes are quite helpful, because if you do not understand the work, you can take them home and listen twice, three times, as often as you want". "And every time his voice will tell you how to do it". Other students introduced several other reasons.

B.T. (1975-76) preferred to study on his own. He preferred to attempt a tutorial on his own, not with ten or eleven other students attempting it at the same time That was why he preferred to take the tapes home and study in his own time. Two students who lived in the same house decided to take the tapes home after doing badly in their package tests. R.M. (June 1976) recalled "In the last two terms, started taking the tapes home and working on them at home". This improved his exam marks a lot, but meant spending a lot more time than he would on a straight lecture course. And went on to say "Working at home together is valuable because you are both at the same stage at the same time, no need to disturb each other".

R.M. and J.S. (1975-76) noted that it was taking the tapes home that turned the tide, being able to spend longer on them. "It wasn't the same in the L.L. for some reason. In the L.L. one tended to pass over little bits that you're not sure of, can't discuss it. One feels isolated in booths". "Dr. Curr's idea was that you worked through the tape with him, through the detailed tape especially".

S.J. (1975-76) took all types of tapes home. He didn't particularly like working at home, because his cassette-recorder was part of a hi-fi system, and it was awkward to switch on and off, which he liked to do with summary tapes especially.

C.G. and R.V. (1974-75) used the tapes before doing the tutorial, stopping, writing, starting again. "The half-hour tape takes an hour". R.V. wrote his own solution sheet explanations because the detailed sheets were just figures. "You add explanations from the tapes".

P.P. (January 1977) viewed the detailed solutions tapes as an advantage. He did not listen much to the guided tape

but the detailing tape and the summary were very good. "He gave solutions that were very detailed. You were getting information that you wouldn't have got in an ordinary lecture, or from asking someone to explain a problem. And if you didn't understand a particular thing on the tape, you could go and ask him". On the other hand, students identified several disadvantages for the policy of taped-instruction.

S.J. (1975-76) thought that the disadvantages of the Kurasini Building would show up if there was a bad lecturer. "The system would flop". He thought it could be very boring listening to the tapes if "the wrong person is doing it". There are lecturers he could think of, who it just wouldn't suit - it would be boring.

D.B. (1975-76) noted that the people who did not like it would just say that they did not understand the tapes and it was a terrible way to teach people, and they would leave it at that. "He was always there, you just had to go and ask, but unfortunately the people who did not like the tapes, who mucked about with the piped solutions, would not go and tell him, and that is why he keeps doing it".

B.T. (1975-76). As a student he did not think about the advantages of the Kurasini Building. Did not cross his mind that there were any. It was just an entirely different system, and as they were getting examined on it they had "to conform to the style of teaching".

A number of students preferred normal tutorials, "where if you asked a lecturer about a problem, he would ask you a question to force the information out of you".

The content analysis of interviews with students and graduates over several sessions, some of their comments the reader has sampled, produced a number of likes (advantages) and dislikes (disadvantages) which, put in summary form, are:

- (i) Perceived freedoms in learning pace and place.
- (ii) Accessability for revision purposes.
- (iii) Effectiveness as an instruction method, for example, repetition of important points, the gradual and logical sequence of presentation, and the way it maintained the students' attention and concentration.

Our focus now is on the students experiences in the 'Drawing Office'.

7:5: The Drawing Office Exercise:

In the 1975-76 session the course documents indicated that "all students must satisfactorily complete the work of the course" which comprises amongst other requirements: a Drawing office exercise, a total of 64 hours (including the introduction) of which 52 hours must be submitted (ON TIME) and for an acceptable though not necessarily a pass standard".

The drawing office exercises, where the students worked in close proximity, presented a new working experience. The students were divided into small groups. The students' learning in these sessions was seen to consist in large measure of gaining 'experience' through their direct immersion in the reality of the civil engineer's 'design office', rather than the assimilation of 'academic' facts. As an introduction to each exercise students were asked, in their groups, to watch a tape-overhead introduction to the work they were required to do.

In the following sections, the nature of such 'experience' and of engineering 'reality' are explored. In these groups, students negotiated their common views on shared problems or debated their differences of opinion. There were opportunities for informal contact between them.

In seeking solutions to their common problems students generate what are referred to as "group perspectives" (Becker and associates, 1961; p.36), which are defined as "... modes of thought and action developed by a group which faces the same problematic situation. They are the customary ways members of the group think about such situations and act in them. They are the ways of thinking and acting which appear to group members as natural and legitimate ones to use in such situations".

Such 'perspectives' are of particular significance in relation to 'choice points' where previous knowledge and experience do not provide recipes for action; here members will negotiate their shared solutions to difficulties.

H.D., a graduate student (April 1974) remembered in the old drawing office system, there were about 60 students at Hammond Street building, and maybe three members of staff and two research students who were available to answer questions. The last few sessions were large classes - 80 or 90. The year before the move to Kurasini Building was the last one in which they were able to operate in one drawing office. In his days, the third year 'Design' was the old formal thing, three or four hours in the drawing office twice a week. You were very lucky indeed to see a member of staff. There were 50, 55 people. In the old system, the lecturer had to give the class the instructions for the drawing live, had to shout out to the class. The acoustics in some parts of the building were not very good. Quite a lot of people used to go away and do the work at home, just as well doing it where there was peace and quiet.

When the Kurasini Building became available, Dr. Curr developed the idea of splitting the class into groups of 12. These groups were 'matched' in some years, but in session 1974-75 G.H. (January 1975) remembered that Dr. Curr told them to hand in their names if they wanted to work with particular people. You would pick one person, and he would try to sort it out. But it was hardly worth it for pairs only. Working in pairs all the time would spoil the group work aspect. "I would like to be able to choose the rest of the people in the group that I was going to go into, rather than be plonked in a group of people maybe that I don't know, people that are different in outlook from myself that might be a lot older ..." The class was split into groups to make the best use of the small rooms at Kurasini Building, and that continued after moving to the new campus at Doha.

A.L. (May 1978) noted that the groups did the 'design drawings' in some sort of a rota. There were (at the Doha Campus) two viewing rooms and six groups. Two of the groups

would be using one viewing room, doing one drawing, two groups using another viewing room doing another drawing, and two groups who did not have a drawing to do that week.

The majority of students felt that Thursday (the day on the timetable for doing the drawing exercise) was a hard day. R.M. and J.G. (June 1976) noted that Thursday mornings were not the best mornings. "Every time you go, you feel it is going to be a hard day and it is". The pressure of time in the introductory session and the time limit set by the lecturers for finishing the drawing contributed to what one student described as "mental exhaustion".

As already mentioned, part of the new system involved an introduction to the work to be done using a tape/overhead system.

What happened at these introductory sessions?

Again we see that dependency developed, as students tried to take down everything on the overhead and yet still depended on the staff to explain difficulties.

B.T., a graduate student (1975-76) did not find the drawing introductions entirely satisfactory. "Because you would come in and be subjected to the tape-overhead, you get all these facts. You have never seen it before, or done anything like it in your life, and you get the tape-overhead with facts coming at you, boom, boom, boom. You had to take in all these facts, look at the problem, decide how to apply the facts to the problem. You had to just go right into it". It was very difficult and he didn't finish. His marks were hardly ever over 12-14 out of 20.

T.B. (1973-74) noted that most people took down exactly what was on the transparencies. There was a lot of detail on them which Dr. Curr went over quite quickly, because of which they always stopped so that everybody could copy down exactly what was up there, and they used to rewind and go over exactly what he said again. So virtually everything on the tape-overheads was written down, and if anyone did not understand a point, the tape was played over again. "So you were writing as fast as possible and at the same time trying to

listen to what he is saying. This all contributes to the impression of facts coming at you, and the state of 'mental exhaustion'. You know that within thirty minutes you have got to go upstairs and try to arrange all the facts into some sort of order, and present them on a piece of paper. Rather difficult".

After Easter, most of the drawings were in the morning, depending on timetable pressures, and there were seminars with Dr. McIntyre in the afternoons. You were too exhausted to give your complete attention to that.

B.M. (December 1973) thought that the preliminary tape-overheads were 'airy-fairy', and could definitely be improved upon. You had some idea about the problem when you went in, and you came out with it more confused in your mind. If, after listening to the tape two or three times, the students found it ambiguous, one of them went out, caught Dr. Curr, brought him down and asked him to explain to the class. He did this twice to Dr. Curr and once to Mr. Tyler (O.D. 1973-74). Students asked when the tape was unclear or ambiguous, or the lecturer was putting the material forward badly. "Might be left unsure about the problem he was doing and the way he was doing it, or why he was doing it that way. These are typical reasons for going to get the lecturer ". "There are also little things on the tapes which are not important enough to bother asking about, whereas if the lecturer was present, we could ask. You let these things go, thinking that you understand, or that it will come alright when I go upstairs". (O.D.1973-74).

Students needed the guidance of "Live" lecturers to sort out the problems they came across when dealing with the tape/overhead sequences.

Many students preferred to have the lecturer in the room to answer their questions. O.D. (1973-74) noted "You cannot ask a machine questions. All we can get out of that machine is as good as what Dr. Curr puts into it". Dr. Curr was on a different level from the class, he had done it all before and there were little problems which were important to them, but which he forgot about.

R.V. and C.G. (1974-75) noted that one criticism of Dr. Curr was that he came around too late, making suggestions about what you should or should not have done. There was one tape-slide introduction when he said he would come and see them right away, and they waited an hour. But he couldn't be everywhere at once. You needed someone around if you got stuck. This was the idea of Kurasini Building and there usually was someone around, though you were likely to have to hunt for them. With 18 people in fact they could have done with two members of staff around.

The same comments were repeated in sessions (1975-76) and (1977-78) when A.L. (May 1978) noted "Dr. Curr might be around, while the drawing office is going on, but there is nobody really in charge. Nobody has to sort of keep an eye on us all the time".

Here, one notes that the availability of the teaching staff was not always possible, although this was claimed by Dr. Curr himself earlier.

R.M. (1974-75) thought that it was too much listening to the tape and watching and drawing on your notes at the same time. He would rather have someone come and talk to them for an hour. "But obviously if there is so much going on, he can not talk to everybody at once".

C.J. (1974-75) felt drowsy in the tape-overhead when he wasn't writing. In C.J. and R.M.'s group (1974-75) they got ahead of the tape with the slides - one might turn out to be just a heading, so they put on two, and they were not really listening to the tape. You are just copying down, so you miss out a lot of it. You miss out on the main points".

S.J. (May 1976) remembered "At first I thought 'Gosh, you don't really remember much', because you come out after an hour and almost everybody was lost. Very rarely did anybody understand what was really wanted". His group did not tend to stop the tape to take down diagrams. "Now I myself found it a rush" to take down the slides/overheads.

At first the group wondered whether the tapes were good, because they were having to rush.

Students were assigned two-hour design exercises and these tended to follow on from each other. An example of these is to design base, beam and slab of a column. The calculations carried over from one drawing to the next. There were other times when the design exercise was one off, not related to anything else. An example of this was the bridge detail they did. But the splitting of the exercises into smaller designs with little reference to the totality of a design project did not find favour with some.

R.M. (June, 1976) noted that "What gets me is that you design little bits of a structure, but never a whole thing from start to finish. It is difficult to visualise what you are doing. You design one beam. But in an office, how do you analyse the structure to get the condition for one beam? That is bad. There should be a design where you start from scratch".

If somebody wanted them to build 40-storey flats, they would not have a clue where to start, "but there must be some things that they do from start to finish".

The introduction gave a general, not a particular, method. "In the office you get a particular example that he wants you to study, you just apply the general formulae. But it does not always work". (R.M. and J.S., June 1976).

Students moving to the next stage of the exercise, that is the production of the drawing itself were faced with a number of problems which can be stated in summary form as:

Firstly: time-limit. B.T. (1975-76) noted "there was a time-limit, and you could not ponder over a point for too long". G.M. (1974-75) noted "In an engineering office you would come back to finish in the morning. At Kurasini Building you have to finish at 5 and hand in the work".

Secondly: marker's expectations. O.D. (1973-74) was upset because of the "inconsistencies in the expectations of the markers. One wants a detail one way, one wants it another way. In an office there would be a detailing book".

Students 'group perspectives' and coping strategies are best illustrated by the 'drawing Office experience'. T.B. (1973-74) would begin by trying to relate the facts to the problem and decide how he was going to present the facts in the drawing. There was always a lot of co-operation amongst students in his group. P.P. (January, 1977) remembered "First you see if there are any calculations, if there are, you do them. So we are allowed to talk to each other and compare calculations as we go along. This goes on a lot". In his group especially, there was one man who had been a draughtsman, so he always knew how to do it. Doing the calculations took up the greater part of the time, and usually you didn't have time to ink in the drawing. The proportion of time spent on calculation depends on the exercise. In a 4-hour exercise, it could be two hours. The drawings were different. They were drawn to different scales and those who drew quickly managed to get in more detail. There could be a lot of variations in the way the information is conveyed. If you got stuck you could ask the nearest member of staff. But usually you asked your friends first depending on how much work they had done". He went on to say "There is a lot of coming and going in the drawing office". Students co-operate and the drawings are the result of the co-operation amongst its members. T.B. (1973-74) noted that there was always a lot of co-operation amongst students in his group. If you gave information to someone who is a good draughtsman, who got the better mark? It was difficult to tell. There was one guy in his group who had a lot of drawing office experience, he was the top guy in the class at that time, and the group practically centred around him. So, Dr. Curr was presented with 10 very similar drawings. He knew this was going on, but how could he prevent it?

J.S. and R.M. (June, 1976) thought as a result of this 'co-operation' there were 'good' and 'bad' groups. J.S.'s group was a good group, two or three really bright guys in it who helped everybody else. In R.M.'s group there was a guy who came into the second year with an HND which helped him a lot, especially with drawing. Again, he benefitted

the whole group, because they were working together. In a group where everybody was getting low marks they tended to stay about that level.

M.K. (1973-74) and C.G. and R.V. (1974-75) noted that the groups doing the drawing first were at a disadvantage. The ones that did it afterwards could always come and ask them. But the drawings were staggered so that the same group was not the first all the time. In the first term of the 1975-76 session there were copies of drawings from the previous year with 20/20 or 17/20. Everybody tended to copy from these and take measurements from them. But in the second term, there were no drawings on show, so it was the group's own work. (J.S. May 1976).

The pressure of time produced a shift of emphasis in the production of the design drawing when J.S. and R.M. (June, 1976) noted that normally drawings consisted of a couple of pages of calculations before you draw it, and usually had about half an hour for the drawing. Most marks were gained on the calculations. G.M. (1974-75) commented that initially they were told that they would be pressed into drawing quickly, not spend hours writing on numbers etc. They wanted the drawing done and completed, not necessarily extremely tidy, because the drawings only going to be handed from the designer to the fellow that was going to build it. Now, provided it could be understood reasonably easily, there was no reason why it should be especially neat. "Enough to have it properly laid out, and follow procedures".

The pressure of time and the amount of detail and neatness of the drawings were rationalised in terms of outside 'engineering office practices'.

The students resented being time-pressed all the time. M.G. (January 1975) felt that he was never getting anything finished. He did not get the satisfaction of completing the drawing before the fellow said 'stop'. The lecturers felt that time was relevant in a drawing office, couldn't muck about - one had to keep at it all the time. They didn't want to produce people who could do lovely neat drawings in

three weeks whereas it would take someone else a couple of days to do it sufficiently well. "That is not the attitude".

Engineering office practice outside the university has been quoted in justification of the students' practice of the swopping of ideas. J.S. and R.M. (1975-76) commented that the argument was straight forward and valid. But if you put yourself in the position of working in an office, you would not just sit around when you had problems, you would ask somebody else. It helped you to be able to do that. It was fair if you had a couple of bright guys helping the whole group.

Nobody refused to supply information.

M.J. (1973-74) thought that the pressure applied in the third year drawings was necessary to give you a stimulus, as in drawing offices, where you were trained to be a fast, efficient draughtsman.

R.M. and J.S. (1975-76) thought that 'motivation' was provided in the drawing sessions by the time factor. They got quite a lot of satisfaction from getting a drawing finished within the time limit. "You like to get it finished. It puts you off when you have worked all day at a certain thing and then don't get it finished".

To deal with such sentiments, the lecturer of the course instituted what may be termed an 'Insurance Policy'. In session 1975-76, from the 60 hours of drawings, students were allowed to select the four best drawings from the first term and again in the second term and one from the third term. There were nine altogether. This accounted for 1/6 of the 'continuous assessment' mark.

In session 1974-75, C.G. and R.V. (June, 1975) thought that although you were time-pressed it was good because if you did not get a drawing finished, you still got good marks if you made an effort. "If you have been there for the two hours, and put in a bit of effort, you'll get a pass in it". "To fail, your drawings must be pretty bad".

In sessions 1973-74 and 1975-76, students voiced their doubts about being able to repeat the drawing office designs

which they had completed.

D.O. (April, 1974) noted "I am upset about the drawing system because you tend to come in here before a drawing exercise, you copy down however many slides he puts up, you go up and you do the drawing and the week after you could not do it again. It is just a matter of getting the drawing passed and getting as many marks out of 20 as possible".

S.J. (May, 1976) maintained that once they heard the tape and did the drawing, that was it forgotten about, because there was no time to absorb it. "And everybody went away and forgot it".

Many of these comments indicate that students felt, through time pressure, unable to engage with the material fully, they were forced to adopt surface approaches by the way in which the material was being presented.

7:6: The "Blend"

Now, one will turn one's focus on another feature of his degree course. Dr. Curr in his diagnosis of students' educational needs noted (1974):

"In the real life situation the graduate would never be independent or free or autonomous".
"On the contrary" he concluded, "he will never have to act truly independently since he will be constrained, advised, assisted or directed".
Hence, "It seems desirable that his course of study should call for him to make similar partly dependent decisions, in similar contexts, during his progress to intellectual maturity".

Dr. Curr translated this belief into what was known as the 'blend'. He admitted that in all years of the course much of the content was firmly prescribed. He warned that the syllabus was not divided by the staff into two distinct sections, labelled "essential" and "optional". The following section identifies students' reactions to the "enrichment

material" of the blend. It confirms the sentiment that students' intentions to maximise grades led them to systematically manage time, effort and study conditions to produce the greatest perceived "pay-off".

7:6:(i): Open-ended activities and 'enrichment material'

The Learning Unit had a tradition of supplementing the general lectures, audio-tutorial tapes and summary tapes with what was known as 'enrichment material'. The use and the value of these materials from the students' point of view is discussed in the section below.

S.J. (June, 1976) noted that they had 'enrichment material'. There was a couple of lectures on 'form work'. An hour T/overhead projection on wind, or maybe it was 1½/2 hours. That was self-enrichment, you were meant to go and find out stuff yourself, think about it, go and ask if you got stuck. There was a third activity which he couldn't recall as we did not look it up for the exam.

Self-enrichment material came into the last package test (four hour duration). At most it would normally be about 20% of the paper. And there would be a choice of questions so that you could do all of them if you wanted to, or better, specialise and do that particular point. "If you are wise, you will specialise". There was very little point in trying to do all of them, because if you were answering a question you would be expected to answer it fully. One gets the same marks for learning up one fully as for two or three. "That is the one place where you have a choice in the package test system".

J.S. and R.M. of the same session (June, 1976) noted that in these activities students watched slides, took notes down, copied what was on the slide. Then there was a tutorial. There was a detailed tape for it, but J.S. did not do it until the week before the exam, because there were rumours going around that there was going to be a question on it in the exam (wind loading). And a question did come up. There

were two or three weeks without drawing, when they got tape-slides on shuttering and a sort of general knowledge one, and one introducing the "Bruce Report" they had to write on at Christmas. Another week they had an hour to go to the 'welding shop'. It was just general knowledge they got when there was no drawing.

The tape-slides were available at any time afterwards if one wanted to go and have a personal showing. One of these enrichment materials was a 'civil engineering game' called 'Load'. The invention of this 'Game' had its historical roots.

In the early 1970's, Dr. Brand from 'Abbassia Polytechnic' produced a test where engineers were asked to sketch the shapes of bending-moment-diagrams without values. The emphasis in this test was on the 'qualitative' aspect of how structures behave. Normally the civil engineer is given figures for calculations (quantitative emphasis) to determine that behaviour. Dr. Curr collaborated frequently with Dr. Brand on this aspect of teaching the subject of what will be called here 'Bending-moment-diagrams'.

Students evaluated these activities in terms of gaining marks on the package tests.

P.P. (January 1977) remembered that two pairs competed against each other. When someone made a mistake the game was finished. He did not take it very seriously. As far as he knew they did not get marks for it, it was just for learning. On the other hand, M.J., a graduate student, (December 1974) noted that the 'Load' game was not only a good laugh, it was useful as well. It was a relaxation, a break after a hard day's work. The Learning Unit work was concentrated at times. In M.J.'s third year (session 1972-73) they had another activity - 'The Site Simulation'. It was amazing how people reacted to it. At one stage it almost came to blows, it was taken so seriously. When he went on site, just after, he found out how true the simulation was, how people bickered. It taught him a lot. Exactly the same on site.

In session 1974-75, students did experience the 'Load'

game, but the 'Simulation' exercise was cancelled due to shortage of staff, although enough names of students were put down to participate. M.G. (January, 1975) did not have a clue how to do the 'Load' game at the beginning, could have done it at the end. He did not want more games. It was good because it was unique.

C.G. and R.V. (May 1975) noted that they learned a little from it, not a lot. They thought it was not practical. In real life they would use calculations, work it out, not just look at it. But it gave you an understanding. It was competitive, a game, not really a learning situation.

Again, in these comments, the contrasting perceptions of innovator and students emerges very clearly.

The class of this session (1974-75) were shown a tape-slide sequence called 'Production of Concrete'. G.M. (January 1975) found that interesting. He could just sit back and look, not bother taking notes. A good change. Maybe see things twice to take notes the second time. He went in ready to take notes. The previous package had a tape-slide on 'wind loading', just like the 'concrete' one, go and watch it, no more said about it. Some people missed it because they had heard that it was boring. Then questions came up on it in the exam.

Once more, the influence of assessment requirements determined the students' judgement of the degree and direction of their efforts, this is evident when they judged the 'Report writing' exercise of their course work.

Part of the students' course work was to go to one of the meetings of the Institute of Civil Engineers during the year to write a report and hand it in. C.G. and R.V. (May 1975) thought that it did not carry any marks, it might help you if you were borderline. In R.V.'s experience, in the fifth package test paper, the second question where the student had to defend an argument about the design, there was an ICE lecture on it. He did not go. Those who did had a definite advantage. Question (1a) was similarly oriented. Every student had to go to an ICE lecture. He went to one on 'Traffic', but was not sure he would use that material.

Other course work activities related to practical work and here the abstract nature of the course can be detected, students preferred to have more concrete examples of what they studied. At the same time, they saw this practical work and the writing up of laboratory reports as competing with their valuable time. Time needed urgently to cope with the audio-tutorials.

7:6:(ii): The practical work:

M.B. (1973-74), a graduate student, noted that there was not enough practical work in the course, especially more needed in concrete. He believes they do that now. But if he had not been on site, he could have graduated without having known how reinforced cages were put up, in fact, how concrete was made. A very basic introduction in first year was the only knowledge of concrete. Now they do more practical in second and third year. B.M. (1973-74) hoped to have more laboratory sessions. "No concrete labs out at 'Kurasini Building' these days".

A.M. of the same class, noted that the tutorials were practical design exercises, but "we never see anything actually carried out". Dr. Curr tried to give theory and practicals in the form of labs where they saw the difficulties of making steel-reinforcement cages etc. But they did not get any on-site experience.

O.D. (1973-74) mentioned that laboratory sessions were explained to groups of 12 at Kurasini Building. The lecturer in charge gave a handout, experiment procedures, how to carry out the experiment. Then usually left to do it by themselves, unless very complicated experiment. M.K. (1973-74) thought that the purpose of the laboratory sessions was to see whether what they read was true or not. They had to write a report, for submission, with results and conclusions. This was course work which had to be completed.

O.D. (1973-74) complained that students were very disheartened because they thought they were overworked.

There was a lot of useless work - laboratories where you had to copy up theory from books, and it was given before. But he could see their point of view. The students had to be able to write reports. The work would be better spaced out if they had, for example, a course on report writing in the first year. "It sounds silly to teach English to undergraduates, but it is necessary". S.J. (May, 1976) noted that if he was falling behind in other subjects, he would tend to blame lab reports. "The laboratory reports took up more vital time".

Here we have another good example of management of time to achieve the maximum "pay-off".

7:7: Assessment in the Learning Unit:

Learning is a many-sided phenomenon. Just as there are many different things to learn about, so too are there different processes of learning and different outcomes. This section is mainly concerned with the assessment process of these outcomes. In considering this process one is reminded that this is dependent on the nature of the discipline, the curriculum content, the competencies required, the subject methods and its modes of enquiry and the kind of knowledge or other outcomes which are most prized. It will be important to recognize the direct effects these have on students' approaches to learning, and so what is ultimately understood and remembered.

The analysis of the Learning Unit assessment procedures will be clarified when the following analytical framework is adopted, this framework has been developed by careful study of students' responses to the researcher's questions and to a complex set of observations.

Assessment procedures do not operate in isolation, but within assessment contexts. The Learning Unit students knew who the examiner was and they were much closer to each other and to the examiner, a situation which has certain

implications as we shall see. Dimensions of the analytical framework are: Firstly, the assessment task complexity and the predictability of its requirements. Secondly, how important this assessment task is? i.e. students concern of the 'weight' given to the results of the task. Thirdly, the frequency of the assessment task or the task distribution over time and the strategies students adopted to cope with this change, and Fourthly, the time allowed to complete the assessment task and how this affected students' study strategies and the results of the assessment procedure. Finally, the students comment on the "fairness" or otherwise of the assessment procedure.

7:7:(a): The assessment task complexity and the predictability of its requirements:

Assessment tasks vary, and these are related to learning tasks, examples of the learning tasks expected to be performed by students were mentioned in Chapter 2. Simple tasks entail simple mental operations, examples, recalling information, formulae, performing computations and drawing diagrams. Other more complicated tasks demand multiple decisions, for example, about what information to select and include or how to organize and present a sustained argument. These can be thought of as involving decisions that are high-level and strategic.

Students' first source of information for the assessment task requirement is the Learning Unit documentation where 'the package test system' is presented in a very favourable light. This is examined in the following section.

7:7:(a)(i): Assessment: the Package Tests:

Course requirements of session 1975-76 indicated that "All students must qualify for a final mark which may be obtained from either (a) a degree examination in June (80

marks) plus a course work mark of two four-hour design exercises in the third term (20 marks).

Or (b) five 'package tests'. These were 'open-book' examinations. The duration of the 'open-book' exam was one hour for packages 1, 2, 3 and 4, while it was four hours for package 5.

Students were allowed 15 minutes at the beginning of the examination period to read the questions before they started writing their answers. Example of "Package Test 3, February 1976" is appendix 6-7.

The final mark of the package test was calculated as a percentage of: (i) the 'package test' mark, taken at roughly five week intervals, counting 100 marks each and (ii) the best returned drawing marks as follows:

Four each from terms 1 and 2.

One from term 3 - proportioned to give a total of 100 marks.

Students who opt for (b) do not preclude themselves from attempting (a) nor are they committed to complete (b).

Withdrawal from (b) may be made at any time. Marks of less than 40% will not normally be awarded under scheme (b)".

The package tests were given an increased element of importance when Dr. Curr tended to relate marks obtained in these tests to the anticipated performance of students at the end of the fourth year tests. This 'bench-mark' aspect is echoed here by B.T. (1975-76). Dr. Curr produced a list of results at the end of the year, and his average made Dr. Curr think that he would get a third class Honours.

This practice has been a constant feature of the Learning Unit practices in the form of an 'analysis of results and general observations' after each package test has been marked. (See Appendix 7-1 and 7-2).

Some students saw the division of the assessment requirements over the whole session as an advantage.

B.T., a graduate student, (session 1975-76) noted that the 'continuous assessment' aspect of the Learning Unit experience was great. "You had only to swot up five weeks' lectures. Once you had sat the exam, that was it. You were

not being examined on a whole year's work. You did not have to drum so many facts into your head as you normally would". But what was expected of the students?

One way of identifying the assessment task complexity and students prediction of its requirements can be gleaned from their preparation for these examinations and their perceptions of the 'package test' questions. Here, students' strategic approaches are most evident when numerical questions were preferred to "essay type" questions, and the challenge to students' intellectual faculties was kept to a minimum, since most of the questions were similar to the "detailed tutorial problems".

7:7:(a)(ii): The 'package test' questions:

"The package test questions were familiar in that you can only cover so much in five weeks, and the questions must be similar because they relate to certain parts of the course. But the exam questions were always varied in such a way that you had to know exactly what you are doing". M.J. (graduate student, 1973-74).

Students agreed about the limited scope of the questions, while the undergraduates could identify the closeness of the examination questions to their audio-tutorials.

The exam problems were "very similar to the tutorial questions" B.M. (1973-74). Students preferred 'calculation' questions rather than 'essay type' ones and had some reservations about 'tricky' questions.

G.M. (January, 1975), a third year student, noted that "After the last test (second package test), Dr. Curr gave a handout saying that a fair amount of the questions were descriptive, and most had been dealt with in tutorials or class work and there was only one completely new question". He said the last test was a bad one. He did not know why - probably people were expecting arithmetical questions rather than descriptive ones. Dr. Curr said something like "There has not been such a massacre since Glencoe ..."

R.V. and C.G. (May, 1975) preferred calculation questions because students were not used to essay ones, they were not used to having to express themselves in writing. They tend to be long-winded, not precise. They thought that 'descriptive questions' "would be good for a student with a good civil engineering sense, an insight into what happens on site, who is not good at maths. He might pick up marks". It is good that they have to do this writing in English because they do not do it often. "Not very many of us can put two sentences together". They had the Institute of Civil Engineering report to write and essays on other subjects.

Reviewing the fifth package test paper (time allowed was four hours) which R.M. and J.G. (May, 1975) had just completed, they noted that five questions were straightforward, one was tricky, one a bit tricky and one "with several ways to do it".

M.G. (1974-75) noted that Dr. Curr liked to put the odd trick question in, to catch people not reading the question properly - caught M.G. in the last paper - electric crane became hand crane. He could not remember actual tricks, because he missed them, "I fall for his tricks, and you do not see them. Even looking over it afterwards". "You have to be wary". "He is the kind of person that would put in questions like that".

Students' preparation for these tests identify how much the perceived assessment requirements can influence students learning tasks and the management of their time and effort.

O.D. (session 1973-74) thought that the first package test was from work of first four weeks. Second was from work of the second four weeks. Third package test was from first four weeks of second term. The next will be for the whole term. The first and second package test marks produced a major change in the way the students studied for their 'package tests'.

R.V. (May, 1975) changed his method of study because

of the low package test mark. He was just above the borderline in the first test. He had no worries. Then in the second test he had a low mark. He gave the reason for this as "I did not write out solution sheets at first. I just took the sheet, listened to the tape and said 'fine'. In the exam the solution sheet was in front of him, but "I could not see why the lecturer was doing things". In the next exam, he had explanations in front of him.

This is a clear and good example of the influence the learning material (i.e. the detailed solutions) had on students' learning strategy. Just listening to the solutions performed by the lecturer produced "surface learning" and the student had to adopt a new strategy for his study.

C.G. and R.V. (May, 1975) were interviewed together after they had done their fifth 'package test', hence the researcher enquired about their revision strategy for exams. C.G. used notes, looked at first topic and did the tutorial question, he made sure he knew how and why Dr. Curr did them. Maybe try them, get stuck half-way, then look at solutions. After finishing tutorial, he started on last year's paper. This was the night before. He did this for every subject. Dr. Curr stressed in his lectures what was important. Skimmed some bits, but laid down the law at others, made sure he had gone over it. You picked up hints here and there. R.V. did not use solution sheets - rewrote them, giving explanations etc., all the way through. So he had the explanation of why each thing was done, when the exam came. When revising he went straight through tapes and just sat and listened to the processes, picking up little things. "But the first time, there are always things you are not sure of, one listens over again".

There are several aspects of C.G.'s strategy worth noting here. Firstly, dependence on teaching staff i.e. recorded solutions by Dr. Curr to reach some understanding of the problem solutions and use of formulae. Secondly, emphasis on "question spotting" or being 'cue-conscious', by following the lecturer's methods and his style of where

the emphasis is laid and when to "skimm some bits". Thirdly, the need for substantial time to listen, try the solution, identify errors made, listen again and re-write solutions with explanations of why and what is going on in these tutorials.

Other students went even further where they would select the formulae used by the lecturer and ignore the rest. Example of which is: G.M. (January, 1975) went over tutorials, did them all, and read notes. He rated the pieces questioned in the tutorials as the bits that were especially important. If there was a list of formulae and only half were used in the tutorial "I won't bother with the rest much".

B.M. (session 1973-74) thought that the exam problems were very similar to tutorial questions. He revised by going through tutorials for bits you were not sure of, maybe took out the tape, which was just a detailed description of the lecturer's methods of the course, step by step. "And you learn how to do it almost parrot fashion, get it drummed into you".

It is evident from the last quotes that some students were intent on a reproductive conception of learning and therefore emphasized the efficient transfer of the knowledge of the subject matter in simple language without major intellectual demands.

But we have already seen, in relation to the audio tutorials, that other students who were intent on seeking understanding took a different course of action when they used the learning material to emphasize personal meaning. One of these students is A.M. (session 1973-74) who noted that you tried to identify the important bits from what the lecturer said. "It is not so much identification as correlation with the lecture and the tutorial, trying to relate everything he says so that you know what is going on, so that you can understand the subject completely." "I feel that with these audio-tutorials and these 'package tests', you have got to know the subject absolutely perfectly, or you do not pass the 'package test'".

Other students displayed a "strategic approach", where the intention was to maximise grades. One is reminded that the problem either in the tutorial or the package test is not an isolated event, it comes after a certain lecture and is likely to relate to it. But the Learning Unit students see these problems not in terms of civil engineering content, but in terms of the teacher setting this question. Each student, in different ways, relates the problem to its educational context; the lecture, the lecturer, the solutions on the detailed tapes. Here is a good example of how students evaluate their solution not within the terms of the problem alone, but in relation to other aspects of its context.

O.D. (1973-74) thought that the important bits were what Dr. Curr stressed in the lecture notes or anywhere else. Whatever went on the board was important. And whatever they gave you questions on in tutorials - if you could do them, you would pass the exam. Occasionally questions thrown in which asked you to think about the problem rather than remember past problems. But most of first and second year exams just wanted to make sure you could go through the motions, solve the mathematics.

Other students displayed "Cue-deafness".

K.M. (June, 1974) noted that it was very difficult to say which topics were important for the exam, because unless you covered the whole syllabus, you couldn't pass. You had to work out the tutorials and that meant you had to know the theory behind each tutorial. And material was carried over from one lecture and tutorial to the next. You had to find out how to do the questions, go and see the lecturer because it was very chancy to rely on looking up stock problems in the exam.

Now we move on to the second dimension of this analysis.

7:7:(b): Students' concern of the "weight" given to the results of the 'package test':

Students emphasised that their attitudes towards the Learning Unit depended very much on their examination performance.

R.M. (June, 1976) mentioned that with low marks in the first two packages, he felt the pressure really on before the fourth and fifth packages, so probably his attitude would have been more critical then. But Dr. Curr used all possible means to 'sell' the system to students.

O.D. (February, 1974) noted that continuous assessment was a way of getting a lot of work out of the students. "We do not have to do the continuous assessment, but it is presented to you very attractively at the beginning of the year." Without it, there were six exams in May or June, with it there were only four, assuming you got exemptions. "But at the beginning, no-one realises the amount of work you have to do in it. It is depressing quite a few of the class who have had it now".

A.M. (1973-74) and M.K. (same session) observed that you had to pass either the five package tests (20% drawings mark and 80% tests) or the June exam but, "you have got to know everything in the course to get through the tests". B.M. (1973-74) noted that "at the end of the course you have to be good in every part of the course to pass. You cannot revise only three or four topics for the final exam".

The results of the 'continuous assessment' were not taken lightly. Students believed it had a certain role to play in their chances of getting into the Honours stream. Some students made up their future choice of subjects for the fourth year in accordance with their performance in 'Design'.

A.N. (1973-74) thought that the continuous assessment was sorting out the Honours material from the Ordinary.

C.G. and R.V. (May, 1975) indicated that everybody wanted to get into Honours, but everybody thought they would not make it, because you had no idea. If the wrong questions came up, too bad. C.G. felt that he would not make Honours because

of the bad mark in package two. It was getting him down. At the time he thought - "Oh, I won't make it now". R.V. did not expect to get in either, but it did not bother him unduly. Some firms only offered one hundred pounds (£100) a year more to Honours graduates. It did not seem to matter too much in Civil Engineering. "You are quite happy to get a degree, Honours is a bonus".

C.G. and R.V. (May, 1975) mentioned that a lot of people did not take 'design' in the fourth year. That is because it is not Dr. Curr who takes it. It is back to the old-fashioned lectures. He would do it if it was the same as third year. Lots of people said the same. If it was Dr. Curr he would know for a start that he would pass the exam. And he would learn something.

J.S. and R.M. (June, 1976), thought that 'Design' the next year was with a different lecturer who used a different code from Dr. Curr, who used the latest code.

J.S. (June, 1976), decided what subjects he was going to do without reference to the lecturer taking it. Next year he was doing 'Theory of Structures', 'Soil Mechanics', 'Hydraulics', and 'Computation'. This was the most general course. Any other subjects meant specialising too much in one field, not desirable in present job climate. He needed a course acceptable to any employer. J.S. thought the course they had chosen was biased towards working in a design office, which was what he wanted to do. R.V.'s idea of a civil engineer was someone who designs. Here one notes the relative importance of doing well on the 'package test', since it might determine entry into Honours or it might determine the subject choice of the following year and the choice of future careers. In recent years, there has been a trend towards increasing the weight given to course work done during the year, as indeed the Learning Unit did. What did the students have to say for and against continuous assessment from their point of view?

7:7:(c): Assessment tasks and their distribution over the whole session: (continuous assessment):

Students viewed the advantages of the 'continuous assessment' system in terms of their immediate concern, saving time for study of other subjects towards the end of the session, and as a useful mechanism to cope with the 'burden' of the course content.

J.S. (1975-76) indicated that you accepted the continuous assessment aspect in 'design' because, "Design is a difficult subject". B.M. (1973-74) noted that the amount of work they had to prepare for final exams in 'design' would be 'phenomenal' if you opted out of the continuous assessment system. Continuous assessment however, meant working throughout the year. They were (in session 1975-76) continuously assessed for 'Theory of Structure' as well. J.S. and R.M. did not spend as much time on that. Three exams in 'Theory of Structure' five in 'Design' R.M. "Spent the same amount of time before both kinds, one being a third of the year's work and the other a fifth. 'Design' is a really heavy subject, an exceptional subject, one can't talk about it in general terms". A.N. (session 1973-74) thought that it was not good to have too much work, there was no point when students couldn't keep up, it was self-defeating. "But the course gives all the basic learning for your career".

A.M. (1973-74) benefitted from continuous assessment in final term, when everything was at panic stations for the exam. "It eases the tension a little bit, not much". B.T. (a graduate student interviewed in session 1975-76) thought that after the fifth package test, one examination paper was over and you would catch up for the other four exams, you knew how well you had to do in the other exams, how much effort you had to put in, say to get into Honours. You did manage to catch up.

R.M. and J.S. (May, 1976), thought after they had finished all their package tests, that it was a good system, made you work the whole way through term.

On the other hand, continuous assessment did represent

some other problems.

G.D. (week six, second term 1973-74) complained that continuous assessment, especially the five week package test, discouraged you from reading books. The package test was always there. The first week of term, you did not work because you were settling in, so the second week you had a double work load. In the third and fourth weeks you were thinking about the test, and in the fifth week it was on you. It was worse at the end of term when there was a Theory exam as well.

R.W. (1975-76) would not at all like to have all subjects tested that way. Too much pressure throughout the year. Like having June exams all year. "It would be okay if the week's work was tested each week, no revision would be needed".

R.W. comment reminds us of an image of a 'conveyor belt' where students are offered a broad conspectus of specialized knowledge but no first hand experience in acquiring it.

Furthermore, the continuous assessment in the Learning Unit did have an influence on students strategy for learning other subjects.

Here we have a very good example of teaching staffs' competition for students time.

Researcher: "Did you work for 'continuous assessment' at the expense of other subjects?"

B.T. (1975-76) noted, obviously, you prepared for any exam. Some people tended to fall behind when there was only an exam every term or two terms. The work for other subjects was pushed into the background. Your other work did suffer.

M.J. (graduate student, session 1973-74) recalled that "half-way through his first term in the third year, people were missing lectures to study for the first package test, and other members of staff got annoyed because half the class did not turn up. For one lecture only three or four turned up. The lecturer refused to give that particular lecture again. It got his back up. The lecturer for that particular subject tried to get continuous assessment stopped. He tried to get

the course stopped at one stage, when he was upset about the students missing his lecture. The class felt so strongly about it, that they got up a petition saying that they believed that continuous assessment and the learning programme should continue. They apologised for missing his lecture and insisted that no steps should be taken to stop the work going on at Kurasini Building. That was in 1972".

J.S. and R.M. (1975-76) noted that continuous assessment took a lot of time away from other subjects, especially the tests in the middle of the terms. They had to devote a whole week at least to the test, falling a week behind on other subjects. S.J. of the same class supposed it did have an effect on marks in other subjects. You did not work on them so much, you did not spend so much time on them as you would normally otherwise have done.

Some other students believed that continuous assessment provided a more valid basis for staff judgements concerning their capability, but with a reservation. Example of this is:

S.J. (1976) thought that it showed up well if you were consistent. But it was bad for those who did not do any work till the end of term. But if you had one bad package it was 1/6 of your mark. It could pull you down quite a bit. But you were not under the same pressure in the last couple of packages if you passed relatively quickly, so you had to push yourself not to lose ground.

In the following section, one will discuss the dimension of the time limit for completion of the assessment task.

7:7:(c) (ii): Package test task time and its limitation:

The one hour aspect of the package test was very unpopular with most of the students.

M.J. (1973-74) thought that the exam was a bit hectic. He was not used to the one hour situation. He made mistakes, it was unrepresentative of his ability. B.T. (a graduate student, 1975-76) noted that everybody handled the time

aspect wrongly. You had one hour to do the questions. It was very difficult. Making the exam open-book was not really all that helpful, because you had to look at the questions, decide how to do them and go at it right there and then, or else you would lose valuable time. Everybody found the one hour exam very unsatisfactory, you did not answer the question as well as you would have done with more time. "Working under a strict time-limit might not reflect your ability to pass the exam". S.J. (1975-76) thought the time aspect will not allow any "thinking" to take place. "Thinking is a luxury in any exam. If you want to do really well in an exam, a lot of the time its just stuff pouring out. It must come out automatically. But if you do not think about the Kurasini Building stuff while you are getting it, you won't properly understand it, and that will show you up in the test". B.D. (1975-76), a fourth year student, remembered there was continuous assessment, an exam every half term, just one hour. "If you got bogged down with one question, you had absolutely had it. There were people scoring ten marks". R.M. and J.S. (1975-76) thought that the exams were very much for the person who was fast. "In the first two terms they had a small calculator where you had to push a lot of function buttons to get a sine or cosine. That was pretty slow, so they got new calculators with single button functions, that speeded the work up, and the marks definitely rose. That was unfair because the standard of calculator you have affects the speed you can work at".

Students were allowed to take in notes and books into the examination hall in what is known as 'Open Book Examination'. Students' comments on the presence of these books were very illuminating.

B.M. (1973-74) noted: "All that open-book implies is that you do not have to learn formulae parrot-fashion. You have got to know how to do it, there is only one hour". B.T. (1875-76) said that Dr. Curr stressed that it was open-book, but that did not matter at all. "You have got to know everything that is in the book before-hand". He would

normally prepare as for a normal exam, i.e. memorize all the formulae, methods etc. He only relied on the book if his memory failed as it often did.

B.T. (session 1975-76), a graduate student interviewed after graduation, thought that although everybody was working within the same time-limit as you, your reaction to working under a strict time-limit might not reflect your ability to pass the exam. It did not for him. Dr. Curr produced a list of results at the end of the year, and his average made Dr. Curr think that he would get a third class Honours. In fact, he got a First. So the design was not entirely successful for him. The reason was that, apart from the tutorial detailed tapes, the system did not agree with him. He was used to exams with five questions and half an hour to do each which was usually adequate. But he was put in a situation where the time was really tight and you had to answer the questions in half the time you normally would. The system reflected on his mark. It turned out to be his worst mark. The 'bench-mark' list Dr. Curr produced at the end of that year was nothing like the final list at the end of the fourth year. He guessed that it was indication of the lack of appeal to the majority of students. He did not know if he produced similar lists in subsequent years. It could not have been further from the truth, it was entirely wrong. There were people changing from his 1st to 3rd as well. One guy who was down for a second got an ordinary, which was quite a big jump. That was one thing he disliked about it.

The fourth year (final) mark was based on six final exams, plus thesis. But, if you were a borderline case, your third year marks would come into it.

Different students objected to the one hour examination. This was put to Dr. Curr, who said that the last (fifth) package-test would reflect that the complaints were not fully justified (see below).

The students complaints about the shortage of time in the package-test were met by a number of measures which can be described by the researcher as 'Insurance Policies'. In the

section below, the perceptions of the students of these 'policies' will be explored.

(1) Scaling of marks:

J.S. and R.M. (June, 1976) thought that scaling was fair enough. If the top 15 papers average 42, Dr. Curr would mark out of 42. The mark of R.M. jumped a good 10% and Dr. Curr said that he had set them too much in the first hour. "If the top 15 men in the class could not complete the paper, then the paper was too hard, should be scaled up. It was quite fair".

C.G. and R.V. (May, 1975) liked the system of scaling the lower marks up and the higher marks down. "It means the spread of the marks is not so large". R.V. gained 6% two exams ago. C.G. had 23% in one package, a really bad mark, but Dr. Curr told him not to worry, he had just had an unlucky exam, not to change his technique in answering the questions. When the drawing mark was added in, he had 28%, much more acceptable. But he blamed the system for his low exam mark.

S.J. (May, 1976) thought that the upgrading of marks was necessary to "show a proper spread".

(2) (a) Post-examination comments: Feedback

J.S. and R.M. (June, 1976), noted that Dr. Curr made comments after some package tests (see above). "It helped to make you apply yourself to the system. I began to know what Dr. Curr was after in the one hour, and if you did not produce that, you would just keep on doing the same sort of thing. It was useful for seeing where you go wrong. Your method of doing the exam is where you go wrong. No-one else produces comments".

This is another example of students' learning strategy being determined by the learning context where they are here, literally, reading between the lines and interpreting

the lecturer's behaviour.

The 'feed back' served another purpose, this time the lecturer's intentions, since he was the main client of the exercise.

Appendix 7-2 compares 'Package 2 test with Package 1' and comments on the change in distribution of the marks.

A policy Dr. Curr has executed enthusiastically to achieve a shift in the distribution of package test marks. Other aspects of the 'insurance policies' i.e. the 'Positive Moderation' practices is discussed below:

(3): The 'Positive Moderation' practice

The Learning Unit notice board carried a statement in May, 1976, after the fifth package test had been marked which indicated a change in course requirements, it read:

"CIII Design of Structures:

Course Requirements:

Following discussions with Professor Young, I have decided to apply the following modification to the requirements which were issued to you in a handout at the beginning of the session:

- (1) Marks of 35% and over will be awarded under the continuous assessment scheme, and students gaining over 35% need not take the degree exam. Never the less the pass mark, taken as an individual rather than a compensatory pass is still 40%.
- (2) A moderation mark, based on the written reports and extra tests (the best 3 of 4) will be applied as follows:

Final continuous assessment mark =

Package scheme mark (percent) Plus moderation mark
(out of 10) minus Package scheme mark (out of 10).

i.e. Package scheme mark 40%.

Moderation mark 8/10.

Final continuous assessment mark = 40+ (8-4)
= 44%

J. Curr

J.S. and R.M. (June, 1976) could not see the point of the 'positive moderation' exercise. Dr. Curr was under the impression in the first two terms that the marks were not good enough, or something, so he was prepared to scale the actual exam marks up. He also gave them an extra chance by giving them three or four small tests on a Thursday. If you did really well, final marks could go up. J's went up 5%. "I could not really see the point of that. I don't know. It was sort of an admission that he thought the course was too hard". "He seemed to be bending over backwards to let everybody pass". Two of the tests were very simple, everyone should have got full marks. The other two were a lot harder. Dr. Curr said he was taking the best three marks and giving a mark out of 10. You had to add this mark in, you could not subtract it. One test was preceded by a video-tape, then right away a small exam. Nearly everybody got 9/10 or 10/10.

There was a handout with words missing, to be filled in, then a small test afterwards. About 20 minutes. Everybody finished it. The test was not really testing anything. It was straight after the learning material. A little bit silly.

Another one lasted an hour. Given a certain truss, they had to put on as many loads as possible to put a certain member in compression. Last one - he gave out four drawings that he had done, and they had to pick out the mistakes or add any information that was missing. It was really difficult, he could not really do it. He never saw the marks. He should have been able to do it, just the detailing which students had done in drawings before, but it was pretty difficult.

Fourth one was report written during Christmas holidays about a steel bridge. There was not much to it, just four or five sides and a couple of sketches.

They did not get the results of the small tests. Nobody asked. They knew before-hand that they would count towards the finals. It could push your mark up, but not bring it down.

S.J. (May, 1976) remembered that Dr. Curr gave the extra tests because he felt that the continuous assessment marks did not honestly reflect the capabilities of some students. Some might fail who did not deserve to. He said that it took time to get used to this kind of exam, and he felt that possibly a lot of it was his own fault, not coming across clearly to the student, rather than just the student himself not working hard enough. So he held three tests, and the fourth, the Bridge Report, which they did not know in advance was going to count. In fact Dr. Curr probably did not know it was going to count either. He felt that the three tests could be to some extent a reflection of the students' capabilities. It was strongly stressed that the results could not lower the over-all mark, but it would help you pass. "I think it was mainly to boost the student who was lagging behind and it was not entirely his own fault". Dr. Curr thought that if a student was really bad, he would do badly in the tests. It was to help the student who flopped once or twice. If you were a consistent 50-man then, by the law of averages, you should get 50 in the tests.

R.V. and C.G. (May, 1975) noted that they never really thought about the system, "because I think most of what you do there is oriented to passing the exam and that is it".

7:7: (d): The fifth Package Test

Students complained that the one-hour exam put people under pressure and that the final mark was not a fair reflection of their ability.

P.P. (January, 1977) interviewed in his fourth year, noted "So then Dr. Curr said that he would show them that time is not important, that the package tests really reflect

their true ability in the subject". And he proved that by giving a four-hour test where he claimed that the work to be done was equivalent to a one-hour test. "And that is not right at all. He gives you much, much more in a four-hour test, but in some funny way". Most students got lower marks, especially those who had got marks on the short tests. The very few who had 80 or 85 before now got 60 and 65. "The results were always swinging a lot". His results were 30, 55, 34, 45 and 60. There was no steady going. It was the same with people getting 80. Sometimes it was 60. S.J. (May, 1976) noted that a lot of people who had already passed the continuous assessment did not go in so well prepared for this exam, and also they thought they could read things up during the exam. But generally people thought that the paper was not a one-hour one. More time was needed. The researcher decided to reflect back to Dr. Curr some of the students comments on the shortage of time. This is detailed in the following section.

Dr. Curr defended keeping time short in the package tests in an interview with the researcher on 4th May, 1976, when he stated:

"There are two effects of the business of keeping time short. One is that if you are inefficient and if I harass you by allowing you very little time, then you may panic; you may be sickened of the subject; you may do extremely badly, and damage may be done which we can't retrieve. And that is a bad thing and in that sense its a tragedy that I put pressure on people in the third year; nevertheless, if they haven't been discovered to be efficient by the third year, then I feel they've got to start learning as soon as possible".

He noted that they might have had one or two students who would go through the year not doing very well in the subject because of shortage of time. He went on to point to the experience of the fifth package (time allowed is four hours) by saying:

"And when package five comes, usually these people discover that they don't do any better in class ranking order than they did in any of the other packages. In fact, normally they don't do any better numerically either. Suddenly you realise that the reason you can't do the questions is because you can't do the questions! Not because you didn't have enough time. Especially when its an open-book exam. And I think that is the saddest consequence of the whole thing. I don't quite know what one does about that".

Researcher: "Perhaps you destroy their confidence in the first four packages".

Dr. Curr: "Ouch, Do I?"

Researcher: "One might say so".

Dr. Curr: "Some of them, yes. I suppose I do. On the other hand, I give a lot of people confidence - I mean, I can think this year of three or four students who didn't do well in the first package, or perhaps the first two packages, and who are now doing well (May) and who are very proud of themselves, who know that they've fought a battle and won! ... The only way you can make sure that nobody has to fight a battle and lose is by not having any battles for them to fight! ... Yes, maybe some people break - not many - but on the other hand, we make some. There are, what 2, 3, 4 guys in the third year this year and they have emerged as men of stature, and they never were before".

It is interesting to note how Dr. Curr introduced a metaphor of education as a battlefield when challenged about the effects on students' self-confidence. Besides talking about fighting battles, he went on to describe 'making and breaking' new recruits, thus extending the military metaphor. But, as we have seen, students did not see such advantages in their experiences. To them the test created unfair pressures and the open-book did not alleviate their difficulties within those time pressures.

The question of the one-hour examination was settled after the Learning Unit moved to the new campus at Doha in session 1976-77. A.L. (May, 1978) noted that the package tests for session 1977-78 were all two-hours each apart from the last one. "Now the last one you were allowed four hours,

just to give you a chance not to be working against the clock". "I honestly think that the fifth package test was designed to take longer, although Dr. Curr claimed that it was a two-hour exam. I do not believe it could have been done in two hours".

Students concern with time pressure and what it creates is a concern for fairness. On the other hand, teaching staff concern for reliability of their tests is to increase the fairness of their exam. One is reminded that the most important single dimension lecturer should be looking for is the complexity of the intellectual operations required to perform the assessment task.

Two styles of assessment dominated the higher education scene in recent years. First, the personalized style of assessment where the teacher knows his students and tries to identify in them high level skills of co-ordination and analysis. He can also practice 'moderation', adjusting marks where he has reason to believe that students have been under psychological or physical strain or even where a particular paper or a series of papers may have a disproportionately negative effect for students.

This has been practiced by Dr. Curr as discussed.

The other style of assessment which strives after objectivity is known as bureaucratic style and is well represented by the MCQ's which operates in impersonal contexts.

Students in the Learning Unit accepted the package system, where they faced the same hurdles on equal footings, except when it came to assess their work in the Drawing Office where the element of "co-operation" was seen as "unfair" practice as detailed in the following section.

7:7:(e): Is the 'Learning Unit' assessment system 'fair'? - Students' perceptions

The time aspect had been mentioned by several students (see above) and in the context of the drawing office, the 'co-operation' aspect of the detailing of the drawings

attracted a number of comments when B.T. (1975-76) noted: "You are faced with the person who just comes and has a quick look, goes away and repeats it. There is nothing you can do about it. Everybody possesses the same information, but you have to interpret it". He did not know how Dr. Curr could find out, sometimes, who was copying and who was not. No doubt Dr. Curr knew that B.T.'s group copied from the top guy but couldn't tell how he would take this fact into consideration in marking. It would be difficult to differentiate. "In that respect, the drawing was pretty useless".

O.D. (February, 1974) thought that the class resented the fact that drawing made every Thursday an exam day. Those with drawing office experience got a better mark. "Its as simple as that". It might penalise certain people who wouldn't get into Honours when they should have. You felt that you could have got a job in a drawing office, but you needed money to carry on during the year so you did something else. 20% may not sound much, but it could make a difference to a borderline case. This leads us to students' evaluation of their experience of the L.U.

7:8: Students' evaluation of their learning experiences:

At this point, it may be useful to remind the reader of Dr. Curr's main objectives: First, he aimed to develop in students some level of competence and skill i.e. the bag of techniques one needs to function as an engineer. Second, the students need to understand what sort of problems the professional deals with and how to deal with them. Third, the student has got to become educationally self-sufficient; he must learn the basics efficiently and effectively. On the other hand, as noted above, students had a different set of questions they asked themselves. Examples of which are:

What is it that is being required of me in my academic work?

What do I myself want to get out of it?

How do I go about satisfying these demands?

What will happen to me if I succeed, or if I fail to meet them?

The researcher approached these questions through the students' evaluation of their experiences in the Learning Unit. The Learning Unit differed from the usual City University pattern, in conceptions of curriculum, of teaching, of learning, in the organization, procedures and in ways the staff related to students.

The Learning Unit constantly portrayed itself in its publications and in the media as being different from the normal programme.

How far were these differences perceived by the students and what did they have to say about the value of the learning experience? It was clear that anxiety about assessment outcomes was part and parcel of the students' everyday conversation - and that anxiety was deliberately used to foster effort. Students mentioned that one of the lecturers said, in the first year, "Have a look to your left, have a look to your right. One of the two people on either side of you will not get a degree".

Furthermore, tension had been building up before students arrived at the Learning Unit when S.J. (May, 1976) and R.M. and C.G. (May, 1975) noticed that students come into the third year to Kurasini Building with a feeling of awe passed down from the classes in front about how hard the Kurasini Building experience was. S.J. noted if you broke away from that at the beginning, you would learn to survive an awful lot quicker and better. Kurasini Building was a great idea as long as you kept your eye on things. Those who survived and discussed their problems with the researcher retained an idealistic view of engineering, even though they reoriented it in the direction of greater realism and adaptation to the role they envisaged for themselves. Here, one can contrast graduate students and undergraduates, and even identify a definite shift in students' views when interviewed towards the end of the session rather than at its beginning. Third year undergraduate students put their long-range perspectives aside and developed more pragmatic and specific perspectives which enabled them to deal with the problems posed by the demands of the here and now of the third year 'Design of structural elements' course. The evidence here can be traced to historical retrospective views of these students. But, let us look first at the views of a graduate student who was also taking part in the teaching activities of the L.U. when he contrasted and emphasized the long range perspective of producing a competent, well educated engineer.

H.D. interviewed in session 1973-74, remembered his first year (session 1965-66) when there were a couple of lectures. The year before he came to the City University, the engineers were still taught together by the Mechanical Engineering Professor, and the students did not like that, because they did not see the Civil Engineering staff. The following year there were lectures with "little bits of Civil Engineering thrown in", but very little compared to now. It was the third year before he was getting much Civil Engineering. You came into the third year and suddenly got the whole staff of the Civil Engineering department to teach you, and they

put forward all the subjects you had heard about, but were not quite sure what went on in them.

The main advantage of the Kurasini Building system now, is that you can cover a wide spectrum of subjects quite fully and well.

Researcher: "What prevented the department from teaching these things in first year before?"

M.B. (graduate student): "Don't know. Perhaps they thought the students couldn't handle it. What standards do you set in first year? It is difficult. One got to set one standard and stick to it. Dr. Curr has set a higher standard. It must just have been departmental policy at the time".

On the other hand, undergraduate students' emotional and attitudinal responses reflect the influence of immediate situational constraints in their learning experiences even when discussed on a historical dimension. This is another evidence of the concern of students to jump the immediate hurdle of assessment requirements.

D.O.: week 6, second term, 1973-74, remembered "We had a trial scheme. Twenty-four people were chosen out of the group in the first year. But that was resented by the rest of the class so it broke down. If everyone could not get it, none could get it. It was led by one or two of the mature students, I think". They did not like to see anyone getting more than them.

Researcher: "What made the class think they were deprived?"

D.O.: "Dr. Curr more than anything. He made things very clear, and the lecturer the others had muddled them up. Dr. Curr had more experience as a lecturer, he could put things across better to a class new to the subject".

The trial group were getting tutorials where you listen to a tape, if you have problems, and "If that does not satisfy you, ask Dr. Curr".

The rest thought that they were, well, they were being neglected. And their main argument was that everyone was

sitting the same exam therefore we should all be treated the same. It was stopped after a week.

The two groups which were included in their 'audio-tutorial' experiment were selected at random and were asked if they wanted to participate. The lecturer's idea was to have a control/experimental group, to "see how good or how bad it was". A.N., December, 1973.

The emphasis here is not on whether the student was a member of the experimental group or not but rather on the performance of the lecturer and the probability of understanding the material and grasping the relationship between the phenomenon and its context. Other students remembered their experience of the Learning Unit in terms of "boredom lessening facility".

M.J., a graduate student interviewed in session 1974-75, remembered that the Unit began in 1970-71, in his second year. There was a television programme followed by a multiple choice test, questions in sets of four. You had to decide what was the right answer then turn a knob on the panel in front of you, and if you were right a light came on. He missed out a year, then in his third year there was programmed learning handouts by which you taught yourself. There were drawing exercises, tape-slide sequences and such like. It began with little things. He did not know if this was part of it, but there were balsa wood models in second year and Dr. Curr got them to do research and gave ten minute lectures to the class. He thought these things were novel and he enjoyed them, and thought they were good ways to teach.

"It took away the boredom of formal lectures, made things more interesting and easier to learn".

Other students (G.M., January 1975) expressed the same sentiment when he noted: "It was different, some days you were very hard-pressed at K.B., but others were reasonably easy, could take your time. All morning Tuesday and Wednesday in one lecture hall at Hammond Street was terrible. It would be better even to walk down the stairs to another hall". The K.B. which housed the Learning Unit had a

specific architectural plan where it would be difficult to avoid all communication. Anybody entering the third floor should go through the "Drawing office". Added to that, the idea of dividing the class into groups to rotate in their uses of the L.U. facilities provided us with a new feature in the organisation of the learning experiences. These experiences had two sides to them, the professional/intellectual side as partitioned from the social/developmental. One way of examining the latter is to study students comments on their relationships and how it developed and also on what they perceived of the staff-student interactions. Students spent three years together in the Learning Unit milieu. What influence did this have on their relationship? Did they relate better or did they feel isolated?

R.M. and J.S. (June, 1976) remembered that the class did not communicate much within itself. In first and second years nobody wanted to be the class representative. The class was just too big. They got small groups forming within the class especially in earlier years. The communications were established in a 'social' activity.

S.J. (May, 1976) remembered that the barriers broke down during the second year. The breaking down of barriers was not due to the Kurasini Building, but to the Surveying Course (field course in Easter holidays) and the football. Prior to the football game it was a very cliquy class. It was the social thing that got them together.

The class was divided into groups from the first year. S.J. (May, 1976) thought that the groups succeeded in breaking down barriers within each group, from what he gathered, he did his first year the year previous to his class and had a year out. But it also encouraged cliques to form. People did not break out of their groups.

But since students can and do interact, they can share perspectives on their academic problems. They can arrive at definitions of their situation and give shared meanings to the people and contingencies they confront. Because they share definitions and meanings, they can develop co-ordinated

lines of action, acting together in ways that help them deal with their problems of academic work. Students' rationality in attempting to meet and satisfy the many demands made on them was well exemplified in the "Drawing office".

The drawing office exercises and the co-operation which went on there helped to cement these relations.

O.D. (1973-74) mentioned "It was an unwritten rule that if someone knows how to do it (the drawing office design exercise), he does not let the others go on the wrong way. He explains it". Outside the Kurasini Building you could go to people even though they were not in your group. You would know someone's name, even if you hardly knew him personally. If someone came to you with a problem you did your best to explain it to them. 60 or 70% of the class participated in this. M.A. (1973-74) noted that this was true for most people, perhaps not for the high proportion (20%) of Norwegians who had to devote a lot of time to their work because of language problems. They work at home, a few were married, they did not mix too well. G.M. (January, 1975) thought that the atmosphere was more friendly because you had to rely on other people more, especially in the 'drawing'. One had to go and see what others were doing.

In certain departments no one would tell you anything in case they gave something away. Nobody bothered in civil engineering. If you were stuck they would help you. If you couldn't do a tutorial, they would give you their solutions. But it had taken too long to reach that stage, right until third year. It should have been like that in first year. The class was too big then. You could get lost in a big class like that. Even in second year when a lot of people left, there were more coming in. But the class had settled down by then.

Being in groups of 12 at Kurasini Building, and different groupings each year, may have helped. It could have a lot to do with it. Everyone was stuck on the top floor of Kurasini Building, you all saw one another.

The evidence suggests that students appreciated an environment that was more supportive, less monolithic and more "relatable to" than that encountered outside the Learning Unit. Teachers were seen as people you could talk to, ask questions of, go to for help.

7:8:(i): The staff-student interactions

P.P. (January, 1977) noted that the staff consisted of Dr. Curr, Mr. Tyler, Mr. Hopkins and the secretary running the Learning Unit - though she couldn't give you information of a civil engineering nature i.e. answer questions - and a post-graduate student. R.M. and J.S. (June, 1976) noted that Mrs. Williams played the role of secretary. She was in charge of the filing system and so on. She set things up in the classrooms, provided tapes, etc. She asked their impressions after one of the small tests - what they thought and how they felt they had done. This test was related to the "Educational Experiment" conducted by Dr. Curr to test students complaints of 'Forgetting' all about the 'Design' exercise once the drawings have been handed in.

The presence of Mrs. Williams tended to soften the division between academic and non-academic, between intellectual and personal. The move towards 'nurturitive' values is customarily linked with female influence.

S.J. (May, 1976) confirmed how Mrs. Williams was warmly regarded and elaborated on her role in the Unit. Mrs. Williams was very good, she could get on with most of the students. Good that she was there, because even those who disliked Dr. Curr could get on with Mrs. Williams. Mr. Tyler, most people found remote. S.J. (May, 1976) had found with him, as with most people, that if you approached him properly, you could get to know him. Students couldn't expect the staff just to come to them, had to be a half-way house. Important thing at Kurasini Building was that the staff were generally willing to meet you half-way.

Mrs. Williams kept everything up to date, she had control

over the tapes, kept them in order so the students could get them. She had the handouts ready. "She is supposed to advise Dr. Curr, and a lot of the time she can gather information from students and then pass it on to Dr. Curr". She showed him where students thought he was going wrong. Sometimes she could even find out if students had a blind spot - they kept on asking for one tape and then she would sort of casually ask, "What are you always asking for this tape for?" It is not a specific job, but she helped Dr. Curr in these ways. Other members of the staff were sympathetic and the Unit was perceived as being 'humane'.

G.M. (January 1975) noted that it was easier to go and talk to people like Hopkins and Curr - informal almost. He never saw some of the other lecturers, still teacher-pupil kind of relationship. If you saw, e.g. the hydraulics lecturer, in tutorial it was because you had gone to ask a specific question. His attitude towards you was completely different from Dr. Curr's, who was always trying to help you, no matter what you asked him. He could be quite catty and nasty if he thought it was a stupid question he would tell you so. But G.M. was not put off by that. Dr. Curr would always be like that, fair enough. "Made you think twice about asking a question which might be stupid".

In session 1973-74, B.M. noted "everybody gets on well, but there are still definite cliques in the class that hang about the lecturers and seem to be the lecturers' pets. They take a particular interest in deliberately going out of the room to meet Dr. Curr or somebody like that, "maybe they will get preference". But everybody at Kurasini Building was always willing to help. Even if they were busy, one could go up and ask them a question. A.N. of the same class, noted "Obviously in a big class it is impossible to give you personal attention unless you go and seek them out, but they will be very helpful if you do seek them out". B.T., a graduate student who was a member of the same class would have liked to have had more social evenings with the staff. He thought a lot of staff would probably resent having contact with students in their own private time. There might be

staff-student football games, beer and skittles evenings.

Students-staff relationships have been catered for on the 'official' level as noted by O.D. (1973-74) who said that they were given 'mentors' in the first year and he had never spoken to his since - Dr. Smith. Other people had Dr. Curr and never went to him. His class went to Mr. Thomson, because he was in charge of the course (second year). You might even go to Professor Young. And they would do their best for you, But Mr. Thomson was the man for personal problems, very sympathetic. You would not dream of saying to Dr. Curr "I went and got drunk last week and I could not do your tutorial". "He'd blow up on you". Two or three times a year, the staff stressed that they would see someone if they had problems. If no-one in the department could handle it, there was the Welfare Officer. Dr. Curr was very sympathetic if you had problems with the exams, if you were sick for instance.

A number of students in sessions 1973-74, 1974-75 and 1975-76, noted that they went to friends to discuss personal problems.

The students appreciated this concern with counselling, caring and showing sympathy. On the other hand there were occasions when students had to search for members of staff, especially in the Drawing office.

P.P. (January, 1977) remembered that it was difficult to get hold of the staff in the third year. They were supposed to be available because Dr. Curr said in his lectures that "we have to make use of the staff" when out of our depth. He said it was obvious that they were not making use of the staff as much as they should.

Dr. Curr was seen as 'tough' and demanding teacher. He would get angry and show it, if suggestions were not followed. But he had established a way of relating to students that was free of many of the ambiguities usually present. His manifestly great concern for students' academic performance was something they responded to with their commitment.

R,V, and C.G. (May, 1975), remembered Dr. Curr as a fair person, if there was a borderline case who had worked all

year he would pull him through.

S.J. (May, 1976), and R.M. and J.S. (June, 1976) confirmed that Dr. Curr made the decisions basically in Kurasini Building, if you had ideas, he would listen to them. But if you wanted to change something, it would have to go through Dr. Curr. S.J. (May, 1976) thought you either got on well with Dr. Curr generally or you did not. He was one of these people you either liked or disliked. He noted that an awful lot of people were doubtful about the system. Many would never go to see Dr. Curr. Those who did get a sympathetic hearing, he told them where he thought they had gone wrong. R.M. and J.S. (June, 1976) thought that Dr. Curr was prepared more than other lecturers to do what the students wanted. The empathy was mutual.

C.G. and R.V. (May, 1975) noted that you had more respect for Dr. Curr because of the work he put in. You were not the only one flogging your guts out. R.V. (May, 1975) mentioned: "I think if the students do sit back and actually look at the work involved, it is quite amazing". Dr. Curr must have spent hours upon hours at it. It is changing every year - he has not spent one year doing it, and then he has the next ten years free. You work throughout the year but he is working just as hard. A certain lecturer in the department wrote a book on his subject. He comes in with his book and just writes it on the board. He is a good lecturer, but Dr. Curr is putting a lot of effort into it".

7:8:(ii) The teaching staff relations: students' views :

Students were aware of certain differences between the teaching staff in Kurasini Building and the rest of the department housed at Kinondoni Building.

R.M. and J.S. (June, 1976) thought that for the lecturers at 'Kinondoni Building', 'Kurasini Building' was just too much for them. "Too way out". They are very conventional. The people at Kinondoni Building did not get on well with people at Kurasini Building. Other lecturers regarded it with

tolerant amusement. He was not sure how he got that impression, just things lecturers had said. They were not all that interested in what was going on there, or how it was progressing. Dr. Curr seemed to have difficulty in persuading the Professor to allocate money for certain things. He told them about that. But the other side did not talk about it much. "It was not one department. It seems to have split up totally". B.M. (1973-74) noted that the department was divided into two groups - those with practical experience and those without, theoretical men. Each group thought they were the cream. There was some leg-pulling. Dr. Curr had more practical experience than some. "I wouldn't say they were at loggerheads, but ...".

A.M. (December, 1973) recalled the very good staff-staff relationships, especially in Kurasini Building. He had not seen the Structural Engineers in contact with the Hammond Building people. They were separate, he wondered how they would get on. At 'Kurasini' everybody got on very well. The junior staff, secretaries, assistants, were all very happy in their work. They worked very closely together. The department (Kurasini Building group) went to other cities to give seminars, which meant that three or four, or possibly more people went away together, travelling together and working maybe twelve or thirteen hours a day.

7:9: The Learning Unit's experience contrasted with the learning encounters outside it:

In the research procedures (see above) the researcher anticipated that the students and the researcher would have better understanding of the experience when the students, as interviewees, were asked to present their experiences in the context of other relevant experiences outside the Learning Unit.

The discussions so far have produced a number of

instances where students commented on what they perceived as advantages and disadvantages of their encounters in the Learning Unit.

The section below adds other aspects that elaborate on that theme.

Many students who had been interviewed towards the end of their academic session repeated the sentiment that their views were a reflection of how well they had done in the Learning Unit's examinations.

When R.V. and C.G. (May 1975) were asked if they would like to have the choice between a Hammond Street situation and a parallel Kurasini Building situation, they replied, "No, you would be worried that you would make the wrong choice, especially if friends did better in exams". They went on to say, maybe halfway through they would have been inclined to choose a Hammond Street situation, but not then, when it was finished and you knew what your marks were like and there was no exam coming up.

Here the criterion is clear, would it facilitate my passing the examination? The same principle holds when it comes to judge the "delivery system" of knowledge.

G.M. (January, 1975) noted that whether a tape is better than a lecture depends on the quality of the lecturer. A good tape-sequence would be a substitute for a good lecture. "But if it's a badly done tape-sequence then you are really lost. Because in a tape-sequence, you cannot ask questions. You can stop the tape and try to figure out what is happening, but often if you do not understand it, no-one else does either. That is the drawback. The lecturer is not there for you to say, "Hold on a second, we didn't understand it". But, again, there is consistency in the tapes, you do not get the lecturer in a bad mood. Dr. Curr does not miss much out and he states things clearly. Most of his tapes are very precise".

A.L. (May, 1978), an astute student who experienced the Learning Unit for three years, was able to illuminate, at the end of his third year, on his learning experiences there when he said: "In the first year you are studying 'Properties

of Material' and 'Structures'. And in second year you do a slightly more in-depth study of 'Structural Analysis', which frankly can't be done on tapes, because it is too complicated a subject. And it requires much more deep mathematics, a deeper understanding, which has to be done by sharing the load between two or three lecturers and then asking questions directly of them.

Then in third year, when you have just a 'Code of Practice' to learn, it is not complicated again. And so it is just width of work. And where the work is great in quality, but not in depth, you can use the Learning Unit. But when it is great in depth, you can't really use the Learning Unit and that is what happens in second year and in fourth year".

7:10: Did the Learning Unit experience affect students' strategies for studying other subjects?

J.S. and R.M. (June, 1976) did not think that the Kurasini Building methods influenced their method of studying in other subjects except to speed up the work rate. J.S. thought they just kept it separate. "It was different and that was all there was to it as far as I was concerned". S.J. (May, 1976) thought that the effect of the Kurasini Building experience on studying in other subjects was that, because it was open-book, it was difficult to revert back to memory-work. The method of studying was established before he encountered Kurasini Building, so he did not have to change his attitude much.

Students who feel happy and secure in their existing study habits are less likely to change them in the hope that some new technique will improve things.

B.T. (1975-76) thought he studied on his own before the third year and did not see why he should change a system which had been so successful for him.

Chapter 7: Summary and analysis:

In this chapter the researcher proposed that the Learning Unit students saw their world in a changing perspective. How to climb the distant mountain may be the ultimate goal, but how to make their way across the swamp they are floundering in now and over the steep hill just ahead engages their immediate attention. Furthermore, the reader is reminded that the content of education is deeply problematic and the researcher's task is to examine critically the relationship between teaching and learning in the Learning Unit with an emphasis on the quality of learning. The approach adopted by the researcher to reach an understanding of the innovation was to focus attention on the use of the 'pre-recorded instruction' learning experience itself.

The scheme formulated in Chapter 6 meant to describe the kind of learning which goes on during the student/media interaction. The summary and analysis of this chapter is to focus on two important aspects of the thesis. Firstly, the crucial effects of assessment procedures on study. Secondly, the contrasting perspectives of the innovator on one hand and the students on the other.

Dr. Curr began the innovation as a result of rejecting certain features in his existing third year course. He identified the nature of change and implemented what he believed to be the most 'efficient' and 'effective' methods of solving these problems.

Dr. Curr believed that the 'blend' of 'basic' engineering subject matter objectives can be achieved through 'direct learning' or didactic teaching. On the other hand the attitudes, values, behaviour patterns are acquired as by-products of contacts with instructors, demonstrators, peers and in the drawing-office exercises in what one can call 'indirect learning' or 'enrichment material'. The City University course has also been planned with this in mind. The distinction is linked to perception of future careers. The teaching staff concluded that if the 'basics' are not

established in a 'University environment', there is very little chance of acquiring them later in the often less favourable circumstances of the world of practice.

The emphasis then is on foundation details (basic knowledge) which must be learned effectively, so that developmental analysis and synthesis can subsequently evolve. This initial teacher-communication of basic information would be followed by conscious consolidation and active reinforcement.

The initial instruction for the third year class was in the form of two live lectures by Dr. Curr supplemented by 'summary tapes'. The consolidation of these lectures was provided by the audio-tutorials. Detailed solutions tapes for the tutorial problems were available to take home.

The open-loop system of lecturing, in the past, created problems and Dr. Curr explored two ways of closing the loop; firstly, by presenting information unambiguously and in logical order with the emphasis on step-by-step progression; and secondly, by ensuring the 'availability' of teaching staff through the pre-recording of instruction.

One might assume that Dr. Curr provided the 'detailed' solution tapes for 'consultation', if the student got stuck when solving the tutorial problems. However, students listened to the 'detailed' solutions with a view to learning and reproducing these answers. For them, the real test of their knowledge was encountered in the examination hall for the first 'package test'.

Dr. Curr (January, 1974) reported that:

"It takes two 'feed-backs' from tests or exams before a class settle into the new study methods required".

During the course of the first two 'package tests' students tried out a number of strategies, working over lecture notes and putting a lot of effort into solving problems while listening to the detailed tapes and summary tapes. Whereas, Dr. Curr saw marking of the first two

package tests in terms of maintaining students' work rate or giving early warnings of possible failure, nearly all the students saw this in terms of guiding their own self-evaluation. The early package test marks represented one-third of the marks needed for the degree examination. The students interpreted this situation and began to make up their own minds about what counted as important. The 'blend' mentioned by Dr. Curr in his course documents in terms of 'enrichment materials' etc gave way to a reality constructed from encounters with the package tests.

Poor marks in the first two 'package tests', (two feedbacks) called for a change of strategy on the part of the student. The 'instant learning' ideal proved to be a failure. The need for internalisation of the subject matter became most evident.

Students began (the initial perspective) with the belief that everything was important and must be learned. However it soon transpired that this is beyond human capacity and new solutions to the problem were sought. The viewpoint adopted by those who set their sights on passing the examinations was to find out 'what they want us to know'. On this basis students attempted to limit their output of effort by concentrating on material they thought that members of the teaching staff deemed most important and were therefore likely to set as examination topics. Students therefore employed various strategies to identify the teaching staff orientations. On the basis of their decisions they concentrated their efforts more effectively on a restricted range of material - i.e. the summary tapes, the lecture notes and hand-outs and the detailed solution tapes.

An 'interface' problem which was submerged suddenly surfaced. Several students indicated that Dr Curr expected them to solve the problems while listening to detailed solution tapes. But students' notes and preparation for examination required a careful study of the lectures, the summary tapes and the detailed tapes. These would provide the personal reference material the student needed to learn for the examination.

Tapes were not 'transparent' for the user. A 'detailed tape' required up to seven hours of study. Students felt that they had to listen to them. Their justification was that "May be Dr. Curr was hinting at something" - they were looking for cues. They justified the time spent on 'Design of Structural Elements' as being necessary for a subject which was 'special', 'difficult' and 'huge'. This sentiment could be explained in terms of the 'bench-mark' status added to it by Dr. Curr.

The students identified two different areas in their course. In a short-hand form the researcher termed the first of these 'grade-focussed', including the highly distilled knowledge delivered in the lecture hall and usually supported by the well-developed organising schemes on the 'summary tapes'. The second area was called 'interest-focussed', and would include the enrichment material and games. Students' allocation of time as revealed by their study habits showed that the enormous industry shown in tackling the 'Design of Structural Elements' was largely due to the time spent on rewriting solutions to the problems on the detailed tapes. This strategy was necessary for students bearing in mind the highly abstract nature of the condensed lecture and 'summary tapes'. The information had to be analysed, coded and then stored in the long-term memory.

"If the coding system is to be effective and recall easy, it is essential that the data base should contain a large number of clearly defined and well differentiated concepts which also carry a large number of connecting links, with other concepts, ideas or events".

(Entwistle, 1975: p.183)

This points to a major contrast of perception between the teaching staff on one hand with their ideas of 'rate of learning', 'learning time' or 'learning per hour' and the students real behaviour. The time spent on writing these notes and digesting the subject matter led to comments like

"using the tapes was exhausting", and "Design took more than its share of time".

Students' dependence on the lecturer was evident. They were not allowed to pose their own questions or to follow lines of their own interest within the pre-recorded pedagogical framework. They followed a path through the subject matter designed by the developer, the routing being both mechanistic and prescriptive.

Knowledge is a structure of relationships between concepts. It must be built by the learner himself as he seeks understanding of the information he has received.

Whereas the summary tapes, the lectures and the detailed tapes gave strong support for teaching, in providing detailed examples to be worked through, they missed out crucial support for learning, i.e. helping the students to create their own conceptual structures, to work independently and to know where they were going. Dr. Curr's concern for 'effectiveness' and 'efficiency' and his apparent preoccupation with economies of time and energy led to pressures towards conformity being brought to bear on the students. Their feelings are evident from such comments as "Dr. Curr is always right". "If Dr. Curr says something, and he is going to mark a paper, you do it ... If he suggests something, 9 people out of 10 will put it down on their paper, because Dr. Curr is marking it. They will not have thought why you do it, Dr. Curr will have had reasons ... etc".

It was very common for students to make little use of text-books and to depend solely on lectures and detailed and summary tapes for their sources of information both for problem-solving as the course progressed and especially in revision for examinations. The learning experience was efficiency-oriented. Students thus searched for the best and most efficient method to get higher grades. Numerical calculations were preferred to essay-type questions.

The message identified from these and similar observations is that engineering can be thought of as a body of concepts, information and procedures which can be transmitted from the experienced engineer. The student has to study and

memorise this information in order to solve problems which are provided and to pass the package tests. This points to a clear difference in perspectives between Dr. Curr and the students on the role of 'blending'.

Also, students' dependence contrasts vividly with Dr. Curr's implicit assumption that the teaching of basics would improve students' chances "to plan and take major decisions unassisted".

Objective tests and surface learning

The main form of assessment in the third year was the 'package test'. The characteristic of many of the numerical questions that were to be found was that they normally involved problem solution, rather than problem recognition; they provided just sufficient information for solution, no excess or insufficiency, and they had single-valued solutions, so that no selection was required from the student.

The time limit of one hour of the package test produced a number of results which are contrary to Dr. Curr's intentions. Some of the important skills that will be required of a student when he leaves the institution are that he will firstly be able to recognise problems when they occur. that he will be able to translate a real-life problem into one that is amenable to the kinds of analysis that are available; that he will be able to perform the analysis; and that he will be able to check his own solution when he has produced it.

In Dr. Curr's statement (quoted in Chapter 6) he shows that he was searching for a method that would allow him "to assess accurately and appropriately knowledge skills and professional attitudes". But what skills were involved? The students' comments on their experience of the 'package test' provide one answer to this question.

In their comments the great emphasis seemed to be on performing the analysis and solving the problem. They emphasised the learning of facts since the type of assessment procedure employed (one hour test) reinforced this need.

Most of the students complained of both a heavy work load and of the severe time constraints in the tests. They went as far as to say:

"Thinking is a luxury in any exam. If you want to do really well in the package test a lot of the time it is just stuff pouring out. It must come out automatically".

"Exams are very much for the person who is fast".

The presence of the open-book in the examination hall was viewed as of little importance since "You have to do as much revision as you would normally".

Time pressure and the frequency of package tests contributed to students' anxiety. The heavy workload, the emphasis on facts, the lack of freedom allowed in learning, and the type of assessment procedures employed all contributed to surface approaches to learning.

A.L. (May, 1978) a student interviewed towards the end of his third year noted:

"In the third year, when you just have a 'code of practice' to learn, it is not complicated. And so it is just width of work. And when the work is great in quantity, but not in depth, you can use the 'Learning Unit' ".

In an engineering course it seems essential that problem-solving as a skill is developed and tested. It is true that in the final year project, many of the skills in the problem solving sequence would have been developed, and it can be argued that real problems are too complicated or sophisticated to be tackled by students. But it may well be that some of the criticism by students is justified. O.D. (second term, week six, 1973-74) noted that he has not used the tapes since the first package test. He was relying on them heavily but now thinks that it is a bad thing. He explained that:

"Dr. Curr makes it sound so easy. In his lectures he comes in and puts down the details. He says 'This is how you design something'. He does also say why, but that's of secondary importance. But I believe that should be the primary need of the lecture, to tell you why you do something. If you know why you should be able to design a way how to. I think that will make me a better engineer ... Anyone can solve problems using a list of formulae given to you. Only an engineer knows why ... I think that is the difference between a technician and a professional".

R.M. (June, 1976) noted that:

"What gets me is that you design little bits of a structure, but never a whole thing from start to finish. (It is) difficult to visualise what you are doing. You design one beam but in an office how do you analyse the structure to get the conditions for one beam? That is bad. There should be a design where you start from scratch - if somebody wanted them to build 40 storey flats, they would not have a clue where to start, but there must be some things that they could do from start to finish".

It may well be that some of the criticism from industry of the universities' preparation of graduates does not just stem from the students' lack of practical experience, but also from their inability to even start on a problem that is wrapped in the complexities of reality.

R.M. above commented on his experience in the Drawing office and we examine this further.

The tape-slide sequences introducing the 'design exercise' could be characterized as 'initial instruction' to be followed by consolidation in the form of the production of the 'design drawings' themselves. Dr. Curr's use of 'the control of time' concept is very evident here. The assumption was that 'working against the clock' would eliminate the 'inefficient thinker'. Students' coping strategies for these situations have already been outlined. It is assumed that active learning is more efficient than passive learning. Nevertheless, we need to go a step beyond the principle that students

learn what they practise, when we examine carefully their practices.

It could be argued that students should develop basic skills very thoroughly, at their university courses, so that they may tackle more advanced problems later on. But the emphasis, by Dr. Curr on 'speed training' in the drawing office runs contrary to this ideal.

T.B. (1973-74) noted that most people took down exactly what was on the transparencies. There was a lot of detail on them which Dr. Curr went over quite quickly. Because of this they always stopped the tape so that everybody could copy down exactly what was up there, and they used to rewind and go over exactly what he said again. So virtually everything on the tape-overheads was written down, and if anyone did not understand a point, the tape was played over again. So they were writing as fast as possible and at the same time trying to listen to what he was saying. This all contributed to the impression of facts coming at you, and to the state of 'mental exhaustion' that was experienced.

"You know that within thirty minutes you have got to go upstairs and try to arrange all the facts into some order, and present them on a piece of paper".

When the students moved to the drawing office after the introductory tape-slide sequence they had to do the calculations needed before the actual drawing was performed. The proportion of time spent on calculations depended on the exercise. In a four hour exercise, it could have been up to two hours. 'Co-operation' between students at this stage was reported by many students. They saw that as necessary and they were not "chatting" as one supervisor of the Drawing Office led us to believe. The presence of a supervisor in the Drawing Office was welcomed by students since they needed his help when the group could not forge ahead. But they had to search him out. Students' production of the 'Drawing Design' was a collective activity and dependence on experinced

draughtsmen in the group was noted. As a result there were 'good' and 'bad' groups.

Doubts about being able to repeat the Drawing Office designs which the students completed were voiced by students in sessions (1973-74) and (1975-76). This represents another case of a surface approach to study, contrary to the aims of the lecturer.

The students received lists of objectives for the lectures in some sessions at the beginning of the academic year. While the lecturer believed the objectives provided the students with a framework to guide their study, the students used the objectives in a more limited fashion. S.J. (session 1975-76) thought that:

"Students were supposed to read the objectives lists and say, well, whenever I come out of the lecture, I understand this and, this is what the lecture is basically all about. You should be able to look at them and give answers. Very few people used them in this way".

Student motivations:

Students value their university experience because of its expected future returns in terms of eventual earnings and occupational rewards. It is this economic return from the university education that is probably the most important source of motivation for spending time on the work assigned to students. For example, R.M. (May, 1975) did not expect to get into Honours, but it did not bother him unduly. He explained that firms only offered one hundred pounds (£100) a year more to Honours graduates, so an Honours qualification did not seem to matter too much in Civil Engineering. Generally speaking, it seems that the larger the value of these extrinsic rewards to the individual for any learning activity, the more time and effort that will be devoted to it. Other more intrinsic rewards, relate to the satisfaction achieved from the activity itself. But, in the Learning Unit,

the very fact that systems of control by the lecturer are so central to the learning experience suggests that students' behaviour is not predicated on the basis of intrinsic rewards. As D.O. (December, 1973) commented: "Some of the courses were geared to get you jobs, more than for your own fulfilment".

The question of motivation, extrinsic or intrinsic, is a very important element in students' approaches to study. Simple mechanical variations in the use of time may not have a significant impact on achievement or other learning outputs.

In Chapter 9, the meta-analysis will build on these contrasting perspectives, but in the following chapter, members of the teaching staff in the department who were not directly involved in the running of the Learning Unit will paint the 'view from outside'.

CHAPTER VIII

How is the 'Learning Unit' viewed from 'outside'?

8:1: Introduction

Figure (6-1) presented the Learning Unit as a social system in a larger system encompassing the City University civil engineering department and the other audiences detailed there. This suggests further use of concepts of holism and interdependence. This system model forewarns of the possibility that a change in one part of the system may yield unforeseen and undesirable changes in another part of the system, due to the interdependence of its elements.

The perspectives of the teachers in the L.U. and those outside the L.U. overlap and intertwine in a complex of expectations and interventions. Other teachers bring along ideologies as well as rational criticisms. They bring interest and points of view which are legitimate but different.

One of the aims of this chapter is to probe the philosophical assumptions which members of the teaching staff in the civil engineering department seem to make in considering their teaching. Examination of their belief system will expose the resulting differences in aims, objectives and procedures adopted to achieve these aims. The (chorus) in this chapter is one step removed from the day-to-day action of the Learning Unit 'Arena'.

In Chapter 6, a detailed discussion of the views of several staff of the civil engineering department - those closely involved in implementing the innovation - has been detailed. This Chapter presents the perceptions of additional members of the department, who were not directly involved. Taken together with Chapter 6, then, most of the views of staff will have been presented.

This coverage and contrast is important in this ethnographic type of research since one seeks to identify the competing definitions and the consequent upheaval. This

point concerning comparative perspectives relates directly to the issue of the generalizability of such research and its "findings". The analysis will be developed at three levels.

Level one uses the specific questions asked during the interviews to illustrate the contrasts in the respondents' teaching philosophies and their views about the specific innovation in the Learning Unit. The starting point is a single general question presented in Section 8.2 "What makes a good civil engineer?"

The procedures which two members of the teaching staff adopted to achieve their aims in their own teaching subject are detailed in (Section 8.3). The 'interference effects' created by the introduction of pre-recorded material in the civil engineering department will be seen as a main point of reference for these teachers when they explain their perspectives in section (8.4) to section (8.7). Section 8.8 asks: Is the Learning Unit a "success"? This will provide the other perceptions and indicate what constitutes evidence for those perceptions and also the weight of this evidence in judging the relative success of the Learning Unit.

Level two is more abstract and analytical where, in the summary and analysis section, the contrasting perspectives of the teaching staff outside the Learning Unit are progressively focused.

The third level comes later in Chapter 9, where the varying perspectives of the several parties are compared and contrasted with each other and where the narrative and the analytical interpretations will move towards a synthesis with evidence presented in earlier chapters.

8.2: What makes a good civil engineer?

This question was intended to reveal the respondent's underlying beliefs about the functions and purposes of an

undergraduate course in civil engineering. In response, Professor Young had known civil engineers at the extremes of all sorts of axes, across the field. He identified the man who is happy to sit in a design office and do elaborate calculations. Many others would hate the idea of a career which consisted of a lot of mathematics in an office, and would prefer to be in control, on a site, see what is going on, and hopefully improve on it.

He also raised the question of what the individual wants to specialise in, whether to handle planning, or construction problems, or research. Because of these individual matters, it is difficult to say what a civil engineer ought to be able to do, or what are desirable qualities.

"One thing civil engineers have in common - (they've) got to be able to deal with a new situation. If we can't deal with new situations, we have shown a deficiency because a crisis can happen to anybody and you need quick answers to complex problems".

Mr. Anderson, a lecturer in the department, thought that a good civil engineer needs a grasp of fundamental principles of 'Newtonian mechanics', 'statics' and 'dynamics', a grasp of the 'properties of materials', the ability to look at a problem and decide how to solve it, carry out a solution, then go back and check it. Economy is an important criterion for Mr. Anderson when he quoted an American definition, "a civil engineer is a man who can do for one dollar what any damn fool can do for two". Another aspect which Mr. Anderson mentioned has to deal with the 'integration of knowledge'. The important thing to learn at University is that an engineering problem involves many of the techniques which they have tried to teach the student, and probably a number with which he is completely unfamiliar. He considered it unfortunate that students tend to compartmentalise their work. They must have the ability to use all the information and knowledge that they have, know whether they have sufficient information and if not must seek it elsewhere, look up books and periodicals, have a willingness to seek advice. These things are difficult to

achieve within the confines of single subject courses. "You can talk gaily about integrated projects but it is terribly difficult to produce one, they require an awful lot of time".

Professor Young noted this problem also when he thought that "there is something in all of us that tends to put water-tight barriers around every field of learning that we have. And civil engineers are rather apt to keep in separate compartments - 'Theory of Structures', 'Soil mechanics', and 'Hydraulics', and so on".

"It is very noticeable that in a decisive examination paper a student will merely make use of what has been given in the relevant lectures and will do ridiculous things from the point of view of another subject that he wouldn't do in the context of that subject". So there is a tendency to refuse to transfer material across subjects' boundaries. Professor Young saw advantages in this respect in the project (fourth year project), in which the student is compelled to do whatever can be done and therefore he tends to ignore these artificial barriers and to use all the available material.

The problem of basic principles and the integration of knowledge also looms large on the horizon of the other civil engineering teaching staff interviewed.

Mr. Hunt, a young graduate who was acting as a demonstrator, thought that a good civil engineer had to have "Basic understanding of the concepts" and to be able to get on with people. He also thought that a good civil engineer is someone who can approach a problem in a practical and systematic way, and produce results in an economical and efficient way. He is necessarily someone who knows all the theory, but he has to be able to apply that theory and know its limitations, and where the approximations come in, so that he realises when it does not apply. Mr. Hunt thought that there was a certain amount of basic information which the student/engineer must know. "It is only an experienced engineer, like Dr. Curr, who knows the essential information that the student is going to need".

To produce better engineers, Mr. Hunt thought that this

could be achieved by giving more practical problems in the courses, rather than simplified hypothetical situations.

Another demonstrator stressed that the whole civil engineering course was geared towards producing practising engineers who can think for themselves. They should have the knowledge behind them, which would allow them to arrive at decisions, or do the calculations and so be responsible engineers.

Professor Young believed that producing civil engineers would be the objective of any university civil engineering course, and hoped that all of his staff were thinking about this. "Not merely providing information and testing whether the student knows it, but presenting the information in such a way that the student can build on it himself, and use it in different ways". He thought that it was difficult to encourage this because in the early stages the student has not got enough knowledge to be able to operate independently.

Narrowing down from the discussion of broad principles we now consider contrasting views on how these principles would be reflected in teaching.

8:3: Two contrasting styles of teaching "civil engineering subjects" from members of the City University civil engineering department outside the Learning Unit

In the following section, the approaches of two lecturers from the civil engineering department, outside the 'Learning Unit' will be contrasted. The first lecturer details his method of teaching the basic principles of his subject for a second year class; while the second lecturer discusses his approach to achieving the aims of his fourth year Honours class.

Mr. Anderson's (June 1976) feeling about 'Mechanics' is that the department does not give the students enough practice in applying the basic principles, so they do not fully understand them when they come to use them in relation to problems in 'Structures', 'Soil Mechanics', 'Hydraulics' etc. Here one has the conflict between a "university approach" and a

"school approach". At university there is an attempt to "enunciate the principles clearly in a lecture, give the students some tutorial work to do, and hope that by their own efforts at tutorials, by reading, by enquiring of lecturers if they do not understand, that they will get the necessary background, and forget the habits the students have acquired at school". In practice, students have the bad habit of doing the 'required work' and little more. The first thing Mr. Anderson does to identify the weaknesses of new second year students is to set a simple test in "Elementary Statics". At that stage, "the first or second hour of having them, you can find out if they understand the equilibrium of static bodies. And the answer for the last two or three years has been that they do not". He has to go back and start again and continue with examples on it throughout the year - maybe 25 special examples of shear bending moment problems in the year, in addition to tutorials.

Mr. Anderson's preference for 'rote learning' is emphasised when he noted, "Because a lot of these simple things in Statics really require great repetition. It is doing lots of problems that enables you to see basically how simple the principles are, and how one applies them to lots of different cases. Very much going back to school system, but this repetition of examples is essential".

Mr. Anderson's experience was that students tend to ask themselves what formulae to use, instead of what principles. They are quickly upset by problems that do not fall neatly into patterns they have done before, and can apply formulae to. The worry is the general area of problem-solving. They have to sit with a problem and beat it out, appreciating that there are many different ways to get to the answer, all probably equally valid, some longer than others. They will never be set a problem which is unanswerable. "But they will not persevere. It is this lack of doggedness, the ability to get one's teeth into a problem and keep shaking it about, until you get the answer out of it".

This is a worrying state which arises from school. It proves difficult to turn out graduates who can solve problems not just put figures in formulae. "Maybe (we) should teach 'theory of problem-solving' or something. If the problem does not come out in 20 minutes, they think it is insoluble".

The second example deals with the fourth year 'Transportation (Honours') and Highway Construction. This subject has been selected for a number of reasons. Firstly, the lecturer in charge of that subject decided to use the audio tutorial approach for different reasons than those professed by the Learning Unit. Secondly, the students in their fourth year class are in their "transition year between preparatory first-third years and going into industry".

Mr. Truman when interviewed in December, 1974, noted that he taught 'General Design', not just 'Structural'. He went on to say that in real-life situations one is inevitably designing with less data than one would like, some of it irrelevant, some insufficiently accurate, some missing altogether and one has to produce the best possible design within the limitations of the information within the constraints of the politically and economically possible. So you have constraining factors which are nothing to do with technology. Secondly, things usually go wrong in engineering because people are looking for complex solutions to fairly simple problems. Looking back with the wisdom of hindsight one can see how the 'box girder' bridge began. People were designing adequate solutions to the wrong problems.

In his teaching, his students are expected to do some reading as a matter of course. Handouts at the beginning of the year tell them the things that they are trying to do and that everything they are taught is in that context. University should provide all-in activities, but there is a limit to what the staff can do. The information given by the staff is not complete in itself. It is a skeleton, a rough guide. His use of pre-recorded tapes is simply seen as a better way of giving the students the skeleton and perhaps coincidentally a little bit of the flesh as well.

These points are made at the beginning of the course. The handout is the objectives of the course. The trouble is that these are objectives of a kind difficult to measure, hence "we regard them more as aims". (see figure 8-1).

Mr. Truman indicated that one of the snags with any teaching is that "one gives, for simplicity, fairly artificial situations, not what they are going to face when they leave". So he tried to teach Design in the broadest sense, in industrial context. Another problem in teaching was that students tended to compartmentalise their subjects in individual little watertight compartments. So in his classes, when it came to actual design exercises, the students were presented with them in such a form that they could not "scurry away" and produce a stereo-typed solution. They had to collate ideas. They were also given lots of irrelevant information, in the belief that many of the things that went wrong in later life were not because of failure to find solutions to problems, but of failure to identify problems correctly. "So we can teach them how to define a problem, if nothing else. With guidance on that they are three-quarters of the way there".

He admitted the difficulty involved in how to evaluate "problem solving" skills by putting the difficulty of how to teach the identification of problems behind the belief that there were many things which one could not measure the success of, but could nevertheless justifiably attempt. He tried to give the design exercises in a complex form, where they had to sort out the bits and pieces and reject much of the information, so that by the time the students got to exams they suspected that in any exam question they had to throw away about one third of the information. "So one hopes that one is building in instinctive reactions, the belief that much of the data could be irrelevant. How successful this is, nobody knows".

For these reasons, the advantage Mr. Truman saw in the approach of pre-recorded material, was the flexibility it gave the student in learning when he wanted to, being able to

1.0 Aim of the Courses

The aim is to provide a broad study of the characteristics of moving vehicles and the facilities on, or in, which they move. In principle, all modes of transport are considered with equal importance, although road based transport tends to occupy a disproportionate amount of the time available. The factual data is presented in a way which it is hoped:-

- (a) Emphasises the systems approach to engineering design.
- (b) Suggests the need to consider the implications of engineers proposals; however much the engineer wants to be uninvolved, thinks he can be, or tries to be.
- (c) Develop the ability to design using input data which may occur within wide and varying limits, or of which some major elements may be lacking.
- (d) Illustrate the application of traditional engineering principles in unfamiliar contexts.
- (e) Develop the ability to evolve and present reasoned and logical arguments in situations lacking the artificial prop of a mathematical format.
- (f) Suggests the avoidance of a problem as an alternative to evolving a complex solution.

Looking ahead to the examinations, it is suggested that particular attention is paid to (e) above.

(Figure 8:1)

refer quickly to a body of material, and "the fact that one can give far more information on a pre-recorded tape than in traditional lecturing".

Mr. Truman noted that preparing tapes took much longer than lectures, maybe four hours to produce a half-hour tape and that was starting with existing material. It was difficult to know how much time had gone into the preparation of lectures because they had been prepared over a number of years. "You have got to distil the information to some extent, otherwise the students will see no continuity in it, but again because you do not want to present things in a way that is artificially simple, you try to give as much information as possible on the tape and let them select what is important. Hidden away in the background is that thread of continuity".

As a lecturer, he expected to do the initial sifting operation, so a lot of the fringe information had been discarded. The lecturer was then left with a basic backbone to put over in the hour that was available. He noted, that in learning, most of us needed this peripheral information, not as permanent data for the memory, but to help understand the backbone. By recording, he thought the student could have much of that information when he first listened to the tape and then when he went through it again Mr. Truman expected the student to prepare a "set of lecture notes" or "key words". Then the student could discard the peripheral information entirely. The student never had to spend time actually writing it down but he had the benefit of being exposed to it.

Mr. Truman expected the students to run through once listening. At the end of the day wanted them to have a set of notes, having picked out the important information, assessed relative importance of information, indicated that they knew the inter-action between different bits of data. So they knew where separate pieces of data conflicted in presenting a particular viewpoint, or where they coalesced and supported each other. Looking for evidence in their notes that they can accept how many alternative presentations of data there are and to what extent some interpretations may be more valid in certain circumstances. They are given the tape and they

have to feed back what they feel to be the real crux, and he marks this, not numerically, just comments.

Students notes come back to him in a written form and he goes through and marks bits where the emphasis is perhaps wrong. So the question is thrown back to them "Are you sure ...?" This has got to be in a form that gives them practice in abstracting the relevant information.

Given the limited use that Mr. Truman had put these resources to, he believes that it had appeared to pay off. The student wrote a set of notes that could be less than in a normal lecture, because he knew that if he had not a full set when he came to revise, he could come back to the tape. With ordinary lectures the student was "scribbling away like mad" because he knew if he did not get the information then it was lost for ever as far as he was concerned. "So I see the function of the pre-recorded material, in I suspect, a very different light to the one that is being used by the "Teaching Unit".

Students' Reaction: to the fourth year transportation tapes:

Mr. Truman mentioned that reaction from students had been favourable. A few complaints had been made that the tapes were too long. His answer is that they are still trying to note down too much of the information. He has made the point that a lot of it is just to listen to and more or less forget, except as background, that part of their training is being able to condense this material to about thirty minutes worth of notes. That is the only complaint. They seem to be quite prepared to spend the time listening to the tapes. From the questions they are asking, his idea that the peripheral information is beneficial is supported. "Maybe it is just this year's students, but they seem to be asking more sensible questions and questions about more subtle aspects".

Mr. Truman used tapes for the fourth year in 'Transportation' and hoped to use one the following term for 'Engineering Practice', although he had had "teething problems" getting the quality up to a reasonable standard.

Another aspect in Mr. Truman's experience emphasised the competitive nature of using the limited departmental resources, when he noted that: The Learning Unit was programmed by the hour with a limited capacity of resources. There was a problem fitting in utilisation. They were organised on a reasonable basis to cater for exercises of hourly duration and there was a 'hiccup' a few months before when Mr. Truman tried to use the facilities. Mr. Truman thought the system, apparently not designed to fit in variable periods at unspecified times, could not be expanded to accommodate this without a fairly major upheaval. Mr. Truman thought that perhaps a complementary set-up was needed for situations where you wanted students to be able to use tapes at peculiar times of the day or night, take them out and organise for more flexibility. This immediately brings in the problem of utilisation. The more flexible it was the less fully utilised. Mr. Truman tried to get round this with the fourth year Honours. Due to small numbers, all with tape-recorders or access to them, they did not need the same formal booking system. It was possible for people to behave on trust, simply give out tapes and make sure you got one back when you gave the next one out. Mr. Truman planned to keep two as library copies and hoped that when the students wanted copies before the exams they would be able to share these amongst six of them. This was a reflection of the small numbers rather than the flexibility that he was after. It worked, and he was sold on the idea of using pre-recorded material, though not on having it rigidly time-tabled, except perhaps in the early years.

8.4 'Outsiders' views on the origins of the Learning Unit and what its teaching staff set out to do:

Mr. Hopkins (February 1974) a lecturer in the department, noted that the whole situation was Dr. Curr's brain-child. It evolved in response to a problem. Dr. Curr had broken his leg and was in hospital and wanted to continue his classes despite that. That took him on to the idea of giving lectures

by recording tapes with transparencies.

The next problem was when they moved to Kurasini Building, so far from the main building. They could not time-table students to come for an hour and go away again, also the rooms are not big enough to take the whole class at one time.

The move to Kurasini Building led Dr. Curr into the field of modern teaching methods and to initiate the research he was doing. That is what pushed him into it, he had to find a solution to a practical problem. In order to have something like six groups going at once, Dr. Curr and Mr. Hopkins had to use recorded material.

Mr. Anderson (June 1976) thought that it was a 'one-man band' about which the department knows very little because of the separation of premises. The bulk of the department has not been involved and they do not know what is going on.

Mr. Anderson (June 1976) gave the reason for the establishment of Kurasini Learning Unit as to try and raise the general standard of the students passing through by giving them greater interest in the subject itself - to try and widen what had previously been a fairly traditional course in 'Newtonian mechanics' and 'elementary theory of structures', to accommodate the tremendous range of backgrounds of entrants (from fifth and sixth years at school, HNC, ONC, mature students, A-Levels). The difficulty is that so many have virtually no 'Applied Maths' when they come, and because of the change in the 'Physics' syllabus they have done no 'Statics or Dynamics' at school. Scottish students tend to come in earlier, maybe age $17\frac{1}{2}$, so there is this range of age and experience.

It was to try to overcome some of these difficulties that the slightly more flexible approach of 'programmed learning' was adopted to enable the good students to go rapidly through it, perhaps just brushing up while the poor ones have the opportunity to go more slowly and do more examples.

Mr. Truman's (December 1974) impression was simply that it was "Dr. Curr's own private interest". There was no active policy on the part of the department, wanting to have a

'teaching unit' and looking for someone to do it. From the side-line, it looked as if it grew out of using balsa wood models. The seeds were being sown back in 1968 and 1969. Dr. Curr was the driving force behind it. Mr. Truman was not aware that he invited people to talk about it or contribute to it. The Professor was involved with him in the early days, and a couple of research students. This was because they happened to have some interest themselves and saw what was going on. There was no formal approach to anyone else, until Dr. Edwin Smith came. He was the first 'outsider' who seemed to be officially linked with it. It seemed as if someone asked him if he would like to be involved and he then was co-operating very closely with it. Up to that stage the other people involved seemed to be doing it on the fringe. The Professor obviously has not the time available to spend too much time on it. He seemed to have a genuine interest, but could not take a very active part in running it.

Mr. Truman was not sure about Dr. McIntyre. He had the impression that he is not involved in the Learning Unit. He always thinks of him as someone who uses the Unit and contributes to it, but as one of his fringe activities rather than one of his main interests. Being a chemist in his basic training, he saw himself as contributing in many situations to parts of the course. He would do things within whatever format was requested by the person giving the bulk of the course, e.g. he would give his contribution in 'teaching-unit' form.

"It started off being called a teaching-unit, and eventually somebody suddenly remembered that in fact they are here to learn, not to be taught".

8.5: The Learning Unit practices:

(a) Teaching:

Mr. Truman thought that he differed from Dr. Curr in some

respects in what they are trying to teach.

"Dr. Curr's interest is in the earlier years where you are teaching them fairly short-duration concepts, which you put over in 10 minutes or so, and that is the end of it. You can then check to see if they have understood, if not you do some remedial work. In a period of an hour, you can take them from the stage of knowing absolutely nothing about it, to knowing two or three concepts. Once you are getting up to fourth year that sort of teaching is not appropriate any more."

His use of the teaching-unit type facilities is different from the sort of approach that "I would want to put it to if I was to use it". The advantage Mr. Truman saw in the approach of pre-recorded material was the flexibility it gives the student in learning when he wants to, being able to refer quickly to a body of material, and the fact that you can give far more information on a pre-recorded tape than in traditional lecturing. He went on to state that the present organisation reflected a particular type of approach that the existing users are employing. There are different approaches that would seem reasonable - "that would mean altering the system".

Mr. Anderson (June 1976) was not sure that the Learning Unit had achieved its aim of raising the standard and coping with variation amongst entrants. He believed that the standard of students coming into the second year had dropped over the past four or five years. They seem to be less familiar with 'elementary statics' and also less willing to work hard at a problem to solve it themselves, before they come to a lecturer to be shown how to do it. It is easy to show them, but they are not really getting to grips with the problem and learning how to apply the basic principles. This was a worry. It arose from the way the Mathematics syllabus had been re-organised in schools, so that problem-solving was playing a less important part and multiple choice was used instead, where if you do not see the answer quickly, you must proceed or you are wasting time. In engineering you get more benefit from sitting with a problem for an hour trying to solve it than in being able to solve twelve in an hour.

Mr. Anderson felt that he had to indicate to people that learning is hard work, especially learning new concepts and fundamental principles on which the rest of engineering education is based.

He thought that the 'Learning Unit' falls down in not repeating material sufficiently. They try to elaborate the students' experience by talking about things like shear force in beams. Until you got a grip of the basic statics of a beam, shear force does not matter. It is a question of getting the grounding right.

He noted that in any sort of programmed learning, the idea is to have the quick answer to the short problem. You proceed step by step, and you are led through the steps of a problem in very short, shallow steps, whereas the real difficulty is to see what the problem is, look at it as a whole, see what information you have, and what information you need and decide then how to approach the solution in progressive parts. Programmed learning tends to have the steps set out for you and merely gets you to go through them. "The actual numerical solution is simple compared with deciding how the problem is to be tackled".

Mr. Anderson (June 1976) thought that the attempt at Kurasini Building to make the students think that learning is 'fun' was probably wrong. Learning is not great fun. The actual acquisition of knowledge is a hard, painful grind. To give the students at the beginning of their university career the idea that it is anything different is deceiving the students, and giving them the wrong attitude. It is intensely hard work to learn completely new concepts and principles. To try to cover up that difficulty is not a kindness to the student. They have to appreciate that one can spend days going through one page of a book really to understand everything that is in it.

He suggested that the origins of the idea of learning as 'fun' came from the Nuffield Science Project, 'Science by enquiry'. It left pupils with a very sloppy grasp of principles. He had students in the second year who had

never heard of 'Archimedes principle'. The move away from 'rote learning' created problems. It was only by learning standard definitions that the principles gradually were absorbed. Even if you did not fully understand at least you had a sound definition to grasp and relate everything else to.

Mr. Anderson (June 1976) mentioned that students did comment on Kurasini Building to other members of staff and it seemed, from what they said, that they preferred the 'conventional lecture', "possibly on the basis that it is more flexible" - if you saw the class was not grasping a point, you could alter your lecture there and then. You could fairly quickly detect if the class was with you and if necessary you could completely shift the emphasis of a lecture. With 'programmed learning', even if the system is flexible as far as the students are concerned, the content is fairly rigid. This was the advantage that the students felt with lecturing. There was a two-way interplay between class and lecturer. There was no question of leaving the class behind, which he always felt was a worry with a fairly pre-organised course. "It has not got the instant response that one can get by actually looking at the chaps and seeing how they are getting on".

(b) Assessment:

The Learning Unit assessed the work of the students of the third year by what is known as "continuous assessment" in a 5-package test. Students were also allowed to use books in the examination hall this being known as an "open-book" exam.

Here one notes an important element i.e. the competition of the staff for students' time as mentioned earlier in chapter 7.

Mr. Anderson (June 1976) noted that it was not obvious what was meant by "continuous assessment". The range was apparently from five "package tests" to three terminal (end

of term) exams. The difficulty was that if terminal exams count towards final marks, you undoubtedly encourage the students to work harder in that subject. But they could only do this at the expense of not working in other subjects. If you tried to introduce 'continuous assessment' in one or two subjects, the other subjects suffered. That was quite wrong from a departmental point of view. And yet if you introduced 'continuous assessment' over the whole range, it would impose an unnecessary workload and strain on the student. One of the attractions of university is that one should have time to wander down the by-ways, read books that aren't immediately relevant, edit the student newspaper, play rugby for the university fifteen, etc.

Mr. Anderson (June 1976) thought that the reason students did better in continuous assessment is that they worked harder. He went on to say that there was also the retention principle - if you had a term exam, all you needed to retain was one term's work. If you had a once-a-year exam, you had to try to assimilate a whole year's work. Also, because of the amount covered in a year, you had to be able to pick out what was important and fundamental in that year's work. Whereas if you were tested every six weeks or five weeks, you were only covering a relatively short bit of work and had to know it all in greater detail. On leaving university, the actual amount of information that the graduate had was small, so the hope was that what he had was the really fundamental information. He did not believe that 'continuous assessment' encouraged them to sort out and identify what was really important as opposed to what was going to be asked in next term's test.

Mr. Truman (December 1974) commented on another aspect of the Learning Unit practices - limitation on time - by saying it was fair that students should be pushed for time, as long as they knew why. He was a bit worried if the students thought they were being unfairly made to work against the clock. They should appreciate that in later life, designs have to be produced with a constraint of being required by a certain date. It is cheaper for the customer sometimes to

have the design quickly than to have the best possible design. As long as one got it over to students that they were being trained to work quickly for this reason, and that the staff were not just being downright awkward, then he would support the idea of working against the clock.

Mr. Truman (December 1974) noted that, in the Learning Unit, the students were judged by exam marks and marks for design exercises. The weakness was that the marking obviously reflected the staffs' attitudes towards the sort of solutions we think we should be getting back. He was aware that with a different marker, they might well get a different set of numerical marks. But when someone had taught the course, stated to the students what points they were trying to get over and told the students that they would be marked on a certain basis, then he did mark on that basis, and as long as the basic ideas were reasonable, then believed this was a reasonable method.

Mr. Anderson (June 1976) thought that the general feeling was that the 'open-book' made things more, rather than less difficult, for the student. The good student knew where everything was in his notes, and did not need to look it up anyway. It hurt the weak students, who spent more time looking for information than was justified by the benefit they got from it.

8.6: What are the interaction patterns between the Learning Unit and the rest of the civil engineering department?

The Learning Unit was located a mile away from the rest of the department. The physical location was not the only factor involved in its activities being relatively unknown. The Learning Unit staff tended to isolate themselves. Particularly at the beginning, the staff tended to distance themselves. Unquestionably, at certain times, there had been elements of hostility expressed.

Professor Young (February 1974) noted that a fraction of

the lecturers in any department would be impressed and would approve the methods used at Kurasini Building, but not all. He would not expect all the Civil Engineering staff to prefer that method, but people in Civil Engineering who thought along the Kurasini Building lines could easily work with those lecturers in mathematics who were also interested and similarly prepared to activate it. Whereas, those who used standard methods in both departments could more easily co-operate with each other.

Mr. Truman (December 1974) noted that most of the time the rest of the department did not know what was happening. The criticisms you heard were of what they thought was happening. If you talked to them about what they thought should be done in education and the direction we should be moving in, the people who were quickest to criticise Kurasini Building would define the very thing that was going on there. Perhaps the criticism was largely based on ignorance and clouded by personality problems. A lot of them did not appreciate how useful the things were that were going on at Kurasini Building. They assumed that the activities were fairly "way out" and not really close to civil engineering.

Mr. Truman (December 1974), noted that "one picks up bits of gossip, and it has been complimentary to the Learning Unit, not critical".

He noted that "a large part of the Learning Unit function was research into the effectiveness of its teaching". He went on to confirm that a large part of the Unit's time was spent on measuring the feedback, not simply on teaching the students, but on assessing how well they had been taught and deciding what sort of remedial work should be done, giving it to students and retesting them. He thought that the lack of flexibility was an inevitable reflection of the fact that, with a limited number of people, the system clearly reflected what they wanted to do. This was perfectly reasonable, he added. But, it seemed, that someone with different preferences would have difficulty if they wanted a variation that

was not of any interest to the people previously involved.

Mr. Truman thought that a lot of people would want to use the Learning Unit as it was being extended, as a service facility. They would feed in their information for that part of the course but they would not want to be involved in assessing the objectivity of whatever was being done. Expansion would depend on whether Dr. Curr and the others would be prepared to have people coming in on that basis. If it was seen as a teaching unit doing teaching research, then that imposed a limit to expansion because you were assuming that anybody involved also wanted to be involved on the teaching-assessment side.

Mr. Truman concluded by saying that he would like to see the provision of variations on the theme that was there at the time. The way it operated was ideal for the given set of circumstances in which it was being used. As it stood it would be very difficult for him to do the things he wanted with the Unit. He would be happy to see complementary facilities added to it, to give it the flexibility to accommodate different approaches. He would need better facilities for getting photographic work done, but "that is just a normal book-keeping problem".

Mr. Anderson (June 1976) commented on some of the practices of the Learning Unit in contrast with the rest of the civil engineering department and noted that the department had in the past used closed circuit television. There had probably been a greater use of the overhead projector, as a means of revising, especially where you wanted to get a lot up but not necessarily have the students take it down. There had been considerable increase in the use of photocopied handouts as well. He was using these much more himself, as they saved putting up elaborate points on the board and ensured more complete notes for students. With graphs, by the time he had reproduced it on the board and the students had copied it, it bore little relation to the original. If he could hand out a copy, the student just clipped it into his file and he had a good, true graph. He was not sure how

much was Kurasini Building influence and how much was the change from rotary duplication to the 'Xerox' machine.

Mr. Anderson (June 1976) thought that the Kurasini Building situation must put a strain on the department's budget because the staff employed obviously cost money and there was a considerable amount of teaching effort which went into it, in addition to assistance in the way of technical and secretarial work. It was difficult to say how much, because there were few people who went to Kurasini Building to see what was happening. People were not encouraged to come and see what was going on, "and it never feels very welcome".

He thought that things would have to change to some extent when they moved to the new campus at Doha. For example, there were three secretaries in the department to twenty members of staff, so if one secretary spent all her time producing material for the Learning Unit, the other lecturers were going to notice and feel concerned that they were not getting their fair share of secretarial assistance. If people at Hammond Street wanted to type a paper they had to do it themselves. They even had to prepare handouts themselves. "I am going to feel very upset, I think, if I see someone else getting all their material typed for them, when I have got to do it myself and take up time I could otherwise devote to research and reading".

8.7: Perception of the general atmosphere at Kurasini Building

Mr. Truman, who has an office in the same building, noted that the good atmosphere in the Learning Unit probably came about because people felt that their time was being fully utilised, both staff and students. In these circumstances they would be happy, co-operative, helpful etc. If one was frustrated one was not quite so co-operative.

In contrast, Mr. Anderson asserted that the departmental staff were not encouraged to discuss Kurasini Building. There

was a certain prickliness about the subject. It was a matter of personalities as much as anything else, each person had his own way of doing things and was not terribly willing to listen to comments, criticisms and so on.

8.8: Is the Learning Unit a 'success'?

The question is multi-dimensional. Interpreted widely it asks for a judgement on the experiences of all the students who have passed through the Learning Unit. Interpreted narrowly it boils down to a question of what subjects have been 'covered', and the numbers of those who passed the Unit's examinations.

Professor Young (February (1974) noted that the class wished them to avoid 'controlled experiments', without which it was difficult to know if they were learning better in the 'Learning Unit'. If you compared exam results with previous years, a 10% increase might only mean that the paper was 10% easier. You would have to look at 'distribution of marks'. The difficulty was that it was a far more subtle test that you really needed. He suspected that the very best students would have a performance relatively unaffected by the way of teaching. You could not move their performance very much. So the top, say 10%, of the class form a fairly stable control group. If you found that in previous years a third of the class were below 50% and with a paper you believed to be the same standard only 10% were now below 50%, and you had done very little to the control group, you may possibly have shown something.

Professor Young went on to say that the students themselves thought that they learned better in the Learning Unit. He very nearly had a strike on his hands a couple of years earlier when it was suggested that half the class should have audio-tape tutorials and the other half should have standard tutorials, which everybody had used up to then. Students said, "This is unfair. The others are going to pass easily, and we are going to fail the exam". So, at that time, they believed that these methods were a help.

Professor Young (February 1974) went on to say that any good lecturer can look at the class and see whether he ought to try another tack. He gets an instant feedback, if he is sensitive, but this is not always so. A lecturer can be missing the students he ought to observe, the 25% who are not receiving properly at a given time.

It is easier in a tape presentation for a student who has not got the piece of material to turn back and have another go. There may be big advantages in the lecture, when the lecturer is very good, but there are also big advantages in tape presentation.

Professor Young noted that the Kurasini Building worked in his opinion, because Dr. Curr was an excellent civil engineer as well as an excellent lecturer.

"That is vital in this particular case. The teaching would not be as good with an excellent lecturer who nevertheless was not soundly based in the subject. Dr. Curr would not be so good in the teaching situation if he was not also soundly based in 'civil engineering' research and practice".

Mr. Trumen (December 1974) noted that he would just be guessing to say why the students preferred the Learning Unit method. "You wonder if it is the boredom of ordinary lecturing. Whatever speed the lecture is delivered at, it is almost by definition the wrong speed for the bulk of the listeners. You are either going too fast and losing people, or too slowly and boring them. Either way, presumably they are not taking the information in". He believed that the 'Learning Unit' should make it easier for them in the sense that they learn more in the time that is available, so it should make better use of their time. The time spent actually learning should turn out to be a very large proportion of the time spent using the facilities. "It must make it better, or one would expect it to make it easier for them to learn". Also it is at their own pace. "One would like to think it would be harder in the sense that one could give them more work as well, by making more efficient use of available time. Really it should be one of these ideal situations where they are happier learning and we are happier giving them more

information, so both sides win".

The Learning Unit received numerous visitors and members of the teaching staff have been invited to national and international meetings. Professor Young (January 1977 R.A. 4) in a paper entitled "Problems Facing a Head of Department who seeks to rebuild an Engineering Course", identified a number of problems which were related to the Learning Unit. He noted that administrative matters included possible amendments of Regulations of Senate, or other academic authority, course structure approval, recognition of examination course, or degree by other institutions (e.g. Institution of Civil Engineering) and finally acceptance by external examiners.

Organizational problems included time-tabling and room allocation, office work and financial support for new equipment.

The establishment of a new social structure needed better public relations than before, to reassure students, to encourage staff, to inform service teachers, other departments and other Institutions.

The creation of an innovation would bring new problems. Professor Young noted that, "Is a particular part of the course more in need of a 'subject' expert, or a 'teaching' expert?"

"Is it better to improve the quality or the quantity of output: Should we try to get two satisfactory slides or one good; one grade five technician or two grade 2B; one brilliant package, or two satisfactory ones, one re-edited tape or one the same as last year, plus one on a new topic"?

Further problems dealing with the production of teaching material, as noted by Professor Young, were, "Is it worthwhile producing several versions of an exercise, by using a main tape, a revision tape, a remedial tape, a detailed tape etc." Other problems related to safety, electric shock, fire risk, security against theft or damage and finally research into what the innovator had achieved and the "method of presenting even unchanged material".

Part of the strategy adopted by Professor Young to cope

with some of these problems was the emphasis that the new development was a desirable feature for their departmental teaching and therefore they would do it within the department.

In his paper Professor Young identified other tactics to overcome these problems. These concerned the choice of the right staff. By this he meant they should be enthusiastic, hard-working, systematic, self-motivating and could work together to form a group. Secondly, the right manager, a head of department or a lecturer with firm delegated authority. The manager would provide the necessary facilities and shield the activity against things which might be trivial in what is well-established, like time-tabling changes, peaks of work for technicians, inadequate stock of supplies and spares. The need for tolerance of new departures and requirements, willingness to be flexible and acceptancy of the likelihood of repercussions in the apparently unchanged parts of the course.

He advanced two pieces of advice for someone embarking on an innovation in a University. Firstly, "Give yourself time. Produce a year's course for one subject, make your productivity high, sketch out a system of control and try it, build up your educational capital, and then start with the regulations, the space the students, etc". Secondly, "Don't start either too comprehensively nor too modestly. It will be best to do a limited, self-contained amount well, but if you start in too small a way it will be expensive in terms of money, time, and energy for what is achieved". He gave an example of such an exercise, "Equip for about one-eighth of the students involved. For eighty students, for example, start with at least ten booths, ten tape recorders and two or three spares, enough tapes to run the outfit for a month without wiping any, four or five projectors, enough magazines, screens, etc. This amount of equipment with intensive use will permit about 20% of your total departmental teaching to be converted later on". "The equipment cost is really quite modest when compared with a single lecturer's salary".

VIII:9: Summary and Analysis:

The Learning Unit as a "protected subculture" in the civil engineering department added a new dimension to the way members of the teaching staff outside it had perceived its functions. Also the physical distance had coloured the staff views. Mr. Anderson who had an office in 'Kinondoni Building' with the rest of the civil engineering was very critical, while Mr. Truman, who had an office in 'Kurasini Building' and a closer knowledge of the Learning Unit's practices had more favourable views and more articulated understanding of what he perceived as the strengths and weaknesses of the exercise.

A closer examination of what has been stated in the narrative points to different priorities and contrasting aims and procedures. In the philosophical framework of each member of the staff, they spelled out the "worthwhile" things they considered university education should be doing, but they proved to be rather different in emphasis.

Professor Young saw the need for innovations in Universities' teaching practices on par with their research work in the professional field. He concluded that the differences of civil engineering courses at different universities are designed to "fit" students with skills needed to cope with unforeseen problems "coming out of the mill" in 10-20 years time. He noted that changes in a university are not easy to institute. Administrative problems conspire with natural conservatism.

A good civil engineer was defined by Professor Young as one who would be able to deal with new situations, being able to integrate knowledge from different fields, and being able to build on the basic information received at the university and constantly trying to relate rather than isolate experiences. This view underlines his encouragement to any innovative activity in his department and his backing and support of Dr. Curr played an important part in the continuity of these activities.

Other members of the teaching staff emphasised the need for a grasp of fundamental principles, economy, integration of knowledge, development of an approach to solving problems in a practical and systematic way.

Contrasting Mr. Anderson's views with Mr. Truman's one can't help but notice that Mr. Anderson's philosophy belongs to a traditional outlook on education. His emphasis is on "rote-learning" and to hammer the "basics" in students' minds. Mr. Anderson's approach to teaching his second year subject of civil engineering was based on the belief that there is a marked difference between a "University approach" and a "school approach". His diagnoses of the students problems who came to his second year class stemmed from their bad habit of doing the 'required work' and little more, their lack of understanding of principles, lack of doggedness and perseverance when it came to solving problems. These students tended to ask themselves what formulae to use instead of what principles. He adopted what Ausubel (1963) called the "Reception Learning" approach with an emphasis on repetition of examples to help students internalize the material being studied.

Mr. Truman's diagnosis of the problems inherent in the learning/teaching situation of his fourth year Honours class and based on his previous industrial experience were; in real life situations one is inevitably designing with less data than one would like, secondly, people design adequate solutions to the wrong problems, thirdly, in teaching lecturers tend to give, for the sake of simplicity, fairly artificial situations, not what their students are going to face when they leave.

In his classes students were expected to identify problems, collate ideas, analyse and judge data, synthesise and present him with a set of notes on what they feel to be the real crux and he marks these not numerically but just commenting as a form of feedback.

This points to a university lecturer who is interested in the processes of teaching and learning and his preference to experiment with new ideas and to test other lecturers' innovative approaches.

Mr. Truman's use of audio-tapes in his classes is seen

in terms of the flexibility this gives the students in learning when they want to and being able to refer to a greater amount of information on a pre-recorded tape than in traditional lecturing. His perception of the students' use of this tape is that they should discard the peripheral information entirely and should never spend the time actually writing it down. He tried to use the hardware of the Learning Unit, but there was a 'hic-cup' since it was not designed to fit into variable periods at unspecified times.

Members of the staff interviewed emphasised that the Learning Unit was Dr. Curr's brain-child. Other reasons were, that the Unit was established to cope with the tremendous range of backgrounds of entrants and to do research on 'modern teaching methods'. The Learning Unit's practice was seen as being based on 'programmed learning principles' where the steps were set out for the student and he merely had to go through them.

Mr. Anderson thought that the attempt to make the students think that learning is 'fun' is probably wrong. He thought that there was too much glossing over by the use of techniques rather than understanding of the fundamentals. He thought that with 'programmed learning', even if the system was flexible as far as the students were concerned, the content was fairly rigid. The lecturer in a lecture hall has an advantage over this since he can get the instant response by looking at his students and seeing how they were getting on. The 'package tests' as a method of assessing the work of the students was seen by Mr. Anderson as imposing strain on the students' time and learning experiences in a University environment beyond the subject content.

He expressed his doubts on whether the 'continuous assessment' encourages students to sort out and identify what was really important as opposed to what is going to be asked in the following term's test.

Mr. Truman pointed out that students should be made aware of what the examiner is looking for in a design exercise. Uniformity of expectations on the side of the assessors would

be fairer to students and a more responsible method.

As mentioned earlier, the Learning Unit as an organisation always involves people, individual actors. If one sees the members of the teaching staff - outside the Learning Unit - as having intentions, purposes and needs, as having attitudes, motives and emotions and as having skills, abilities and talents, all of which they bring along to the civil engineering department, then one will expect that their idiosyncratic work patterns vary and sometimes to the point of being in conflict. The most evident conflict was on resources. These can be students' time, machines, raw material which makes up the work, the tasks to be done. Some of the teaching staff seemed to view the Learning Unit and its facilities in terms of "What gains could be achieved by this innovation in the day to day activities of their teaching in the department?"

Mr. Trumen noted that "a large part of the Learning Unit's function is research into the effectiveness of its teaching". He thought that other members of the staff would want to use it as a 'service facility'. They would be prepared to come in on that basis without being involved on the teaching-assessment side.

Mr. Anderson thought that the Learning Unit must put a strain on the department's budget because the staff employed obviously cost money and there was a considerable amount of teaching effort that went into it, in addition to assistance in the way of technical and secretarial work.

Evaluating the Learning Unit activities, the "outsiders" were consistent with their original philosophies and aims.

The Learning Unit's success, thought Professor Young, could be judged by the reaction of students which was favourable, and the change in the distribution of examination marks. He emphasised that it works because of the excellent qualities of Dr. Curr as a lecturer and him being soundly based on civil engineering research and practice.

Mr. Truman wondered if it was the boredom of ordinary lecturing which made the Learning Unit more popular with students.

The general atmosphere within the Learning Unit was described by Mr. Truman as being friendly since members of the Unit, both staff and students feel that their time is being fully utilised.

Mr. Anderson (June, 1976) was not sure that the Learning Unit had achieved its aim of raising the standard and coping with variations amongst entrants. He believed that the standard of students coming into the second year had dropped over the previous four or five years. Students seemed less willing to work hard at a problem to solve it themselves before they came to the lecturer to be shown how to do it. He thought that the attempt at 'Kurasini Building' to make students think that learning was 'fun', was probably wrong. The actual acquisition of knowledge is a hard, painful grind, and students should be taught this at the beginning of their University career, something Mr. Anderson thought, the Learning Unit had failed to do.

This chapter completes the analysis of the contrasting perspectives on the innovation by outlining, and seeking to explain, the views of staff in the department not immediately involved in the innovation. We are now in a position to bring together the contrasting perceptions so as to interpret the totality and to seek implications from the understanding of the impact of this innovation, using the literature to explore the generality of the experience recorded and analysed in the last three chapters. The final chapter presents this higher level analysis.

CHAPTER IX

IX(1): Introduction

In this thesis we have described contrasting perspectives of an innovation in civil engineering. We have seen how the innovator himself describes the purposes and the achievements. His colleagues have rather different views about the reasons for its introduction and its effects on the department. Finally, the students deal with the innovation in ways which suggest yet other perspectives.

In this final chapter another perspective, which has inevitably intruded from time to time already, is brought to the fore - that of the researcher himself.

It is time to try to interpret the differences in perceptions in relation to the previous literature and against a broader canvas. The constraints of writing a thesis has inevitably limited the material that could be presented - much more information was provided in the whole range of material collected. As far as possible the conclusions reached in this chapter will be related to the evidence already presented, but the interpretation also draws on the totality of the researcher's experience in interviewing staff and students in the Learning Unit.

These perspectives cannot be viewed in isolation. The innovation was produced as a reaction to both a general and a specific problem. The general problem was the climate of opinion in industry about engineering education, the specific problem was rooted in the innovator's dissatisfaction with students' problem-solving and examination performances. And the perceptions of other staff in the department can only be understood if we consider the nature of the department before the innovation was introduced.

Before, therefore, our meta-analysis of the three preceding chapters can be undertaken, we have to consider these important background considerations - first the discontent in industry about engineering education, then the situation in the department prior to the innovation - a

situation which can be seen as a fairly general description of a traditional engineering department.

IX(2): The discontent with engineering education:

Chapter 1 identified the "problem" of engineering education and the need for change and innovation. Along these lines a survey amongst employers by the Confederation of British Industry (CBI) warned (May 1976) that an increasing number of recruits display poor personal motivation, little professional commitment, lack of flexibility, breadth of vision and creativity in problem-solving.

They also said that such graduates needed close personal supervision and were deficient in inter-personal and communicative skills. This led to a reconsideration of the boundaries of engineering education and to questions about where the responsibility of the university department begins and ends at undergraduate level and also, what role professional or industrial training plays within the course?

The first degree is but one element in the training of a professional engineer. There are at least four components of the life-time education of an engineer: pre-training, including initial schooling and/or work experience, the undergraduate course, the postgraduate course and/or industrial training scheme; and continuing education, post-qualification. Involved in this area are many bodies: schools, further education institutions, universities, industrial training establishments and companies themselves. And overseeing these activities are many other institutions the universities, CNAAB, the Engineering Industry Training Board, the Council of Engineering Institutions, individual engineering institutions and businesses. There is a clear question here. Where does the responsibility of an individual university, and in particular of an Engineering Department, lie?

They are, at least, responsible for the academic content of the undergraduate and postgraduate courses that they offer.

But this certainly cannot be seen in isolation from the rest of the professional education of which it forms only a part.

Some universities run sandwich courses which ensure that the industrial component provides an adequate practical training as well as work experience. If the university is providing only the academic element of the training, can it adequately plan this in isolation from the other elements of professional education for which it is not responsible?

The problem of the boundaries between the various responsible bodies is serious and if each body only looks to its own area of activity then the education of the engineer is in danger of being incoherent and badly balanced. When such boundaries exist then worthwhile experiences which, say, link academic and practical matters will fall into the gaps and each body may regard it as the other institution's responsibility to develop it.

The educational issues that are raised by this problem are central to university and professional education. Is it desirable that graduate engineers should be produced, by universities with little or no 'practical' experience? Does the professional education have to be split into an academic component and a practical component existing entirely separate from each other? If the answer to these questions is no, then a major change is needed in the structure and finance of engineering education. Responsibility for initiating such a change lies with the university as much as with anyone else.

The Committee of Inquiry into the Engineering Profession (Finniston) published its report in January, 1980. On page 122, the report recommends "To become 'fit to practise' as fully professional engineers, aspirants should have undergone a balanced and well-integrated formation package encompassing formal education, practical training and structured experience in the working environment including the exercise of personal responsibility on the job. Only a minority of British engineers have hitherto received an adequate formation in these terms by the time they are deemed qualified, largely

because there has been insufficient input to engineers' formation from employers and from current engineering practice".

The report recommended the introduction of a new national statutory Engineering Authority, which would bring together practising engineers, employers and engineering teachers to develop models and guidelines for the initial training and employment phases of engineers' development, and would supervise and monitor the administration of those models in teaching departments and employing organisations.

After a long wrangle, we have seen the establishment of an Engineering Council, a Chartered body, and that is a creditable step forward. But little else has been done, and one is worried that in important areas the situation is now worse than before Finniston pronounced. The U.G.C. has cut back on University funding overall and has discouraged four-year courses for which engineering professors pressed hard and which national conference on engineering education and training endorsed. Although the U.G.C. has argued that in its allocation of funds it is encouraging a shift towards engineering, cuts did occur in several University departments of engineering.

Finniston advocated integrated education and training for engineers more related to the needs of industry. The U.G.C. objective appears to be to redistribute engineering students between institutions, reducing numbers in the large departments of some former Colleges of Advanced Technology and increasing them in other Universities. But it is difficult for small engineering departments to provide the breadth of expertise necessary for professional courses of the type Finniston recommended.

Significant progress has recently been made in relating engineering in the Universities to industrial needs. However, the recent decisions have damaged the morale of engineering professors and lecturers responsible for these developments, souring the enthusiasm with which Finniston's main educational recommendations were received.

It is against this background which we must now view the

situation in the particular engineering department in which this study was located.

IX:(3): The traditional engineering department:

In the majority of Universities, most single subject degree courses are the responsibility of a single department within the University. In those departments are to be found specialist and generalist staff who contribute to the various parts of the courses.

In small departments there is usually close contact amongst these staff with possibly collaborative research between different areas. This is the case in the civil engineering department of the City University. Each department is proud of the subject that it expounds and wishes to protect those parts of the curriculum in which its staff feel they have particular knowledge. In this situation the courses tend to be moulded in the image of the existing subject areas represented by the teaching staff and there is no independent methods of assessing priorities within the course.

Little cross-fertilisation can occur without effort. The co-ordination which takes place is concerned more on agreeing on who should teach which topics. This is a logical outcome since most of the course is organised around subjects in which staff have special proficiency and interest. It is assumed that when these courses are assembled they will provide a balanced course for the prospective engineer.

No attempt is made to analyse the requirements of graduate engineers in terms of the skills and abilities that they require for later aspects of their professional training and their working life. On the other hand, much time and effort is spent on discussing and preparing the content of the undergraduate curriculum. The teaching methods are usually left to the individual lecturer to work out in his own way, and it is regarded as the norm that any course, other than practical subjects, should consist of x hours of lectures,

supported by approximately x/4 hours of problem-solving type tutorials.

The staff have most experience in lecturing, and so they feel most comfortable operating in this mode. They do not appear to be sufficiently familiar with other methods to use them in their own courses, or to judge whether they are desirable; they have not experienced them as students and would have to gain the experience specially if they thought it worthwhile.

In this tradition, the courses give a powerful unstated message to students through the ways in which they are presented. Courses are given in a similar manner, namely by lectures, where information is provided and discussed and which the students record. They then study these lecture notes in order to answer questions which are provided on problem sheets. This is the normal pattern for most of the four years of the course.

The message the students get is that they should study and memorise the information in order to solve problems which are provided and to pass the examination at the end of the year. It is well recognised by staff and by students that these activities bear little relationship to the activities of the professional engineer and the methods by which he will learn when he gets outside the institution.

If these observations are taken in conjunction with the trend for students to have much less practical experience in industry in recent years, another issue becomes clear. Students, in this tradition, probably have less motivation to study the more analytical and theoretical aspects of engineering than before. They also have less familiarity with the concrete level of engineering against which they can balance the more abstract aspects which they find in the university courses.

There is a tendency for university courses to include more and more 'advanced' subject matter, demanding greater degrees of sophistication on the part of students. On this higher level subject matter, students are asked simpler and simpler questions as they would otherwise neither be able to

answer more complex questions, nor would they fit in with the constraints of the examination system as presently constituted. The main form of assessment, in this tradition, in most engineering courses is the three hour examination. The great emphasis is placed in examinations on the selection of appropriate methods of analysis and on performing the analysis whilst other skills, such as students' ability to check his own solution, are neglected. It is only in the final year project that many of the skills in the problem-solving sequence will be developed and tested.

It can reasonably be argued that real problems are too complicated or sophisticated to be tackled by undergraduate students but students' inability to even start on a problem that is wrapped in the complexities of reality is quite alarming.

Another aspect of the 'traditional' approach - the dependency of students on staff is evident. Any teaching situation is likely to be one of dependence of the person who is being taught, and who possesses little knowledge, on the teacher who, presumably, possesses more knowledge and experience. This is not surprising. However, one of the main aims of university education is generally recognised to be the encouragement of the students' independence of thought and action, so that by the time the student graduates he is not dependent on his teachers for his learning, but has the skills and capacities to learn on his own.

There are many signs that, at present, the structure and organisation of 'traditional' undergraduate courses leave students still too dependent on the staff. This is certainly not intended, but is inherent in the style of the course. As mentioned previously, most courses are based on lectures, which form the predominant teaching medium.

It is very common for students to make little use of text books and to depend instead solely on lecture notes for their source of information, both for problem-solving as the course progresses and especially in revision for examinations. Their lecture notes are rarely reinforced or supplemented by

additions from text books. Text books are apparently used more as a last resort in problem solving than as a medium for initial learning. Indeed, it is not uncommon in engineering for no text books to be recommended as immediate support for the course. The result is that students are not accustomed to use text books. By the time they reach the final year these students have established the habit that all they require to do is to listen to lectures and take notes without reading books. The emphasis is thus on subject matter *per se* with less attention being paid to other skills and abilities the undergraduate course might otherwise seek to develop.

Another aspect of the 'traditional' approach pertains to staff-student relations and the involvement of students. At the formal level, the engineering department will have staff-student committees. This committee may meet regularly and discuss issues raised by the student body, if that body is active. Students may express their attitudes to such a committee by their enthusiasm or otherwise in electing their representatives. If the department, in a traditional mode, does not fully take account of the fact that students are a vital part of the educational community and are only allowed to become passive recipients of courses which staff provide, then many opportunities are lost for the development of interpersonal and decision-making skills. Furthermore, if students are not involved in some way in planning and decision-making then their dependency on staff will be reinforced.

In such a tradition, there may also be effective mechanism for forward-planning at the departmental level in the institution. The department may have an Academic Plan for the future, but this is more concerned with manpower and resource planning than with the detailed nature of the courses. Much of the change policy is in response to immediate pressing problems that had been foreseen by some staff but had been rejected in terms of a collective, structured approach to dealing with them. The result of this, for some staff, is that it appears that the department is not collectively

concerned with the future. Unfortunately, engagement in educational development is normally a low status activity. Staff feel, justifiably or not, that time invested in the activity will not be rewarded to anything like the same extent as research. This may be clearly identified in traditional circles when they pose the question: why is there any need to innovate? Our graduates find jobs, we have good reports of them from employers, there is no obvious dissatisfaction amongst our students: so, why innovate?

This presents the "traditional" approach in a very unfavourable light. But the analysis provides a backcloth for the examination of the contrasting perspectives of the L.U. teaching staff. If we are to be able to understand the actions of the innovator and the reaction of colleagues, next we have to consider what role lecturers saw themselves as having and to discuss two contrasting models of innovation - the 'drawing board' and the 'potter's wheel'. Our argument will be that the innovator followed the first of these models, with somewhat unfortunate consequences. The alternative model, in our view, would have led along a different path which might have avoided serious side-effects, among both colleagues and students, which have been identified in this evaluation.

ix:(4): Contrasting roles of the higher education institutions and its lecturers

In Chapter 1 Edgar Schein distinguished three types of role that our institutions are preparing their students for in their professional lives. The first is the role of custodianship, the second is that of content innovation, the third, and the one he suggests universities should be aiming to produce, is role innovation. Most university teachers have only experienced the first and second of these roles themselves. The academics' idea of the kind of graduates they want to produce is the most powerful determinant of the undergraduate course. The custodianship expectation will limit students

to knowledge of the *status quo* in engineering theory and practice, content innovation expectations will tend to try to develop the innovative capacities of the student in the subject and both of these can exist within the present framework of courses. The final expectation is a more radical one, and demands a rethinking of the entire curriculum - an opening up of boundaries between subjects, not only in engineering, but between engineering and other subjects and it demands a new outlook on the part of the staff.

To examine this more fully, the researcher suggests an examination of current educational philosophies.

ix: (5): Educational philosophies and alternative models of innovations:

Two metaphors can be used to describe contrasting educational philosophies - the drawing-board and the potter's wheel. In the first metaphor the innovator locates effective social action in an abstract process with the aim of producing blue-prints. He starts with an ideal conception clearly in mind, and simply draws it out. In the latter paradigm, that of the potter's wheel, the innovator wrestles with intractable material in order to evolve a form through the mutual interplay of conception and realisation. Here the 'planning' of the drawing-board paradigm becomes 'moulding'. 'Involvement' becomes more evident since changes are conceived in terms of the intimate feedback and control exercised by a potter's fingers and arms. In both paradigms there is a need for 'quicker and more efficient feedback and control' since the situation is in flux. The innovator in the 'drawing-board' metaphor associates his design with stability, precision and his world appears a tidy place requiring the merest glance to re-establish confidence - at least until things change. When change crosses a threshold, these neat planned roles no longer 'fit', the habitual pattern collapses and confusion results.

The 'drawing-board' innovator belongs to the classic efficiency school, which Taylorism has come to symbolize. For him, the student and his 'learning packages' are the essential building blocks of the learning experience, if the innovator gets these 'right', the outcome has been correctly defined and secured. An example of 'drawing-board' innovator's policies is detailed below.

Consider a situation where there is initially a course of one term to one year's duration which is largely the responsibility of a single member of the teaching staff. Although there is a course examination, there are no clear objectives. The content is decided by the department concerned at the broadest level, the details being determined by the 'course teacher'.

How does the 'drawing-board' innovator set about his task?

His first priority is to arrive at a list of objectives for the course and to plan a new "improved" version. The curriculum objectives are expressed in behavioural terms delineating precisely the substance of the educational programme, the skills and knowledge to be learned. Then the curriculum, course and instructional content, the subject matter is divided into units (packages) and sequential development is carefully planned by the lecturer. The innovator has very tight control on the definition of content and the manner of learning. The next step involves designing instructional strategies usually based on a combination of methods, media and organisation. Next feedback has to be established. New assessment procedures are developed, based on objective testing, and used to identify whether the student has mastered the building blocks of the subject content. This information is communicated to students through various means. Finally, instructional decision making and prescriptions are required. The leader of the innovation in the 'rational planning' approach controls the organizational pattern and use of facilities (personnel, members of the teaching staff and equipment) required to support other subsystems. An emphasis is also laid on the evaluation of

student progress, the provision for prescriptive measures for remedial or enrichment material. Allowance is planned for empirical validation and optimisation of course organization, content, strategies and media to suit the original plan or the 'blue-print'.

Becher (1974) labelled the three basic types of curriculum development in its pure form as the instrumental, the interactive and the individualistic (figure 9-1). The drawing-board paradigm matches the instrumental type. Both assume that knowledge can be broken down into convenient packages, each to be neatly delivered at the appropriate time to a receptive learner. But it is clear from the interviews reported here that students enter University with contrasting orientations and conceptions of learning which are likely to affect them in their initial approaches to study. The researcher will suggest that 'the potter's wheel' model of innovation is much more suited to this problematic situation since the innovator will be trying to deal with the variety of these influences. The 'potter's wheel' can be characterised by a series of contrasts with the 'drawing board'.

The objectives are not pre-specified, the emphasis is less on the product than on the process of learning which the curriculum material help to engender (see below). The lecturer's role is usually central both in managing (as opposed to controlling) the learning process and in judging whether appropriate learning has taken place. He will encourage an interactive learning process, where students work in co-operative groups and he will encourage students to seek a variety of different interpretations of the same phenomena rather than seeking consensus on what is considered to be "correct". Here the learner is seen not as a complex stimulus-response machine, but essentially as a social animal who derives his motivation and refines his understanding by interacting with others. Knowledge is seen not as something which comes in pre-ordained packages, but as something socially defined, stemming from the identification and collective

CURRICULUM DEVELOPMENT STYLES

	Cluster I Instrumental	Cluster II Interactive	Cluster III Individualistic
View of knowledge	PACKAGES (subject disciplines)	PROBLEMS (interdisciplinary enquiry)	PERSONAL EXPLORATION (eclectic searches)
Categories of goal emphasised	JOB/CAREER	SOCIAL ADJUSTMENT	PERSONAL HAPPINESS
Means adopted	HIGHLY STRUCTURED MATERIALS	LOOSELY STRUCTURED (but researched) MATERIALS	UNSTRUCTURED (non-existent?) MATERIALS
Teachers' classroom roles	DOMINATING	MANAGING	ASSISTING
Dissemination strategies	TEACHERS AS PASSIVE (RATIONAL) RECIPIENTS	TEACHERS AS REPRESENTATIVE (TOKEN?) PARTICIPANTS	TEACHERS AS (PARTIAL?) DEVELOPERS
Evaluation Techniques	ATTAINMENT OF PRE-SPECIFIED GOALS	ANTHROPOLOGICAL (case-history) STUDIES	EXTENT OF CLIENT TAKE-UP
View of humanity	PEOPLE AS THINGS (manipulable)	PEOPLE AS SOCIAL ANIMALS	PEOPLE AS INDIVIDUALS
View of external reality	TERRA FIRMA (the real world) Newton?	SANDBANKS (the changing world) Einstein?	TERRA INCOGNITA (the unknowable, therefore unknown) Berkeley?

Figure 9-1

probing of shared concerns.

The lecturer, in this paradigm, allows the innovation to evolve through the mutual interplay of conception and realisation. Other members of the teaching staff are invited to extend and adapt any materials produced by the development team and hence dissemination strategies rely on the collective participation of interested lecturers.

Where the learner is concerned with acquiring professional techniques, or to assimilate large areas of new knowledge, this approach may appear to be of less value. But, university curricula, even at professional schools can be designed to mark points of transition between the pure 'drawing board' and pure 'potter's wheel' models. Our focus now is on the Learning Unit, subject of this thesis.

IX:(5):(i): The Learning Unit: an example of an innovation:

The Learning Unit teaching staff tried to satisfy the role of custodianship and that of content innovation (Schien classification mentioned above). But members of the teaching staff outside the L.U. in the department were not wholly committed to the idea of the project. Furthermore, a number of problems have been identified within the confines of the L.U. itself.

One important lesson this study has provided us with is the need for an efficient and effective system of monitoring the innovation. The researcher's method of studying the innovation provided the basis for such a mechanism which is sensitive to the day-to-day problems of the innovation and to the study of its outcomes.

The Learning Unit innovations were grafted on to existing provision in the Civil Engineering Department to minimize its threat to the *status quo*. It was a replacement of an element in the course structure. One of the problems for Dr. Curr, as the innovator, was to demonstrate the effectiveness of the pre-recorded material in handling the problems of

curricular complexity in the face of resistance from other members of the teaching staff. One way of searching for reasons for this resistance is the examination of the teaching staff's educational philosophies and their conceptions of teaching and learning and its implications.

IX:(5):(ii): Dr. Curr's model of educational innovation

Dr. Curr, following a model similar to the 'drawing board', believed in what he was trying to do in a passionate way. One is reminded that among the many and pressing responsibilities of his leadership is a need to develop a 'Weltanschauung', a general view of the Learning Unit's position and role within the department.

His point of view contained statements of goals and objectives. In effect, it was a plan - a guide to individual and group activity. It possessed a manifest function.

The Unit was designed with certain specifications in mind. But because a large number of innovative elements were introduced, priorities in terms of degree of influence were more difficult to assess. This was accompanied by a degree of vulnerability and an openness to outside threat. To keep the Unit running smoothly Dr. Curr had to take a series of crisis-averting decisions with very little chance of sifting, selecting or testing alternatives. These decisions had to rest on compromise and restraint, to try to close the gap between what he wished to do and what the Unit staff could achieve.

Meanwhile Dr. Curr's unassailable belief in what he was trying to achieve made his point of view, at times, unyielding to intellectual attack or analysis. This appears to have led to several dysfunctions. First of these was the cloaking of the organizational realities. Selznick (1949) argued that every organization to some degree masks its internal functioning to its public. One may hypothesize

that the more formalized the "point of view" becomes and the more internal the problems that exist, the greater the degree of masking that will occur. This was a phenomenon observed in the Learning Unit.

As a new organization, the Learning Unit lacked the stable ties that old organizations enjoy with those in its environment. As we have observed the teaching staff, outside the Unit, had linkages to it which were often conflicting. One way of explaining this is Dr. Curr's insistence on keeping the pace of the innovation in the forefront. He was, apparently, not prepared to recognise that the innovation was creating hostility and his favourite method of dealing with the problems the Unit faced was to devise a "fix" rather than a rethink. In the face of staff hostility he reasoned that this was due to "human nature". On the other hand, when students' performance on package tests was poor he introduced the "positive moderation" practice reported in Chapter 7.

One may suggest that what was needed, on such occasions, was a 'rethink' with an aim to 'rejig' the model as advocated by the "potter's wheel model" rather than an application of a "Band-Aid" fix.

An invitation to other members of the staff to co-ordinate the resources available in the department by mutual adjustment and getting them acquainted with the developing new roles and procedures could have been useful in reducing the levels of hostility experienced.

As pointed out in Chapter 6, innovators in general, and Dr. Curr in particular, pay more attention to the individual student in the learning situation than to how the technology affects social structure, and how it might be integrated into the organizational frameworks of departments, schools or universities.

While one may agree with the notion that long-term future trends in educational innovations will be increasingly affected by changes in technology, the extent and speed of changes in instruction will, the researcher thinks, be determined more by growth of insight into educational practice and process

than by development in technology itself.

The increase in technological changes will increase the friction of a technological approach against entrenched long-term patterns. The need for a more ecological - as opposed to technological - research philosophy is surely indicated.

We now focus our attention on the perspectives of other members of the teaching staff outside the Learning Unit.

IX:(5):(iii): Other members of the teaching staff perspectives:

Professor Young's support for innovations in his department stems from his belief that the future will be different from the present and many of our present solutions will no longer be applicable. This is commendable but, on examination of his views as detailed in Chapter 8 under the title "Problems facing a head of Department who seeks to rebuild an Engineering Course", one may conclude that his identification of the immediate concerns over-shadow one important aspect in the implementation of any innovation i.e. the need to involve the whole department in the planning of such innovation. This might have guaranteed much closer co-operation between those active in the L.U. and those outside it. Mr. Anderson and Mr. Truman can be easily located in the "traditional" school of thought detailed above. Mr. Anderson did not pay enough time or energy to study the reality or the potential of the innovations in the L.U. His surface understanding of what seemed to be the actions of the L.U. staff reinforced his established traditional views of emphasis on rote-learning and his conclusion that student learning in the L.U. set-up was being sacrificed for some glamorous and 'fun-type' activities.

Mr. Truman was ready to think about the L.U. activities. He seems to know about it, but his knowledge is rather limited, with an emphasis on what their innovations can contribute to his own course. This is a case of 'fallout', with relatively

unclear understanding of the L.U. aims and objectives, since he mentioned that 'programmed learning' was a major dimension in the Unit's activity.

We turn our attention now to the contrasting perceptions between Dr. Curr on one hand and the students on the other.

IX:(5):(iv): The contrasting perceptions of Dr. Curr and the L.U. students:

In Dr. Curr's belief system he identified the characteristics of a good civil engineer where he emphasised, amongst other things, that his students should be good problem-solvers, a commendable goal for any engineering course.

There has, of course, been a long tradition in the close examination of how students actually interpret the courses that they take, especially studies deriving from the works of Becker and his associates (e.g. Becker *et al.* 1977). Since social scientists first began to scrutinize what actually takes place in the lecture theatre or the seminar room, there has been a deep interest in the different ways that students 'make out' the subject they are being taught. Particularly in the field of professional education, there has been a continuing interest in the degree to which students become 'professionals' by gradual stages, and the extent to which they attempt to cope with courses in ways which are quite often detrimental to the professional aims the courses are intended to fulfil.

In the Learning Unit, students in general identified similar characteristics of a good civil engineer to those reported by the teaching staff. In Chapter 7 the researcher asked students to indicate the value they saw in the subjects they took, with reference to their eventual intended careers. Technical courses were seen as most useful while 'background' or service courses were seen as least useful. From other data collected by the researcher, the high evaluation of

technical courses is characteristic of all years of the Learning Unit, though it is most marked for the 1st Year students.

For graduate students, the service subjects are seen as having slightly more use. Students did change their views when interviewed at the beginning and at the end of the year and this has been a function of their performance on the examination. When one considers that students rated importance, relevance and interest of various subjects, taken in the City University, in terms of the respondent's intended career, it seems that all students share a high evaluation of "civil engineering" subjects, a lower estimation of background or service subjects. The picture presented by this conclusion and teaching staff views is revealing. The relationship between students' culture and faculty perspective is seen as complementary rather than conflict-ridden. The two cultures are portrayed as mutually reinforcing. This is important in establishing standards of professional and personal behaviour. In Chapter 6, members of the teaching staff informed us that students were being treated as junior engineers and in an egalitarian manner. They were being groomed for full professional status as soon as possible. But, students in Chapter 7, under the pressure of heavy work load, adopted a defensive strategy and their approach was one of "survival" by "playing it safe".

Students, as indicated in Chapter 7, have two depths of focus. The idealistic long-range perspective of being a good civil engineer offers them little opportunity to cope with and solve the immediate problems of passing the "package tests". So, this idealistic long-range perspective must be pragmatically subordinated to a perspective tied to the immediate situation. A perspective that helps them solve the problems of getting the training and experience they want and at the same time satisfying the teaching staff that they are doing a good job in dealing with the different aspects, and the formal requirements, of the course.

From the teaching staff perspective, there is an implicit assumption that if one is going to be a competent civil engineer, one will pass the exam in the process. But the students' reading of the situation, forced on them by their experiences from the early days of their arrival at the City University, shifted their focus. In Appendix 5 students are reminded that the assessment system is a hurdle that "you've got to jump over". Furthermore one of the lecturers said, in the first year, "Have a look to your left, have a look to your right. One of the two people on either side of you will not get a degree".

Here we can see the logic which underlies the students' behaviour, when they move from the lecture hall to their use of audio-tutorials, and explains the way they approached the introductions of the 'Design problems'.

Students, as initiates, are faced with immediate practical problems of 'getting by' in novel situations and must find ways of coping with their work therein. Where there are others available who are "wise", the necessary "survival kit" of "tips", "winks", and "dodges" can be handed on, when such others are not available they must be found anew either individually or collectively.

There is obviously a mismatch between what should be done to pass the exams and how to acquire the qualities of a good professional civil engineer. The examinations determine the course of the students' career in the university and they also determine what happens to them after graduation. For it is increasingly true in many occupations, and absolutely true in engineering, that students cannot move on into the world of professional engineering unless and until they have demonstrated their mastery of the required knowledge to their lecturers. No alternative way of learning and of proving one's proficiency is provided. Therefore, one must keep one's lecturers satisfied with the progress in the desired direction.

The students, as they become involved in a variety of situations, each with its own special obligations, develop their perspectives. These perspectives should provide

solutions to the problem of overloading of the course with content. They define, in this perspective, the academic situation for themselves and set their own level and direction of effort. They discover the necessity of selection and the most economical ways of learning from their encounters with the "package tests".

They add to their behaviour a new criterion of selecting what is important according to whether it is "what the members of staff want us to know" and develop techniques to discover what this is. These activities are aimed at reducing strain and tension and also pave the way to co-operative ways of behaving that draw the class together in the effort to predict and fulfil staff requirements. Most students feel that, in directing their effort towards learning what the lecturers want, they are also learning engineering, but they also recognise that they have somehow been forced to give up the ideal of learning for themselves in order to pass the examinations (Chapter 7). Here the emphasis and the accent is on the role of being a "student" vis-a-vis "a professional engineer".

One is reminded that the researcher is not, after all, attempting to study engineering education in its entirety. Rather, he has confined himself to studying one aspect of engineering education, the way students collectively formulate and act on perspectives which influence the level and direction of their academic effort and how these perspectives differ from Dr. Curr's.

The emphasis here will be to discuss these contrasting perspectives when students used the audio-tapes, the tape/overhead in the design exercise sessions, and the way students dealt with the 'Blend'. Students, as explained above, do not see these exercises in terms of future careers. The 'problems' are seen not in an engineering context but in a more pragmatic one of achieving the best grades on the tests (Chapter 7). The students' premise is that there are many things to learn and many ways of demonstrating learning on examination. They believe that each lecturer or department

has its own ideas about what should be learned and how this learning should be expressed. Quite aside from the question of their own abilities, they believe they must make every effort to find out what a lecturer wants in order to study intelligently for an examination and do themselves justice in taking it. The emphasis here is on the micro-level of problem solving. The real world problems of engineering, the macro level, are subordinated. They see it as part of their jobs as students to understand the lecturers' perspective on his subject, and then direct their effort towards this end.

In the Drawing-office design exercises, students use the tape/overhead introduction in a very different way from what Dr. Curr had in mind when he prepared these sequences. The introductions were meant to give the students guidelines in advance of the exercise to help with how to tackle the problem of design. Students saw these introductions as a detailed set of instructions to be copied down in detail in a very mechanistic fashion. Armed with their copies of the instructions they proceeded to the drawing office to discover that they still needed the help of "Live" lecturers. A strategy was also developed, to cope with this problem, co-operation and making the best use of other students with previous experience as draughtsmen. This is an example of an unanticipated outcome in the history of the L.U. The co-operation drew the class together in the effort to predict and fulfil Dr. Curr's requirements in assessments.

The "Blend" and how students differentiated and valued their experiences within its contents, has been discussed in Chapter 7. It is easily explained along the same lines.

One cannot help but sympathise with the L.U. students for several reasons. The students' perceptions of the innovation are determined by their whole experience in the University which is very traditional. They see it in relation to a traditional course and the demands of a traditional course. The innovation forced on them new challenges to which they had to develop new survival skills. Furthermore, Dr. Curr's pre-occupation with improvements in

the examination results might have increased students' conscious attention to the importance of grades in their university careers. Dr. Curr's need to change the distribution of the marks in the 'package tests' and to improve students' problem-solving skills were two conflicting positions. These two positions co-existed in the world of the L.U. students, but rationally and logically are not capable of existing together. The students had to sacrifice one for the other and from the evidence produced in this thesis the reader may come to sympathise with students' inevitable choice.

The analysis so far dealt with the students' collective perspectives. But in Chapters 2 and 7, the researcher indicated that students are of different types and some have limited approaches to studying. On the level of the individual student several approaches emerged when the student was challenged in different learning situations.

IX: (5) : (v) : Students approaches to learning:

Research on students learning summarised in Chapter 2 provided very clear and useful concepts to explain the L.U. students' learning practices and coping strategies on the individual level. In a deep approach students actively strive for meaning and understanding. There is an attempt to make sense of what is being learnt, to tease out core ideas and principles, to relate concepts and arguments to evidence and data and, equally importantly, to forge links with their previous knowledge and experience. Other students adopted a surface approach in which there is a passive concern with memorisation and rote learning. The aim is to be able to reproduce rather than understand. There is a concern with isolated details and with fact-spotting or a mechanical adherence to problem-solving procedures regardless of their appropriateness.

In Chapter 7, a certain student was observed to take two different approaches towards two different learning tasks.

The deep/surface dicotomy does not characterize a stable characteristic of the student, but rather describes a relation between the student's perception of a task and his approach to it. The student's perception of a learning task encompasses a multitude of things: it depends on the task's form and content, on its relation to other learning demands, on the student's previous experience, on the student's perception of the lecturer who marks it and of how it will be assessed.

These could be summarised as an "intention" to learn in a particular way. Students' intentions determine their approach to the learning task and that reflects their conceptions of knowledge and learning. If the student sees knowledge as something external to himself and learning as the process of acquiring facts or principles by memorisation, the emphasis will be on rote-learning.

Others who see learning as part of themselves, will extend their efforts on abstracting meaning and to relate this to the world around them. These differences are probably linked to students' intellectual development and require courage on the student's part and understanding and encouragement from the tutor.

It would be misleading, however, simply to associate approaches with students. This thesis has shown that many (and probably most) students vary their approach, depending on the nature of the task. Students in the L.U. adopted a surface approach in the drawing office exercises due to a lack of adequate background knowledge as a result of perceived shortage of time. But equally, a surface approach may be prompted by an overloaded syllabus, by an assessment situation that appears threatening and arouses anxiety, and by a perception that marking procedures favour powers of memory rather than those of understanding.

Most of these perceptions have been identified amongst L.U. students and, furthermore, they complained about the discrepancies they observed between what tutors said they were looking for and what they in fact rewarded in their assessment.

A third approach, again identified in L.U. students, is the strategic approach where the intention was to obtain highest possible grades. This was characterized by organization of time and distribution of effort to achieve the greatest effect. Students adopting this approach were alert to cues about examination questions and marking schemes and they made sure that conditions and materials were appropriate for studying their learning tasks.

It is important to bear in mind that it is students' perceptions of the situation and their learning milieu that influenced their study behaviour. In Chapter 3, the researcher introduced the idea that individuals at any one time are constantly monitoring the social and communicative texture of the surroundings and are constantly making adjustments that help them to define the frame of reference or register of discourse in which they are operating. This emphasises the notion that student/situation interactions define the learning approaches students adopt. The educational philosophy of members of the teaching staff and their conceptions of teaching and learning described in the previous section parallel students' approaches to learning tasks. As we have observed, staff conceptions of teaching and learning and their educational philosophies influenced the way they viewed and evaluated the Learning Unit. It is clear that the strong influence of assessment has contributed to students' orientations and approaches to learning and the differences one can identify amongst them. No matter what the lecturer says as to what is the best way to use the material, students get a different message, a message grounded in their perceptions of the assessment requirements.

Lecturers thus play a crucial role, not just in transmitting information efficiently, but also in transforming ways of learning which would otherwise prevent personal understanding being attempted, let alone being achieved. This leads us directly to the examination of the educational implications for institutions of higher education based on the above research findings.

IX:(6): Educational Implications:

IX:(6):(i): Implications to practitioners:

In the sections which follow, it is not easy to show the individual origins of the suggestions. They lie partly in the interview data and the analyses in previous chapters, but draw substantially also on the literature reviewed in Chapters 2 and 3. Some of the suggestions have already been made in other subject areas, but here the attempt is to use this evaluation of teaching in civil engineering to indicate ways in which they may most fruitfully be adapted to this particular area of professional training and education.

The presence of contrasting perceptions in any educational milieu makes it necessary for university lecturers to take account of the totality of the teaching/learning experience of their students.

The 'distorting mirrors cube', Chapter 4, pointed to the different interpretations the different audiences may provide to explain the same event, since multiplicity of perceptions means multi-faceted reactions to the same experience. This is true for any subject and for any milieu.

A "rational" planner with his "blue prints" can devise techniques and goals of how to produce good civil engineers, but when these are introduced in a department these will have an impact on the students and the teaching staff.

As observed in this thesis, one will have to distinguish between the formal curriculum, a statement of objectives and content, and the operational curriculum, a set of classroom practices. As well as studying the interactive nature of curriculum practice one needs to examine the conflicts over the definitions of curriculum which precede classroom events (with insights thereby provided into the vested interests involved). In this relationship between preactive definitions and interactive realisations, the thesis has shown that the links are neither direct nor easily discernible, but they

nevertheless can be detected and substantially influence the parameters of curriculum practice. In the Learning Unit, the introduction of the innovation created problems, since the roots of rejections were present in this foreign transplant. Innovations will continue to be introduced and fail, and industry will continue to ask for better quality graduates, unless investigations, such as those reported in this thesis, are integrated to provide a dynamic understanding of student learning.

In the following sections, the researcher will try to indicate some of the implications for the practitioner in his lecture hall and a strategy for introducing an innovation into a department. The chapter will be concluded by the implications for educational researchers. The reader is reminded that the "lessons" learnt are developed throughout the thesis and the following sections add to these and point to some practical suggestions. The principles behind the suggested interventions are guiding, not prescriptive. They need to be reinterpreted and adapted to each specific situation by lecturers who are directly involved.

Dr. Curr's plan emphasised "efficient" and "effective" methods to communicate the course content to his students. But his interventions did not prevent the misperceptions and mismatch between his intentions and students' aims.

The second problem which is becoming more and more evident in all professional schools is the dramatic growth in the knowledge base required for the practice of the profession which results in the subsequent cramming into the course of more and more content.

The 'traditional' view is generally that a structured study environment is necessary and that it provides a proven, disciplined way of achieving sound education which is economic in effort and leads ultimately to maintenance of standards.

Yet, in the Learning Unit, the emphasis on mechanistic control of time (working against the clock) did not achieve the efficiency and effectiveness hoped for. What, then, can the lecturer in a 'traditional' environment do to start

dealing with criticism leveled at universities from industry and elsewhere?

In Chapter 7, figure 7-1 suggested that students' intentions, motives and direction and quality of effort i.e. their approaches to learning are filtered through their idiosyncratic perceptions of meaning and relevance.

The model also suggested that students' perceptions of task requirements are filtered through the departmental support they receive in the shape of a) the learning material, (b) learning skills support, (c) freedom in learning and the work load. In other words, the way in which a student approaches learning a subject is a response to his or her perceptions of its content in the context of the course in which it is presented.

If the aim of the lecturer is to achieve a change of students' conceptions of certain aspects of reality (being an efficient and effective engineer), the accent will have to be on how this change can take place. It is suggested that the adoption of a deep approach to learning is the only way in which changes in conceptions can occur. Moreover, it is more efficient and effective in the long term as a way of remembering facts and it is a more satisfying way to learn.

In contrast, memorizing quantities of information is not only harder work but it means that studying becomes increasingly more arduous and tedious as the volume of material to be digested increases. It is all too simple for a teaching programme to induce students to adopt surface approaches or to employ approaches atomistically. Teaching programmes prone to this problem are those where a large volume of factual information is encountered.

The lecturer should ask himself, can the tasks involved in learning my subject be redesigned to help students understand concepts rather than accumulate facts and thus remember the facts better?

The researcher suggests that the model provided in Chapter 6 (figure 6:3) and the analysis and summary of that

Chapter provide a very useful framework to try to answer this question.

The first component of the strategy (aims) is to represent to students the importance of quality of understanding, as opposed to quantity of information, and to impress upon them that the aims of the engineering course form the ultimate frame of reference. A comprehensive set of aims and syllabuses is to be constructed to orient students towards the understanding of principles and their important application at the expense of detailed munitiae. A conventional and sequential course of instruction which has, by its very structure, inadvertently promoted the accumulation of isolated facts, must be altered to create an emphasis on the integrated whole. Dr. Curr's emphasis on teaching the 'basics' echoes the views of other professional schools that in the early stages of learning professional courses there is no alternative to laying down in a sedimentary fashion layer upon layer of factual information. But, it is easy for inappropriate selection of content, or lack of clarity regarding the structure of learning tasks, to discourage students from choosing deep approaches.

In short the content of the curriculum should be remodelled to be less atomistic and sequential, and more holistic and hierarchical. Learning tasks should be constructed to encourage students to search for principles which give meaning to the facts in a way that organized content into integrated whole. Students cannot do that on their own.

The didactical principles stated by Ausubel (Ausubel et al, 1978) provide a useful start for the lecturer in his plans to achieve that goal. These principles can be characterized in brief as follows:

Use of advance organizers (introductory material with a higher grade of abstraction, generality and inclusiveness, being appropriate for the existing cognitive structure of the student);

Principle of progressive differentiation: the most general and inclusive ideas are presented right at the beginning then

increasing differentiation in view of details and specificity;

Principle of integrative reconciliation: showing relations, similarities, differences, incompatibilities among various ideas;

Principle of sequential organization: making use of material sequential dependencies among the parts of a discipline; and

Principle of consolidation: practice, application, clearing up, correction of what has been learned.

This is a very demanding task for the lecturer and he is expected to provide multiple opportunities for these relations to be established and this leads us directly to the teaching methods to be adopted.

The 'traditional' approach emphasised the use of lectures, tutorial meetings and the practical sessions. Recently considerations have been made for the introduction of teaching methods in undergraduate courses which encourage students' autonomy. For example, in the L.U. such methods included: individual learning material, small group work, case studies and small scale project work. The researcher would suggest that greater use of text books and library facilities is long overdue, and a careful examination of the patterns of interactions between the learning materials and the students should be established. A series of questions in Chapter 6 provides a very good starting point in that direction. Despite the enormous effort Dr. Curr had spent on the preparation of the learning material, students did not always choose deep approaches to learn, nor did they consistently employ them holistically.

The use of 'summary tapes', which were meant to provide 'advance organizing schemes' were not usually used for this purpose, 'guided tapes' were ignored and there was a rush on the use of 'detailed tapes'. The result was greater dependence of students on teaching staff. There are several other examples in the thesis where many students stated that when they perceived an excessive amount of curriculum material to be contained in the course, they often responded by using

surface approaches and resorted to taking 'short cuts'.

Students initially expressed the 'ideal' intention of gaining understanding of the subject. However, after taking the total work load into account, they shifted their major intention away from understanding to avoiding failure in the examination. This contextual dependence of innovation on other parameters outside the department illustrates one of the practical difficulties in changing teaching with the expectation of influencing learning (see below).

Learning a subject can be conceptualized at different levels of generality. Teaching engineering involves helping students to change their conceptions of specific phenomena. It also involves helping them to improve certain general qualities. These include understanding how a professional engineer thinks and still more generally, intellectual independence and 'relativistic reasoning'.

However, the engineering department cannot claim the entire function of helping students to acquire professional competence - at least without restructuring the concepts of university and office so that the traditional boundaries between them virtually disappear. The variety, duration and realism of work experiences required to provide opportunities for developing the full range of professional competences are simply incompatible with the boundaries and structures of university experiences as it is currently defined.

The researcher will suggest a two pronged initiative to deal with this problem. The first deals with the responsibility of the university department and the second falls in the lecturers' domain.

Engineering departments should consider attempting to define and clarify the boundaries of their responsibility with regard to the professional training of engineers in the absence currently of any national decision on this matter.

Secondly, engineering departments should consider examining and making explicit the demands that they would

ideally and realistically make with regard to practical training for engineering students, before, during and after the period of the undergraduate course.

For the lecturer, the challenge is the patterns of interactions with students. In the lecture hall, the seminar and/or tutorial session and practical sessions, the first priority for the lecturer should be to help the student to develop as an effective learner. Adding to what has been mentioned earlier in this section, the researcher suggests some practical ideas for the lecturer to undertake in the areas of curriculum, teaching assessment and in the development of effective learning skills.

(1) Curriculum: the lecturer should try:

- a) To link and match curriculum aims to teaching staff objectives.
- b) To match curriculum teaching and assessment (to clarify goals and standards).
- c) To incorporate applications in syllabus (to increase vocational relevance).
- d) To define 'essential' information (to rationalize work load).
- e) To select appropriate text books (which encourage understanding), and in;

(2) Teaching:

- a) To emphasize principles and concepts (versus accumulation of details). Students should be explicitly required to build up structural frameworks to provide a system of analysis for incoming information. This must be provided by the lecturer in his own lecture plans to set an example for students to learn from, with an emphasis on the process of conceptualization.
- b) To create an environment to facilitate "good" teaching. In Chapter 2, the researcher discussed the different aspects of 'small group teaching' and it is worthwhile noting that the dialogue between the lecturer and the student is the best technique to assist the individual student in his concept formation process, in his learning with understanding.

By purposefully encouraging students to talk, to dispute arguments, to raise questions, to admit without feeling embarrassed that they do not understand a concept, a different atmosphere is encouraged in which - if carried out effectively - students become active participants rather than passive spectators: an atmosphere in which intellectual excitement could perhaps more easily flourish.

In such meetings the lecturer can pose and answer the question "where are we going in this course?" He will summarize what has gone before and indicate what is to come, and try to provide a rationale for the selection of the topics and their order of presentation. Also occasionally he recommends articles or books that provide background knowledge rather than formal instruction. Other aspects have been already mentioned in Chapter 2 and the publications of Nuffield Group for research and innovations in Higher Education (May 1976). Pre-recorded "detailed topics" did not encourage any of these opportunities in the Learning Unit. It is generally assumed that detailed handouts or supplementary audio-tutorials will help students to learn. In quantitative terms, this may well be true; students may obtain higher marks in examinations geared to those materials. But detailed handouts, as this thesis has shown, may also foster dependency; students come to believe that all that is required of them is to reproduce the information in the form provided by the lecturer. They then cease to think things out for themselves and adopt passive surface approaches to learning.

Simulation and field practices have advantages and disadvantages. The Learning Unit's experimentations with simulation and educational engineering games were profitable to some students, although 'games' were perceived as of questionable value since their correspondence with reality was doubtful in the students' minds.

c) To engage students in learning activities which encourage their problem-solving skills.

3) Assessment:

a) Students should be provided with adequate feedback to

minimize unnecessary anxiety.

b) Assessment tasks should be constructed that would allow students to demonstrate understanding and encourage them to use deep approaches holistically. To facilitate this task the lecturer should:

- (i) identify knowledge and skill requirements;
- (ii) use open-ended questions in the written examination to provide an opportunity for students to give explanations (which subsume descriptive information) of important principles and applications, thus encouraging students to display understanding;
- (iii) set questions which should give students scope to show their grasp of concepts;
- (iv) consideration should be made of broadening the range of aspects of courses that are assessed within the limits of the present syllabuses.

This should be done to emphasise the importance of such skills as problem formulation and model building, as well as those of analysis.

(4) Development of effective learning skills and communication skills:

(i) Traditional courses of "study skills" have emphasized the rudimentary skills of note-taking, speed-reading and so on. These have had rather little lasting influence.

Students should be helped to reflect on purposes and strategies - to become more aware or become metacognitive about their approaches to learning. Training procedures emphasizing the elaborative skills essential to a deep approach have been shown to influence the quality of learning. The best way to help students is to improve the teaching and assessment of the programme itself. But in addition, if an individual student encounters learning problems, it is of value to retrace the stages of his or her interaction with a learning task.

This may involve going through written work with the student, focussing on both the aims and the process of what has been written. The student can be encouraged to reflect

on the approaches he or she has used to tackle the task and the topic. An attempt should be made to relate the approaches and how they were employed to the outcomes. This method is designed to raise the students levels of awareness of their own approaches to learning and it provides an opportunity for students to deduce more appropriate future courses of action.

(ii) More opportunities for the development of written and verbal communication skills should be considered for inclusion in the undergraduate course. Wherever possible this should be an integral part of engineering subjects. The effective development of these abilities requires both practice and feedback, and opportunities should be provided for both.

Staff-student relations

In the long term, staff-student relations can only be developed through participation and involvement of students in the courses and in course development and evaluation. Social activities are worthwhile, but are no substitute for close contact in the teaching situations. This is necessary since lecturers interventions have to be monitored from two complementary perspectives: analyses of the experiences of students in their own everyday learning activities and the outcomes of their actual assessment tasks.

We now turn our attention to the introduction of an innovative scheme into a university department in general terms.

IX:(6):(ii) The strategy for introducing an innovation in a department:

The innovator, in a similar situation, must treat the experience as a whole, in a systems approach fashion, not to change one component but to devise ways to change a whole series of components bearing in mind the ecological model

discussed in Chapter 6.

In Chapter 4, the researcher invited evaluators to see some modified totality of the phenomenon under study and emphasized that system points are not isolated, independent or unattached. The interdependence aspect of systems accents the interconnection of parts. One is reminded of Gouldner's (1961) views of the implications of a systemic analysis for the action oriented applied social scientist, these are:

1. System models forewarn the applied social scientist of the possibility that a change in one part of the system may yield unforeseen and undesirable changes in another part of the system due to the interdependence of its elements.
2. System models indicate that changes may be secured in one element, not only by a frontal attack upon it but also by a circumspect and indirect manipulation of more distantly removed variables. These, because of system interdependence, may ultimately produce the desired changes in the target variables.
3. System analysis therefore directs attention to the multiple possibilities of intervention with respect to a single problem. This is a radical demand and requires re-thinking of the entire curriculum, an opening up of boundaries between subjects not only in engineering, but between engineering and other subjects and, moreover, it demands a new outlook on the part of the innovator.

The whole department has to be involved and this requires a different set of attitudes on the part of the teaching staff. But, in reality, that is a gospel of perfection. The presence of different individual perceptions makes it exceedingly difficult to implement innovations unless one can think of an 'innovative department'. Even if this can be achieved another level of constraint exists because of the official requirements of the institution as reported by Professor Young in Chapter 8.

Co-operation of other members of staff in the department

is an invitation for diffusion of the innovation.

Diffusion is the process by which an innovation spreads. The diffusion process is the spread of a new idea from its source of invention or creation to its ultimate users or adopters. Thus diffusion entails the communication or dissemination of an idea and culminates in its adoption by individuals. The Learning Unit activities continued to exist at the level described here as long as Dr. Curr continued to operate as its director. The role-change of Dr. Curr produced a definite reduction of its scope of activities.

To explain this state of affairs, the researcher will try to summarise some general observations based on this innovation and its history.

The diffusion rates in educational systems are slower than those in industrial, agricultural or medical systems for several reasons:

i) Educational/social phenomena are complex and as a result there is an absence of valid "scientific" research findings to support the proposed change.

In Chapter 3, the researcher discussed the problems and methods involved in the evaluation of innovation in higher education. To list these again here would be repetitious. To the lay person education is rather like engineering. By this one means that it is an applied enterprise, designed to put understandings to use, and to deal with real-world problems.

Further, there is also an element of "fixing" things (and hence the particular aptness of the analogy). Engineers operate on the basis of rules-of-thumb, that are derived from physics, chemistry, geology, economics, the social sciences, and many other disciplines beside. Posed with problems, or even creating their own, they seek to apply these rules to produce solutions.

In simple terms, the critical point seems to be that engineers build bridges and they sometimes fall down.

Educationists are unlikely to find themselves in the same

predicament. Unbelievably, educationists have no collapsed bridges, and plenty of justificatory language to encourage the use of behavioural objectives, of small group teaching, or of tape-slide sequences.

ii) It is possible that certain ideological beliefs in the educational profession serve to block effective innovation by insulating educational practitioners from reality. As observed in this thesis when other members of staff regarded the innovation as being familiar, being a slightly different version of an existing procedure or practices, they decided that it was not worth the extra cost - in time and energy - required to shift over to it. Furthermore, when the innovations in the L.U. were perceived as being concerned with "assessment of teaching" which implied a threat to existing practice, rather than mere addition to it, it was even less likely of acceptance.

One is reminded that university teachers are not generally accountable for their teaching and are unused to subjecting it to systematic study.

Any honest account of the teaching of any person or department is likely to contain information which those concerned would not wish to have disclosed to others in the same institution, let alone released for general publication.

iii) Educational products do not have immediate economic payoff. The tension between teaching and research is a major cleavage in university life. But because universities exist to serve both functions, the conflict must be contained and compromise must be reached. The compromise becomes a decision for individuals and for the departmental group within which they operate. Halsey and Trow (1971) from their survey suggest that although most academics are involved in both activities, the majority have a greater interest in research than teaching. This is true for the City University civil engineering department.

To counteract this situation, members of the teaching staff should be given the opportunity for attendance and participation in courses and workshops concerned with

educational developments. Attendance should be given the same standing as that at research conferences. Funds should be made available for this so that research and teaching do not compete at the departmental level.

Furthermore, the reward structure of the institution should give adequate incentive to teaching ability vis-a-vis research and it must be seen to provide such an incentive.

iv) As this thesis has indicated there are different perspectives in the milieu of an innovation, the practitioners must be supported in monitoring and evaluating the innovation at hand, whatever teaching techniques are adopted. This will involve students, colleagues and even interested parties outside the university. The aim, as mentioned earlier, is to orchestrate the changes so that these are in harmony and pointing in the same direction. The role of the person appointed to take prime responsibility for putting new ideas into effect must be acceptable to all the key interest groups concerned. Anyone charged with helping to bring about institutional change has to negotiate his way through a complex pattern of political cross-currents. He needs to be responsive, but in an educative rather than merely passive way. Above all, his actions should never imply that the participants and those outside the innovation cannot manage on their own, but rather that they deserve extra support in exploring new ideas and possibilities.

Practitioners need to look for the contrasting perceptions as they emerge and the question inevitably arises whether innovative schemes should involve insiders or outsiders, or both - to maximise the probability of identifying these contrasting perceptions.

People inside the institution or department concerned, or members of the same academic and professional groups, have the advantage of familiarity with the context. Their ideas are more likely to be accepted by their colleagues, particularly if they have themselves to live with the consequences of any actions that are proposed or any decisions that are made. But, against this, they are less likely to

have much knowledge of educational change or much experience of evaluation. They will be constrained by familiarity with the context and therefore less aware of the potentialities of change. In contrast the outsider usually comes into the situation with a wider background and expertise in educational matters than the existing participants, although with much less knowledge of the particularities of the context, the professional group or the academic subject field. Therefore, outsiders must be allowed a lengthy initial period of familiarisation and trust-building.

One of the most commendable roles for an outsider is to act as a catalyst in the discussion of educational issues, but this person should beware of direct involvement in defining alternative courses of action, let alone the promotion of a particular idea or solution.

Developments in teaching can be most easily and effectively conducted when there is active support; both from the highest level in departments and elsewhere, and from the level of grass roots staff. It is desirable that any proposal for an educational development be initiated jointly between senior staff and those most actively involved so that both parties have an active investment in it.

Two levels of support are desirable for educational innovation. At one level, it should be in terms of money that is available from the normal teaching budget to aid worthwhile schemes. At another level, some form of personal support for innovative staff is helpful.

This can be provided in part by consultants outwith the departments who are knowledgeable and skilled in a variety of teaching methods and who have the personal skills required to aid, but not dominate, individual innovations. Such a consultant, or consultants operating from any central university facility can aid the innovator in several ways. They can provide 'confidential' reports to those immediately concerned with the innovation and try to publish articles in educational journals discussing some aspects and issues

concerning the educational "reality" which they uncovered.

Other issues in this section can be addressed to the ordinary department as well as the innovative one.

Firstly, it is desirable that courses be monitored to examine their effectiveness and also that longer term planning be undertaken to provide for needs which are not being met by present provisions. These should be regular on-going activities and be recognised as important in departmental planning. In this planning it is necessary to consider the worth of specifying aims and objectives for the overall undergraduate course, and for individual courses. Clear reasons should be given for the acceptance or rejection of any proposal for change. If the proposal is accepted then the advice of internal and external consultants should be sought on the methods to be adopted and the resources required for such an activity.

Secondly, an investigation into examinations should be considered to determine the aims of the present assessment system as presently constructed and to assess the degree of congruence between those educational objectives that are tested and those that it is desirable to develop in students. Thirdly, the time-scale of educational developments is long and a planned scheme should preferably be monitored over a period of at least three years before a decision on its acceptance or rejection is made. This time should be spent on modifications and changes to make improvements in the light of an on-going programme of course monitoring. A safe strategy is that any development that is considered should be undertaken first of all at departmental level as a pilot study, in order to determine the degree of commitment of staff to the process before external funds are sought.

IX:(6):(iii): Implications for ethnographers and educational researchers

Traditionally, educational researchers in their move toward objectivity have reported important data in forms of

control, coefficients of reliability and validity, and tests for beyond chance relationships.

Becker (1970), has argued strongly the merits of telling the reader precisely what steps were taken in the research enterprise, thereby aiding the reader in criticising and evaluating the results and interpretations, or enabling him to begin a replication with a new case. Now, with the advent of pluralism of interests in educational enterprise, with contention and conflict of objectives, with alternative views of the degree and kind of educational change both possible and desirable, and with the bearing of research on policy formation, additional clarity is necessary. It is with this concern that the researcher presented an account of methods and procedures in Chapters 3 and 4.

When reality is socially constructed, as this thesis has shown, the quality of the product seems to matter for the different audiences one is trying to address. The thesis should try to say something relevant and significant to university teachers, administrators and specialists in curriculum development, evaluation and policy positions.

In the analysis of the L.U. world the researcher introduced several frameworks and categories which describe important features of psychological or educational reality. The powerful check on this study's validity is whether it described a 'recognizable reality?' (Miller and Parlett, 1974). It is on such grounds, and on the rediscovery of the main constructs by independent researchers in differing contexts, that the researcher's claim for the validity of the findings must rest. The researcher's examination of two other contexts did offer this support. While this research emphasised the situation in a civil engineering department, it encourages teachers to explore and utilize concepts developed here and elsewhere to understand the range of understandings and misunderstandings developed by students in the process of learning and to realize that students' perceptions of their world may be interpreted in a whole range of different ways.

Considering what has been termed the 'micro'-'macro'

description, it is necessary to remind the reader that the researcher's awareness of the context of the innovation and the contrasting perceptions of its participants builds a bridge towards the generalisability of its findings.

Human observers are the best instruments we have for many evaluation issues. The important matter for the evaluator is to get his information in sufficient amount from numerous independent and credible sources so that it effectively represents the perceived status of the programme, however complex. The researcher will then try to communicate this complexity to his audience.

The style of reporting, as mentioned in Chapter 4, is a very important part of the exercise. Direct personal experience is an efficient, comprehensive and satisfying way of creating understanding, but a way not usually available to our evaluation-report audiences. Therefore the researcher will find it increasingly necessary to conceptualize the experience in terms of persons, places and events. He will need to move from the art of story-telling to provide interpretations to his observations based on analytical frameworks and analytical concepts. This can continue to portray the complexity of the phenomenon under investigation and save the reader the difficult task of searching for the "multiple reality" of an educational experience.

IX:(7): Concluding Comments:

Within the field of curriculum development and innovations, whatever the style adopted being an instrumental style (rational planning or blue prints) or interactive (potter's wheel), the development cannot be confined within the tidily antiseptic atmosphere of a planning office or high level adaptive techniques through sophisticated management system.

All such activities have eventually to be played out in a complex and largely uncontrollable social environment. This social environment depends on the interaction of the

characteristics of individuals with a variety of contrasting social settings. There is a discrepancy between the immaculate ideal and the rumpled reality, which surfaces so frequently that it undermines innovators' efforts and credibility.

Traditional research was narrowly concerned with the examination performance of the individual. The evaluation of innovations was based on the assumption that there was a direct and strong relationship between teaching methods and the outcome of student learning.

Current research, including the research reported in this thesis, has recognised that it is crucial to consider changes in students' approaches to learning as well as quantitative changes in examination results. The emphasis on student learning has also drawn attention to the fact that different students perceive teaching in very different ways, which depend on their previous experiences of studying and on their contrasting motivation.

In looking very closely at the Learning Unit activities, the researcher has found that problems cannot be isolated easily, nor can they be solved as easily as first believed. While this discovery is somewhat disheartening, the researcher obtained a more accurate picture of the Unit's practices and a deeper understanding of the motives and actions of the Unit's participants.

The main implication, as the researcher sees it, is that evaluation should help to 'bridge the gulf' between the ideal and the actual, bearing in mind the contrasting perspectives of the participants.

This will be facilitated if developers and educational researchers adopt an 'ecological' metaphor for research into educational process. Curriculum development and evaluation cannot sensibly be divorced from the total circumstances in which they are used. The circumstances i.e. the environment, the milieu, must be studied too.

Becher (1980) noted:

"One of (evaluation's) central purposes might be to unravel the contextual complexities which are an inevitable consequence of putting ideas into practice. Another key task might be to enhance (our) understanding of what does not seem likely to function harmoniously in a particular range of settings".

Pursuing the ecological metaphor and trying to unravel the contextual complexities will lead to more questions being asked than fewer. But the questions it leads into can hardly be glossed over if genuine progress is to be made in thinking about education and its role.

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(A) APPENDIX '5'

The Transcript of the Tape

1/160 AT

for First Year Students at

Kurasini Building

On his first day at the Learning Unit at 'Kurasini', the student receives a "wad of handouts". He also receives a recorded tape which is heard in conjunction with handout 1/160 (Fig. 5-9) activity number 5 in the flowchart of Fig. 5-8.

The transcript of this tape is reproduced here in full to identify the different areas of emphasis which Mr. Currie communicates to his students. This tape is usually heard by each student in a cubicle using a headphone.

Learning Unit Material - Tape 1/160 AT - Precourse Documentation -
Overview

This is an introductory tape for first year students in session 1974-75. Normally speaking when you use the individual tape recorders I would hope that you'll be making considerable use of switching on and switching off facility, although today it may be that you're sitting for most of the time just listening to the commentary. I hope that from time to time if you want to, you'll stop the tape recorder, either to repeat something you didn't understand, or to give yourself time to read something that you do want to read before you go any further.

There should be a piece of what we call "support material" in front of you in the booth; support material is something that you have with you when you're using a tape, but you don't take it away with you. You should also have a set of handouts which are being given out to you at the beginning of the term, and because they're given out at that time we call them "pre-course documentation". If you look at the support material, you'll find out what you're supposed to be doing in this half-hour.

First of all, we want you to get the hang of using the equipment, and if you can hear me now, I expect that means that you've found out how to use the equipment.

Secondly, we'd like to tell you something about the course regulations, and explain how C.E.I. is divided into a great number of lectures. You may find that sub-division confusing. Incidentally, if you ever want to come back and listen to part of this tape again, to get a little reminder of how the sub-division works, please do so at any time in any of the weeks which follow.

The third thing we want you to do - or that I want you to do - is I want to look over the pre-course documentation for the Properties of materials part of C.E.I. Now, that's a very small part of C.E.I, it's about 2 hours a week out of 12 hours a week, but we'd like to look over this wad of documentation that you've got in your hand.

Now, within the university there are three kinds of hurdle that you've got to jump across. In other words, to get a degree, there are three kinds of jobs that you have to do, to show that you should pass.

The first one is that you may have to pass exams where you sit exam papers. Now, in that kind of system, normally speaking, it's the June exam that matters. There may be term exams in December, and in March, but unless somebody tells you to the contrary, the only exam that counts is the one in June. The other ones are there as a sort of early-warning system to let you know how you are getting on. Within the university system the pass-mark is 40%, although there is a thing called a "compensation pass system" which means that sometimes with a mark of less than 40%, you may be given a pass if you have done well in your other subjects. So the first type of hurdle, then, is the exam.

The second way of judging people is by what is called "continuous assessment" and this means that marked exercises, or tests, or some kind of evaluation which goes on, not continuously, but fairly regularly throughout the year, counts for a proportion of the final examination mark. It might count for 25%. It might count for more or less. But it counts for a proportion of the final examination mark, with the examination in June supplementing the balance.

And the final system is the course-work system. You see there are certain items of course-work that you must do. You must write lab reports; you must do drawings in the drawing office. You must hand in certain items of work. And there normally, although the course-work is marked so that you can see how you're getting on, normally speaking, you will have to satisfactorily complete the course-work or not. If you satisfactorily complete the course-work, it doesn't matter whether you score 41 or 91. You have still passed. Now that's different from exams and continuous assessment, if you get 90 in an exam, that may help you with another examination where your mark is a little below 40%. You might get a compensation pass. If you do well on the continuous assessment, then it means that you don't have to do as well in the examination to get an overall mark. But in course-work it's pass or fail - the number does not matter, once the decision's been made.

Now, there are two things I want you to note about these kind of requirements; I have written them very carefully in capitals.

First of all, you won't be examined in all of these ways in every class. Some classes only examine by means of a June examination. Some classes - or some parts of the classes - are only examined by course-work. So that's the first thing.

The second thing is that you should expect and ask indeed for individual lecturers to announce their own requirements for their part of the course. And these requirements you'll find for my part of the course - Properties of Materials and for Structures and Stress Analysis, you will find that they're described in a moment, or you'll be told where to get them on this tape.

But before we come to that, we've got to move on to the next heading, which is this business of sub-dividing the enormous subject of C.E.I. which takes up 12 hours a week. It sub-divides under a great many headings. First of all on a Monday, from 10 till 11 and

with a tutorial some Mondays, from 11 to 12, you have Mechanics from Mr. Ferguson.

Secondly, you have two subjects, Structures and Stress Analysis from myself - my name is Currie, and Mr. Hopkins. That will be on a Tuesday at 'Kurasini', through pre-recorded instruction.

Thirdly, you have Properties of Material where there will be lectures on a Monday from 9 to 10 from myself, Mr. Currie, and Dr. McIntyre, and there will be one hour a week, on a Tuesday at differing times, depending on your group.

Now, all of these three sections of C.E.I. will be examined in an examination in June. There is also some course-work which will be handed out during the year and which you must complete and you must do satisfactorily. But there is no continuous assessment. In other words, there are 100 marks for the exam in June, and that's it. And if you don't get the hang of the subject until May, then you still have as good a chance as anyone else in the June exam.

Now, there are three other parts of C.E.I. with which I am not concerned, but I think we better put them in, to complete the story.

There's Graphics and Drawing, which is looked after by Mr. Thomson and Dr. Smith, and that takes place on a Monday afternoon at Hammond Building, and the assessment there is by course-work. You will either pass it or you will fail it. There are labs which will be run by Professor Young and a variety of other lecturers, they're on a Monday afternoon, and if you don't satisfactorily complete the lab reports there, then you will fail that. If you do, you pass. And finally, there 's Design, which will be looked after by Dr. Smith, who will have lectures once the session is a little further advanced, on a Monday from 11 to 12, and sometimes in the afternoon. And his work will be assessed by means of course-work as well. In none of these sub-sections will there be continuous assessment.

Now, let me tell you about the parts of the course that I am concerned with - In Structures and Stress Analysis, there will be no course-work which will count towards the go/no go, pass/fail system. In other words, anything that's handed in in Structures and Stress Analysis is simply to give you an idea of how you're getting on. It doesn't count for you and it doesn't count against you, and if you decide not to do it, then that will mean that we'll have no marking to do. There will be very little, if any, work which will be issued in that way. It will not count as course-work, and that will be made clear.

In Properties of Material, there is course-work, and we will look at that in just a moment. So could we move on now to the wad of handouts which you have relating to Properties of Material. Let me just tell you what these bits of paper are, and when you are likely to need them. It may be that some of them are things that you should be looking at before you leave here today - like handout 02 (Fig. A-2) for instance.

COURSE REQUIREMENTS
PROPERTIES OF MATERIALS SECTION

PLEASE READ ALL OF THIS CAREFULLY, AND KEEP THE SHEET FOR
FUTURE REFERENCE.

In previous years, some students have found the method of assessment difficult to understand. Since this is the "yardstick" which determines whether or not you proceed to the second year, it is quite important to appreciate what is involved.

Before entering the second year, each student must have satisfied BOTH of these requirements:-

- (a) He must pass the June examination in Civil Engineering I which includes questions on "Properties of Materials", or else he must pass a similar resit examination in the autumn or later.
- (b) He must complete the coursework satisfactorily.

Considering each of these in turn:-

(i) Examination

If you do not pass in the June examination in Civil Engineering I, you must pass at one of the three resit opportunities which follow. The pass mark in the Faculty of Engineering is 40%, although in some cases a "compensation pass" is awarded to candidates sitting an exam.

(ii) Coursework

In some subjects part or all of the final mark comes from items submitted during the session for marking. This arrangement is called continuous assessment, but it is NOT used in this part of the Civil Engineering I course. The only requirement in Properties of Materials is that you must complete the work of the course to the satisfaction of the Professor of Civil Engineering. This requirement is quite separate from the examination system and must be met.

If your coursework is unsatisfactory you may request a second opportunity to submit further coursework (which is generally offered in the form of written exercises during the summer period).

Now this handout contains the course requirements for the Properties of Material section of C.E.I. Only for P. of M. I'd like you to read that before you leave the building today, and make sure that you understand it. And, if you don't understand it, please will you discuss it with a member of staff, and make sure that it's clear to you.

Next, if you turn over the pages, we come up to handout 03 (Fig. A-3). Now this is quite an important handout, it contains the notes, first of all, a description of how we mark. Now that's gonna be important to you, because you're going to mark your own work as well as us marking it. Now, that is perhaps a new venture for you, so you're going to have to use that marking scale first of all to see what we mean when we mark your work. And, secondly, so that you know how you can mark it.

Item No. 2 on this handout 03 (Fig. A-3) describes how you should submit work to me for correcting. Now, you will please read that before you attempt any course-work. I am not interested in submissions that don't follow that procedure. Life is very difficult with a large class; it'd be a lot more difficult if everybody doesn't do what they're supposed to do.

Now, if you turn on to page 2, you'll find details of the exercises which you've to submit. I don't think these will mean an awful lot to you at the moment, because you haven't had the basic instruction, and the only thing that really matters is that you'll notice that the submission date is marked on the paper. For instance, exercise C.W.I., Course-work I, has to be submitted on the Tuesday of week 3 - notice the way we don't use dates, we refer to weeks of the term - by 5 o'clock. Now, I won't remind you of that in week 2, it's up to you to keep an eye on this bit of paper and see when you've got to hand in the various things. So you'll find that there are in fact four items altogether, and they're listed here. And these are the four items which we've got to be submitted during the year.

Now, could we move on to handout 04 (Fig. A-4), which is an assessment record-sheet. This sheet must be handed in with every piece of course-work that you submit. Before I mark your course-work, I want you to mark it, and also there are some exercises that I don't want you to hand in, that's them listed down at the bottom of the page. If you do these exercises, I want you to mark in a mark. If you don't do them I want you to put "not attempted", "N.A.". Don't be tempted to put in a mark if you haven't done them, because if there is something funny about your marking in relation to my marking, then I might come back at you and ask to see the exercise that you say you've done and marked. If you haven't done them, it would just be embarrassing for both of us and it doesn't help. So, if you don't do these exercises, will you please just mark "N.A.", it's not going to count against you. I am not going to point a pistol at your head or anything like that.

Will you turn over the page - you'll find some notes which are meant to be helpful. You may not find them helpful as far as report-writing is concerned. (Fig. A-5)

COURSEWORK - COMPLETE LISTING
FOR SESSION

1. Marking

Marks for all work corrected in the Unit will be awarded on the following scale, which conforms with a 40% pass level:

- 20/20 Perfect.
- 17/20 Better than could be expected from a first class honours candidate at this stage in the course. There is evidence of exceptional effort, previous training, extra reading or the like.
- 15/20 The work of a prospective first class honours candidate: excellent.
- 13/20 The work of a prospective second class honours candidate: very good.
- 11/20 Better than a mere pass.
- 9/20 A satisfactory pass, but no higher.
- 7/20 Fails, but is within a reasonable margin of a pass.
- 5/20 Very poor.
- 3/20 Abject - or incomplete.
- 1/20 Appalling.

2. Submission

Students must submit all work in a envelope type folder with their name and group on the outside top right hand corner. Work should be written on one side of the paper only, and is to be handed in at _____

All exercises must be submitted: late work will score half the marks which would otherwise be awarded. Students who have medical, compassionate or other grounds for non-completion of coursework should report this to Dr. CURR But students who leave to go home before the end of term, or who return late from vacation for any other reason, must arrange for their work to arrive on time, and are responsible for the vagaries of the postal system.

Items/

Items in envelopes addressed to Dr. Curr at Hammond Street may be handed in at any main university janitor's office, and will reach Kurasini Building about 24 hours later.

3. Return

Corrected work will be placed in the lettered drawers in the Fountainbridge building. Please discuss any marking which you do not understand, or which you feel to be unduly harsh, with the lecturer concerned. The marking is meant to be feedback on your progress rather than a test system.

Details of Exercises

CW1 : Serviceability (Submission Term 1, Tuesday, Week 3 - 5pm)

Write briefly and to the point, in terms which might be understood by a first year student in another branch of engineering:-

- (a) Define the term "limit state".
- (b) Explain to him the basic principles of limit state design.
- (c) Explain to him the relationship between the properties of materials and the structural form and purpose for which they are used. Use one or two examples to illustrate your answer, but do not use examples quoted in the lectures or videotapes.
- (d) Give one example of each of the following, preferably taken from within the field of engineering, though not necessarily from civil engineering. Obviously a specific use must be mentioned in each case.
 - (i) A material which must be strong in tension.
 - (ii) A material which must be weak in tension.
 - (iii) A material which must be stiff.
 - (iv) A material which must not be stiff.
 - (v) A material which should be impervious.
 - (vi) A material which should preferably not be impervious.
 - (vii)/

- (vii) A material which must have no plastic range after yield.
- (viii) A material which must have a plastic range after yield.
- (e) Briefly describe, from your own observation, one example of a serviceability failure.

CW2 : Pipes and Pipe Joints (Submission: Term 1, Tuesday, Week 7 - 5 p.m.)

Prepare a set of notes, not more than 3 pages in length, containing as much useful information (useful to you!) as you can present coherently on the appropriate subject taken from the list below. These notes should (if possible) include a description of form, use (in relation to the construction industry), the relevant properties of the material or materials involved, the physical shape and appearance of the item, etc. The object of the exercise is:-

- (a) To find out useful information.
- (b) To set it down effectively.
- (c) To link the properties of the material with its use.

Position in alphabetic list of group members

Subject to write notes on

- | | |
|-----|----------------------------------|
| 1 | Fireclay pipes. |
| 2 | Cast-iron pipes. |
| 3 | Steel pipes. |
| 4 | Asbestos-cement pipes. |
| 5 | Pitch-fibre pipes. |
| 6 | Concrete pipes. |
| 7 | Plastic pipes. |
| 8 | Joints in fireclay pipes. |
| 9 | Joints in steel pipes. |
| 10 | Joints in Asbestos-cement pipes. |
| 11 | Joints in concrete pipes. |
| 12 | Joints in cast iron pipes. |
| (13 | Joints in plastic pipes.) |

CW3/

CW3 : Modes of Failure (Submission: Term 2, Tuesday,
Week 4 - 5 p.m.)

Prepare a written report, illustrated by sketches and examples preferably taken from your own observation. This report is intended for a reader who is about to enter a civil engineering course: when he has read what you have written, he should feel competent to describe the commonest and most relevant failure modes for civil engineering materials and constructions. He should also be able to relate these failure modes to the appropriate material properties.

The length and writing style should be decided by you, and will be two of the points on which the marking is based.

It is expected that at least some of your coursework will provide a basis for the content of this report.

CW4 : Projects (Submission: Term 3, Tuesday, Week 6 - 5 p.m.)

Details of the projects will be issued in Term 2 Week 9. You will be given the opportunity to choose or suggest a question for further study. It must:-

- (a) be related to the properties or use of materials.
- (b) not have an answer which is already known by someone in the department.
- (c) be worth answering.

If you have any ideas, let us know them any time, and we'll try to put them on the list.

ASSESSMENT - RECORD SHEET AND NOTES

NAME

GROUP

* * * Keep this sheet up to date, and hand in with each* * * piece of coursework submitted

COURSEWORK MARKS AND COMMENTS

	<u>Your Mark</u>	<u>Our Mark</u>	<u>Marker</u>	<u>Comments</u>
CW1	<input type="text" value="/20"/>	<input type="text" value="/20"/>		
CW2	<input type="text" value="/20"/>	<input type="text" value="/20"/>		
CW3	<input type="text" value="/20"/>	<input type="text" value="/20"/>		
CW4	<input type="text" value="/20"/>	<input type="text" value="/20"/>		

SELF-MARKING

Mark your own work (or write NA for not attempted). These marks are NOT put on record and do NOT influence your progress in any way. The work is NOT to be handed in.

<u>Term 1</u>	<u>Your Mark</u>
Week 2: NOTES ON OBJECTIVES c (HO 21)	<input type="text" value="/20"/>
Week 3: NOTES ON OBJECTIVES b (HO 23)	<input type="text" value="/20"/>
Week 5: NOTES ON OBJECTIVE c3 (HO 24)	<input type="text" value="/20"/>
Week 7: NOTES ON BEAM TEST - b6 (HO 26)	<input type="text" value="/20"/>
Week 8: NOTES FOR OBJECTIVES b (HO 27)	<input type="text" value="/20"/>

Marking Reports and Notes1. General Comments

Never write a report until you know the answers to the following questions:-

- (a) Who is it supposed to be written for?
- (b) What will he be using it for?
- (c) What is it about?

The answer to (a) will tell you what your reader knows already, what kind of appreciation of the subject he has, and which aspects he is likely to be interested in. A good report will waste no time telling him what he knew beforehand.

The answer to (b) will make it particularly clear what information he must be given in precise detail.

The answer to (c) will remind you that often there is much interesting information which should not be included - because it is irrelevant in the immediate context.

2. Marking

1. Try going through a draft report, and ruthlessly score out:-

- (a) everything which you knew before you started.
- (b) anything which is not directly related to the subject.
- (c) any opinion unsubstantiated by evidence.
- (d) duplication.

2. Check that your report includes:-

- (a) a note of the reason for writing the report.
- (b) a factual record of everything relevant.
- (c) a record of all relevant information given to you.
- (d) a record of all that you have observed.
- (e) a record of all relevant information you have obtained.
- (f) an explanation of any opinions or conclusions you have formulated.

It is often helpful to separate these points distinctly for the purpose of the report.

3. Include sketches, in preference to descriptions - provided the information is needed by the reader.

4. Include:-

your name
a title
the date
the place.

You may also find that they give you some indication of what I shall be looking for when I am marking a report.

Now, if you move on and look at the balance of the handouts, I don't think we want to look at these in any great detail. These are, in the main, the handouts for the Tuesdays at Kurasini in 'Properties of Material'. And each one, if you look at O21, the first of them, each one follows the same pattern in the main. It gives you a list of things that you should have done before you come for the period of instruction, it then lists the objectives of the periods of instruction - in other words, after the period of instruction has been completed, it tells you what you should be able to do. And it might be helpful, again before you leave the building today, will you please make sure that you can satisfy objectives 1 to 8, as far as the 'Properties of Material' section is concerned.

And lastly, it suggests what you should do in the weeks that follows that period of instruction, and generally there is some recommended reading. Now, that's the general pattern, although it varies a bit for each week.

I would suggest that before you come to 'Kurasini' each Tuesday you should look out the appropriate hanout for that week's instruction and bring it with you. I think you should also look over, or do whatever it is you're supposed to do before you come. And I would be disappointed if you didn't find the objectives a help in putting together the instruction and finding out what it was that you didn't understand. And I hope that you'll make use of the members of staff to check over the objectives list if there are any bits in it you're having trouble with before you leave the building.

Now, I think that's all that has to be said under the headings on the support sheet. Please switch off.

Read these paragraphs carefully - they are intended to be more than just a chatty introduction, and apply to all lecture objective lists (not just packages 1 and 2).

0

Presumably most students would prefer to come out of lecture having understood as most of the lecture content and with as good a set of notes as possible. It is certainly easier to tackle this task if you have some idea beforehand of what matters and what doesn't. For instance, a lecture may contain an explanation of a certain point. Possibly you will later be required to repeat this explanation, or to discuss it, or to apply a similar argument in a slightly different situation - or perhaps the point is only being explained as an example of a general principle, and has no great significance in itself. In each of these cases the notes you would wish to take or be given should be different, and the attention you should give to each part of the explanation would vary in its intensity.

I have therefore prepared this list of objectives for the lectures which I hope to give. These state the type of work I think you should be able to perform within a few days of the lecture, once you have had the chance to go over the notes and perhaps to seek out the explanation for points which puzzle you. So you should be able to use each list of objectives, before and during a lecture, to assist in your note taking and in the "learning attitude" (I couldn't think of a better phrase) which you adopt to each part of the lecture. They will also help you in your revision, by reminding you of basic tasks which you should certainly be able to perform.

In the same week as each pair of lectures are given, you will be able to attempt tutorial work in the Learning Lab or elsewhere. The tutorials have been drawn up on the assumption that you can carry out the activities listed on the objective sheets, with the help of your lecture notes or of any other aid which you find useful.

DO NOT regard the objective lists as the equivalent of a complete syllabus. There are other activities in the course, such as tape/slide sequences and drawing offices. Each of these should also contribute something to your overall design ability and experience. And you will also be consolidating your knowledge and experience, leaving you able to cope with more complex problems. So in the tests and exams you may well be asked questions which demand more of you than the separate skills and abilities described on this list. Don't forget this warning later.

October, 1974

APPENDIX 6:2

At the end of the lecture noted, you should be able to:-

PACKAGE 1

Steel Lecture 1.1 Introduction

1. State the various factors which may influence the choice of permissible stress values in steel design.
2. List the conditions for which permissible stress values and design methods are required.
3. State the method of design for pure tensile stress, without eccentricity.
4. Explain the occurrence of eccentricity effects in single angle ties.
5. State and explain the design method in BS449 for single angle ties.
6. State and explain the design method in BS449 for double angle ties.
7. State ONLY (as a cross reference) the design method in BS449 for ties with moment present and tension ruling.

Steel Lecture 1.2: Struts under axial loading

1. State the basis of strut design in BS449.
2. State the effective length rulings, compare them with the Euler values and comment on the contrast.
3. Set out basic guidance on end-condition assessment.
4. State the design method for axially loaded struts.
5. State the modified design method for angle struts in trusses.
6. Demonstrate the effective length rulings for angle struts in common cases.

Steel Lecture 2.1: Bending of Symmetrical Beam Sections (except Plate Girders)

1. Define the scope of this lecture material.
2. State the design method for symmetrical sections in flexure (excluding plate girders).
3. Comment on the neglect of f_{bt} in this method.
4. Amplify and explain the design method with respect to the values for D , T , l and r_{yy} .

Steel/

APPENDIX 6:3

Kurasini Learning Unit - Third Year - Plan for whole session 1974-75

First Term		Second Term		Third Term
Week 1	Lecture and Drawing office work	Lectures and Drawing office work	Other activities	
Week 2	Steel I	↓	Tape/Slide of production of concrete	Concrete II
Week 3		↓	↓	↓
Week 4		↓	Loading	↓
Week 5	Package Test (1)	↓	Package Test (3)	Package Test (5)
Week 6		↓	↓	↓
Week 7	Steel II	↓	Concrete I	FREE
Week 8		↓	↓	↓
Week 9		↓	↓	↓
Week 10	Package Test (2)	↓	Package Test (4)	↓
	Other activities		Each of the T/S lasted about 1 hr.	
	Institutions of Civil Engineering			
	Lecture attendance and a summary of the lecture to be presented to the Tutor			

Department of Civil Engineering

APPENDIX 6:4

Name

Year

Term

Day

Group

Learning unit

STUDENT TIMETABLE

	Week Number									
	1	2	3	4	5	6	7	8	9	10
9		L		C		S				
10				D	EXAM		D			
	S	T		D		L			C	
11				D		D	C		L	
	D	T		D		D			L	
12			S			L		L	C	
1										
2								L	C	
3				L				S	D	
	C	T		L						
4				H				D	D	
	L	T								
5								D	D	
		T								
			L							

Rooms
 Learning Lab L
 Drawing Office D
 Classroom C
 Seminar S
 Tutorial Room T
 Conc. Lab CL
 Public H. Lab P

APPENDIX 6:5

CIII : DESIGN OF STRUCTURES

COURSE REGULATIONS

1. Students must "satisfactorily complete the work of the course" which consists of:-

1. 8 No. 2 hr. exercise (2 per package in packages 1 - 4)
2. 4 No. 3 hr. exercises (1 per package in packages 1 - 4)
3. 2 No. 6 hr. exercises (1 per term in terms 1 and 2)
4. 2 No. 4 hr. exercises (in package 5)
5. 2 No. Report exercises (1 per term in terms 1 and 2)
6. 1 Report on I.C.E. meeting

Students who do not meet this requirement may be offered the opportunity to complete remedial exercises by September 15th of the same academic year, if they so request in writing. Only 3 omissions are permitted within items 1 - 6. Medical or compassionate grounds should be reported to Mr. Currie Mr. Tyler or Mr. Hopkins.

2. Students must obtain a pass mark in the examination. This can be obtained in one of two ways. Either (a) by taking 5 package tests and obtaining an average mark of 40%. Test timings will be:-

Package	Content	Term	Week	Duration
1	Steel - first 4 weeks	I	5	1 hr
2	Steel - second 4 weeks	I	10	1 hr
3	Loading - first 4 weeks	II	5	1 hr
4	Concrete - first 4 weeks	II	10	1 hr
5	Concrete - second 4 weeks	III	5	4 hrs

(for a 1 hr test)

(All the above are scored TEST = 80 marks plus average of best two package drawings = 20 marks)

OR (b) by sitting the June examination covering the entire syllabus.

(scored at EXAM = 75 marks + Package 5 drawings = 25 marks)

OR (c) in the normal resit examinations. (No drawing mark included)

NOTES

In case (a) only marks of 40% and over can be put forward in place of a degree marks.

In cases (b) and (c) marks of less than 40% are possibly eligible for compensation passes.

NO LATE WORK IS ELIGIBLE FOR INCLUSION IN SYSTEM 2(a)

3. All examinations will be OPEN BOOK, with a 15 minute allowance for reading time, before the published starting time - regardless of the intimation in the university timetables.

I.C.E. Lectures

All third year students will attend at least one of the winter series of meetings organised by the local branch of the Institution of Civil Engineers. Each student must complete a report on one of these meetings, and submit this to Mr. Currie for marking by 5 p.m. on the seventh day after the meeting.

The report should be made up as follows:-

1. A Title : make sure that the reader knows who you are, which meeting you went to and when you went.
2. A summary of the paper: This should cover all the main features of the paper, but it should only include details when either the author or the student believes them to be particularly important. (It is often preferable to re-arrange the order of presentation of points, when condensing the paper to a summary.)

The summary should not exceed 500 words, and the word total should be given.

3. An Appraisal of the paper covering
 - (a) content
 - (b) presentation
 - (c) relevance

This Appraisal should answer some (but not necessarily all) of the following questions, or similar ones - depending on their importance in the case of the paper in question.

- (a) Was there too much, or too little detailed information?
Was anything omitted that you would have wished to see included?
If so, then what and why?
Was anything included which you felt out of place? If so, what and why?
Did you disagree with anything said? Explain your side of the argument.
Was the discussion appropriate? How did the author deal with questions?
- (b) Was everything clearly explained - or were the explanations too long?
How would you have improved them?
Were the diagrams sufficient and clear? Give an example to support your comment?
Were the slides well chosen? Quote particular examples.
Did the author make the subject seem interesting? How?
- (c) Were the most important points singled out for attention?
Was the paper conveying useful information or opinions?
What use, if any, was the paper to you?

Your/

APPENDIX 6:5 (cont.)

3.

Your appraisal must be concerned with points of some importance, set out in a rational and properly presented order. It must be comprehensible to someone who was not at the meeting. (a), (b) and (c) may be freely intermingled, or a report format may be followed.

The entire appraisal should not exceed 500 words and should close with a word count.

4. Single out one point of particular interest which you would wish to tell a non-attender about, and do so in less than 100 words.

This may be something you learnt, or disagreed with, or could not follow but felt important, etc.

5. Award a mark to your report (not the paper or meeting), marked as a communication of technical information from one engineer to another, on the following scale:-

20/20	Perfect
17/20	Excellent
15/20	First Class
13/20	Very Good
11/20	Above Average
9/20	Adequate
7/20	Poor
5/20	Very Poor
3/20	Abjectly Weak
1/20	Name spelt correctly

Lectures

Package 4 :	Week 1 Monday	r. Curr
	Week 1 Wednesday - Week 4 Wednesday	Mr. Hopkins
Package 5 :	Week 5 Monday - Week 9 Monday	r. Curr
Revision	Week 9 Wednesday	r. Curr

Tests

Package 3 (Loads)	Week 5 Thursday 10.15-11.30
Package 4 (Concrete)	Week 10 Thursday 10.15-11.30

Design Exercises

3 hour -	1. Layout of temporary bridge	
	2. R.C. footbridge scheme	
2 hour -	1. Influence Lines in use	(<u>revise influence lines?</u>)
	2. SF & BM envelopes	(<u>revise?</u>)
	3. Design of slab	(<u>revise detailing?</u>)
	4. Design of beam	
6 hour -	Grandstand scheme (possibly by syndicates) (<u>preliminary work required</u>)	

Tape/Slide Tuition

- Production of Concrete
- Distribution of Concrete
- Formwork

Report

(other than ICE meeting)

1 hour group preparation for report on crack width criterion selection. (no preparation required).

Package 2 Test : December 1974General

The average "non-attempted" marks total for the first 20 students was 6 marks. The paper was therefore taken out of a possible total of 94, and the top student scored 80%.

Nothing can disguise the fact that there can have been few massacres to equal this one since that sad new year in Glencoe 2½ centuries ago. In all honesty I cannot fault the paper; it was straightforward, simple and elementary. Admittedly the bias to descriptive questions was strong, but many of these were taken directly from tutorials or from class work exercises. There was one completely "surprise" question (3c), but it was only worth 2 marks: otherwise not even a trick question disturbed the pattern.

Either the teaching, the pre-knowledge, the studying effort, or the marking - or a combination of these - must have been at fault. I am still not clear in my own mind which I should blame.

Particular Comments

- On 1 (a) Most answers missed the point: BS449 generally checks mono-axial stress conditions singly, and the three stress conditions mentioned are not directly cumulative.
- (b) The direct quotation for BS449 mentions circumstances in which stiffeners are not inevitable - so a comment is necessary.
- (c) Generally well answered.
- (d) Generally well answered - but it is stress at low temperature, not welding at low temperature, which is the problem.
- (e) Generally well answered by those who understood what "criterion" means.
- On 2 The answers here were appalling. Only 3 students know the worst tensile member in a French truss!! Many even chose a compressive member.
- Sketching adverse load conditions seemed a mere lottery.
- * * This is a very serious gap in the class's grasp of elementary structures - and worth re-examining for that very reason.
- On 3 a/b Either well or deplorably answered.
- c Could not be answered without identifying the difference between (b) and (c).
- On 4 d is neither 400 nor 500.
- On 5 A remarkable number of students made one or more of these errors.
- (a) Omission of P/u component in comparison.
- (b) Worst load is at bolt furthest from centroid of bolt group.
- (c) Centroid of bolt group is centroid of circumscribing trapezium.
- (d) Centroid of group is half way between lines.
- (e) Calculation of loads - only a choice of worst bolt was asked.

Cn/

On 6 LF on P is 1.7 (even if due to wind)

Friction is NOT 0.45(90)

A poorly answered question - perhaps understandably.

On 7 Despite note, some students deducted returns - and did so inconsistently, but they lost no marks.

Arithmetic poor - and ludicrous answers went undetected.

Many had no idea of method.

On 8 Design moment is NOT reduced by $\frac{1}{4}$; this is merely a computational convenience to avoid having to increase every permissible stress.

If using formulae, get the variables right - or expect no sympathy.

Max shear is not half the total load.

On 9 Why on earth calculate vertical moments on the way to the horizontal one?

NB - hand operated, with double-flanged wheels.

"Load" - is crane load, not wheel load. Dynamic effects are taken as a percentage of the moving masses. Read BS449 even if the lecture was weak, and the message, in a few words, is quite clear.

APPENDIX 6:7

CIII: Design of Structures

Package Test 3
February 5th 1976

Reinforced Concrete Design

Reading time 10.15-10.30
Writing time 10.30-11.30

*** OPEN BOOK ***

Design to be in accordance with the stresses, symbols and requirements of CP110.

Use Grade 30 concrete, and mild steel with $f_y = 250 \text{ N/mm}^2$
Take weight of concrete as 24 kN/m^3

1. DEFINE (but do not write short notes on)
 - (a) Partial safety factor
 - (b) Serviceability
 - (c) Dowel force (6)
2. Explain briefly (in less than 50 words)
Why is the effective flange breadth of an L-beam restricted to $(b_w + L/10)$? (3)
3. (a) What is the span of the beam in Fig Q3? (2)
(b) What is the effective flange breadth of the beam in Fig Q3? (3) (5)
4. What is the greatest design shear value in the ultimate limit state at section DD in the beam in Fig Q4? (6)
5. What is the minimum shear reinforcement (in the form of vertical links) which can be provided as nominal shear reinforcement in Fig Q5? (4)
6. What is the strength in bending, in the ultimate limit state, of the section shown in Fig Q6 (which has accidentally been erected upside down, as shown)? (8)
7. What is the maximum design moment for positive bending in the ultimate limit state, in the slab shown in Fig Q7? (3)
8. Which of the beams in Fig Q8 is
 - (a) strongest in flexure?
 - (b) strongest in shear?
 - (c) contrary to the detailing requirements in CP110?(NO CALCULATIONS OR EXPLANATIONS REQUIRED) (6)
9. Calculate flexural reinforcement at section GG in the beam in Fig Q9. (9)

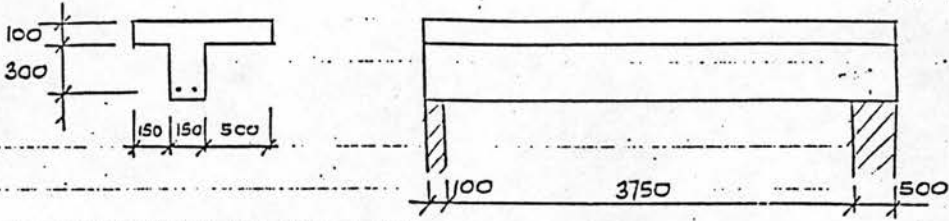


FIG Q3

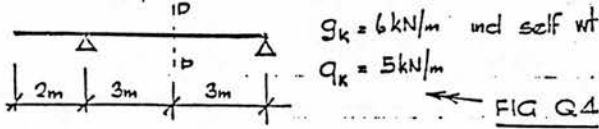


FIG Q4

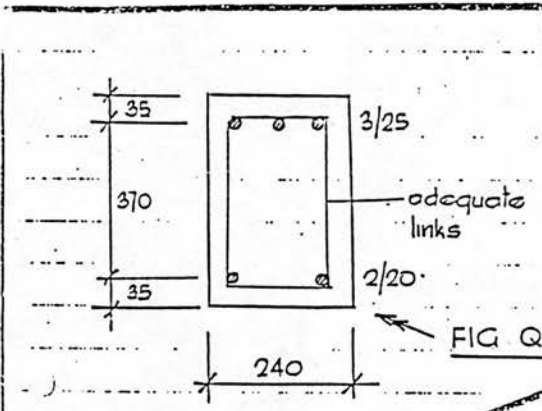


FIG Q6

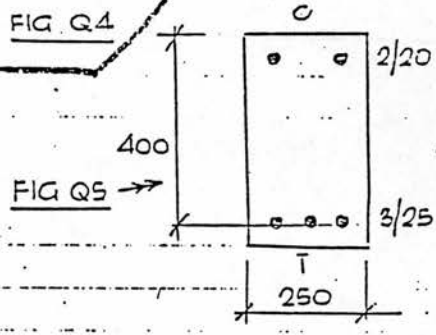


FIG Q5

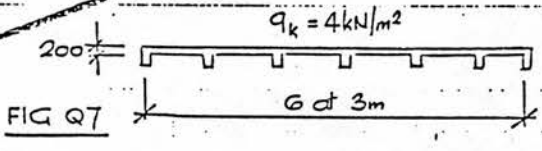


FIG Q7

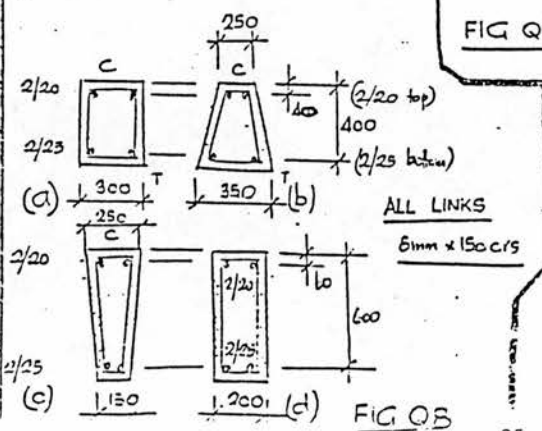
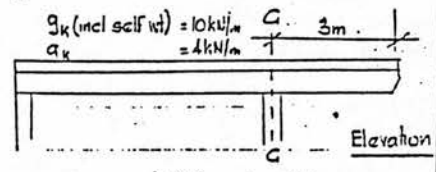


FIG Q8



Elevation

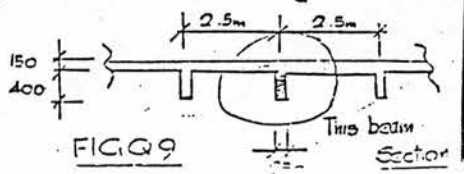


FIG Q9

This beam Section

February 1976

General

The improvement in effectiveness was quite striking; the majority of students managed to obtain and convey a lot of information in a relatively brief answer, whether written or calculated. In addition, the top 20 candidates attempted 47 marks-worth, in what was a fairly demanding paper.

The average mark was about 47%, and the distribution of marks was as follows:-

under 30%	10
30-34%	7
35-39%	3
40-54%	22
55-59%	5
60-74%	9
75% and above	4

With the exception of the number gaining less than 40%, the distribution seems more reasonable than in the 2 previous tests.

Of the 22 students previously having an average of less than 40%, 9 passed in this test, 5 having marks of over 50%; bearing in mind the understandable variability of a 1-hour paper, and the generally favourable effect of drawing marks, the prospects for a negligible entry to the June examination are much more promising than in December.

Detailed Comments on SolutionsQuestion 1

Difficult topics to define were reasonably leniently marked; in that context, they were well done on the whole.

Question 2

More mention of shear lag virtually scored 2: 3 called for some explanation.

Question 3

This question called for intelligent application of guidance rules to lopsided examples; mere substitution scored only 1 + 1 = 2

Question 4

This question was usually very well done, but there were a few with no idea of how to use influence lines once they had drawn them/

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APPENDIX 6:8 (cont.)

2.

them, and another small group who were incapable of identifying adverse loading arrangements for the specified condition.

Question 5

There was an unhealthy tendency to work on Table 5/6 values, and distort design formulae for links in unhealthy ways. Many missed the 12 x 20 restriction on pitch, or took diameter from 25/4 (instead of 20), or omitted to check minimum link percentage.

Question 6

A difficult question, with a questionable answer. The main point was that $T = C$, but T must be very low. The difficulty was to identify the position of the resultant compression; full marks were given for assuming either that it was at A_s , or by taking a compressive concrete stress block.

It was utterly wrong to assume that subdivision into $M_{bal} + M_{add}$ was in any way meaningful.

Question 7

A simple question, mainly answered correctly - but often at appalling length, or using $WL/8$ or $FL/14$, or neglecting partial safety factors.

Question 8

Badly done. The order of strength in bending was $c/d/a/b$ (since A_s is the same in all cases, M_u varies with z). The order of strength in shear was c or d/a or b (bd and A_s being the same, only the additional contribution from stirrups, with increase in d , had any effect).

No beams violated CP110 on detailing.

Question 9

Most of those who misinterpreted the sketch did not do so consistently. It was too popular to design as a T-beam, though.

Marks mainly went for method here.

(C) APPENDIX 7:1

CIII : PACKAGE 1 TEST, NOVEMBER 1974

Comments

Analysis of Results and General Observations

The general standard of work was rather better than is usually obtained in the first package test. Time was very short (as usual) but it was significant that:-

- (a) of the top 25 students, the average amount of unattempted work was only $4\frac{1}{2}$ marks in 50.
- (b) of the failure candidates, only two scored more than pass level in the work they attempted (these two attempted very little!)

I therefore concluded that there was no real justification for any scaling of marks, since this would have passed some "fail" candidates, and elevated to "first class" level a number of students whose work contained too many fundamental errors to merit that description.

A breakdown then shows:-

1st Class	(over 75%)	2
2nd Class	(50-74%)	9
3rd Class	(55-59%)	9
Pass +	(45-54%)	14
Pass	(40-44%)	15
Compensation level	(35-39%)	6
Fail	(20-34%)	10
Abject performance	(less than 20)	2
		—
	Total	67
		—

This seems reasonable, except that perhaps there should be a slight shift from 3rd to 2nd and from Pass to Pass +. But I am satisfied that none of the "Fails" merited a Pass.

Particular Comments

Question 1 : Simple algebraic and arithmetic manipulations were frequently appalling. Decimal point errors were common.

Question 2 : Some ridiculous answers made $1/r$ worse if the strut was continuous.
Too many used $1/r$ instead of $1/r$.
It's no good saying BS449 doesn't help much: you've still got to decide.

Question 3 : 1.5 x uncased or 2 x uncased? Many didn't know (even in open-book conditions)
Use of Z_{yy} was common.
Who said the point load gave fixity.
Wouldn't the casing give torsion restraint when cased?

Question/

APPENDIX 7:1 (cont.)

2.

Question 4 : I accepted 800 or 400 as the stanchion load.

The question was badly worded to some extent: but there was a bonus for anyone who spotted that f was more than p_c and then just stopped (and saved time).^c

M_x was generally disregarded.

The wrong Z was often used.

Question 5 : Intended 2 for properties and 7 for comments. Most spent all their time on the properties (and made a real meal of it). So I gave 7 for properties and would have given 7 for comments, too. No one had an answer meriting 9 or higher, so that was no worry.

Many didn't know the difference between I_{xx} and I_{yy} .

Ignorance of section property calculations was shocking.

Definitions of D and T , stressed repeatedly in the lectures, were disregarded.

Question 6 : A well done question.

Question 7 : No calcs needed.

Must be (c) or (d)

1/r AND area both important (but outstand in d is unacceptable)

Question 8 : What about N ?

D is the overall depth.

