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Learning Intervention and the Approach to Study of Engineering Undergraduates

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Abstract

The aim of the research was to: *investigate the effect of a learning intervention on the Approach to Study of first year engineering degree students.* The learning intervention was a local programme of 'learning to learn' workshops designed and facilitated by the author. The primary aim of these was to develop students' Approaches to Study. Fifty-three first year engineering undergraduates at The Nottingham Trent University participated in the workshops. Approaches to Study were quantified using data obtained from the Revised Approach to Study Inventory (RASI) which was also subjected to a validity and reliability study using local data. Quantitative outcomes were supplemented using a qualitative analysis of essays written by students during the workshops. These were analysed for detail regarding student Approach to Study. It was intended that any findings would inform the local system of Engineering Education, although more general findings also emerged, in particular in relation to the utility of the research instrument.

It was concluded that the intervention did not promote the preferential Deep Approach and did not affect Approaches to Study generally as measured by the RASI. This concurred with previous attempts to change student Approaches to Study at the group level. It was also established that subsequent years of the Integrated Engineering degree course are associated with progressively deteriorating Approaches to Study. Students who were exposed to the intervention followed a similar pattern of deteriorating Approaches suggesting that the local course context and its demands had a greater influence over the Approach of students than the intervention did. It was found that academic outcomes were unrelated to the extent to which students took a Deep Approach to the local assessment demands. There appeared therefore to be a mis-match between the Approach students adopted to pass examinations and those that are required for high quality learning outcomes. It is suggested that more co-ordinated and coherent action for changing the local course demands is needed before an improvement in student Approaches will be observed.

These conclusions were broadly supported by the results from the qualiative analysis which also indicated the dominating effects of course context over Approach. However, some students appeared to have gained from the intervention in that they reported being in a better position to evaluate their relationships with the course demands following the workshops. It therefore appeared that some students could be described as being in tension between the desire to take a Deep Approach and the adoption of less desirable Approaches as promoted and encouraged by the course context. It is suggested that questions regarding the integrity of the intervention are thereby left unresolved even though the immediate effects of it are quite clear.

It is also suggested that the integrity of the research instrument is open to question in that the Strategic Approach to Study scale failed to be defined by one factor under common factor analysis. The intentional or motivational element which previously defined this scale was found to be associated with a Deep Approach factor within the local context. The Strategic Approach was found to be defined by skill rather than motivation. This indicated that some reinterpretation of the RASI and in particular the Strategic Approach to Study scale is needed.

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1.0 Introduction

1.1 Background to the Research

This thesis describes and quantifies the Approaches to Study of predominantly first-year undergraduates in the Faculty of Engineering and Computing, The Nottingham Trent University, between 1992 and 1993 as a basis for the author's research. This research is concerned with the effects that a series of 'learning to learn' type activities had on the Approaches to Study of the participating students. The author's interventions refer to a type of 'learning to learn' seminar programme rather than operational or policy interventions into the learning context students may have found themselves in. The learning to learn seminars were designed, organised and led by the author as part fulfilment for the post of 'Learning Skills Facilitator' at the Department of Mechanical Engineering, The Nottingham Trent University. This innovative post was funded from a central reserve within the University, and initially managed as part of the Enterprise in Higher Education Initiative (Department of Employment) taking place within the Department of Mechanical Engineering.

The learning to learn seminars were designed with respect to a professional brief requesting an improvement in the 'learning skills and time management of students' (Button & Metcalfe 1991). How could this be done, and was this request appropriate? An initial consultation of the literature had described a dichotomy between 'study skills' and 'learning strategies' (cf. Entwistle and Tait 1992). There was also emerging at the time (1992), a national debate about how best to improve the quality of student learning. Indicative of this debate was the Council for National Academic Awards (CNAA) resourced 'Improving Student Learning Project'. As reported by Gibbs (1992) this project supported the in-course development of case studies and pilot schemes aimed at improving the quality of student learning. The project also disseminated findings and experiences through two national conferences. As a delegate at the last of these the author was introduced to current theories and examples of student conceptions of learning and Approaches to Study. These subsequently informed the design of the author's own interventions aimed at supporting student learning.

The author's interventions were a series of one-hour seminars, held fortnightly over the first two terms of a conventionally taught and assessed engineering degree course. Students attending these seminars were all of the 1992 first year

intake to the Bachelor of Engineering Integrated Engineering course which is one of the portfolio of courses offered by The Department of Mechanical Engineering, The Nottingham Trent University. These seminars came to be known by the participating students as either, 'Learning to Learn' workshops, or 'The Learning Strategies' course. The content of the seminars or workshops was based around the concept of Approach to Study, for example, as described within case studies reported by Gibbs (1992) and Entwistle and Tait (1992). As explained later in this review, the term 'Approach to Study' within the title to this thesis is meant to reflect the intentions and learning processes a student adopts in respect of learning tasks (Biggs 1993). There are other supporting and influential factors on the quality of student learning such as educational orientation (Gibbs et al 1984), and conception of learning (Saljö 1979, Entwistle and Entwistle 1991). These and their relationship to Approaches to Study are also discussed here.

In retrospect, the research reported here can be seen to be primarily examining the effect of the author's interventions on students' Approaches to Study *as measured by the Revised Approach to Study Inventory* (RASI)(Entwistle and Tait 1993). This means that student learning was examined in relation to several inventory based variables such as student self-confidence, or the student's intention to understand the material presented to him or her. These variables in turn contribute to the broader dimensions of Deep, Surface, Strategic and Apathetic Approaches to Study.

The main aim of the Learning to Learn workshops was to promote a Deep Approach to Study. In support of this aim, objectives related to conceptions of learning and educational orientation were also included. This literature review has formed the referential basis on which any inference about the relationship between the student's Approach to Study, conceptions of learning, educational orientation, the learning context and academic outcome have been made.

The CNAA Improving Student Learning Project mentioned earlier had a conceptual framework described by Gibbs (1992):

> *When students go about learning tasks they vary in their approach. Every lecturer has experienced students who seem determined to give back, in essays and reports, exactly what they were given in lectures. Other students strive to develop their own perspectives and synthesis of the subject. This may sometimes involve a difference in ability, but most often it involves a difference in intention: students are trying to achieve different things. These two extreme intentions have been termed a surface approach and a deep approach.*

These descriptions of differing intentions and the literature and research supporting them form the basis of the conceptual framework that supports this thesis. Hereafter referred to as Approach to Study, these descriptions offer the practitioner an explanation of how students tackle learning tasks in qualitatively different ways.

The descriptions of Approaches to Study within this thesis involve four constructs, being: Deep and Surface, as well as Strategic and Apathetic. Each Approach to Study is described in the literature as being the intention a student may have in dealing with the information he or she is attempting to learn. The Deep Approach is an intrinsically orientated desire to reach personal understanding, as opposed to a Surface Approach which is often an extrinsically orientated desire to reproduce memorised information as a strategy for passing assessments. The Strategic Approach to Study is described as an intention to achieve high grades through the mercenary application of effort based on the student's perception of what is likely to maximise academic success. An Apathetic Approach is associated with negative perceptions of the learning environment and a lack of direction in study; in essence a reversed Strategic Approach.

After consideration of the literature available, and in discussion with other interested parties, the author chose to develop a series of eight inductive workshops for students beginning their degrees in Integrated Engineering. This degree course has some interesting features supposed to make it distinct from other degree courses in the same Faculty. These are described by Jeffery (1993) in the Integrated Engineering Definitive Document:

> *Integrated Engineering is an approach to engineering in which it is shown that basic principles re-occur in applications that are traditionally regarded as diverse. Engineering is portrayed as a seamless realm comprising the traditional electrical, electronic, mechanical and manufacturing disciplines. Above all, the Integrated Engineer is educated not to consider individual disciplines as having finite boundaries...*
>
> *There is an emphasis on developing the ability of autonomous learning; this together with a thorough understanding of the supporting principles of engineering will enable graduates to develop during their careers in accordance with the changing demands of technology and their appointed role. This will be achieved by the adoption of project based learning and through engineering applications. Appropriate learning methods will be selected and where appropriate will be student centred and include practical*

problem solving. Engineering principles will be emphasised together with a broader application across a range of technology. Communication skills and the application of computer based methods in particular will be stressed. The tendency to overload engineering curricula to the extent that student understanding diminishes will be avoided.

It was felt by the author and his research advisors that the Integrated Engineering course would be an appropriate course to work and research in, not least because of the features described above. In other words the course was assumed to fit better than others in the Faculty, the philosophy of the learning to learn workshops and was organised by members of staff who were and are sympathetic and encouraging toward notions of student support. The idea of student support, as well as the need for staff development which would inevitably come out of this research, is still very new in Engineering Education at this institution. The opportunity to work with a course team as on the Integrated Engineering degree, meant that the author could develop ideas and methods of working in a supportive atmosphere. If successful, these ideas would then hopefully be taken on board by other (and by implication, less supportive) members of staff and courses.

As testified by the growing number of symposia, conferences and seminars in this area, the perceived need for student support is growing. This support comes in various forms, for example, a recent conference, the Staff and Educational Development Association (SEDA) conference on 'Enabling Student Learning: Structures, Guidance and Support' (1994), focused on three areas:

- Support for student learning: strategies and practices,
- Structures for enabling student learning, and
- Guidance and student learning.

Some practitioners are concerned with practical support for student learning such as resource-based learning or study skills provision. Other practitioners concern themselves with policy and management issues related to student support such as student entitlement, while others focus on the systems and strategies of student support. The work reported in this thesis has at its core the first of the support areas listed above; the notion of support mechanisms for student learning. Inappropriately called 'study skills' by many, the author chose to work in the area of what might be called 'continuing support for student learning'. This as presented here, involves the intervention by a skilled practitioner into the study *processes and predispositions* undergraduate engineers may display and use. This

is distinct from study skills and is meant to imply the development of the attitudes and beliefs students may have about 'learning engineering', as well as the development of their thinking and the strategies they use in order to 'learn' about engineering and its knowledge constructs. This debate regarding skills and strategies is further pursued in chapter two.

1.2 Aim of the Research

The aim of this research is:

> *To investigate the effect of a learning intervention on the Approach to Study of first year engineering degree students.*

The learning intervention is the series of workshops referred to above. The so called 'learning to learn workshops' were designed and run by the author, with the intention of improving the general quality of learning of the students exposed to them. It was assumed that an improvement in quality would be indicated by a predominance of a Deep Approach to Study. If Approach to Study was measured before and then after the workshops some indication of change could be established. The aim therefore has a series of hypothetical considerations which were taken into account when trying to establish the effect of the author's learning to learn workshops. A hypothetical methodology was chosen to reflect and inform the engineering culture from within which the research was based. Each hypothesis was sanctioned by the local research committee. The five hypotheses were:

1. *Learning to learn workshops or similar material will have a positive effect on student Approach to Study.*

2. *A Deep Approach to Study is a requisite for success at academic study as measured by formal methods of assessment.*

3. *Students on the Integrated Engineering degree in this Faculty develop an appropriate Approach to Study as they progress through the course.*

4. *Students on the Integrated Engineering full and part-time degrees display a more appropriate Approach to Study than those on other degrees within the faculty.*

5. *There are relative differences in Approach to Study between differentiated groups of students, eg male and female.*

These hypotheses are further discussed and their relationship to the research aim examined in chapter three. Other chapters in the thesis contribute to the research aim as described in the next section.

1.3 Thesis Structure

Following this introduction the literature review critically examines the research literature that has informed the author's thinking relative to this thesis. Based predominantly within either cognitive or phenomenological frameworks, many authors have provided models of student learning and have suggested methods of working with students. This chapter examines the forerunners of modern descriptions of student learning and then goes on to construct the model of student learning the author has chosen, developed and applied to inform and reflect on the design of his learning to learn interventions. Research methods and relevant aspects of the learning process are discussed such as motivation and the relationship between learners and their environment. It is argued that this last point, the relationship between the learner and the environment, is heavily influenced by a number of factors, some personal and some institutional. This naturally leads to a description of higher education as a system in which several influential factors are interrelated.

Students may have certain tendencies or expectations to learning based around their knowledge, experience, values, expectations and motives. The literature review to this thesis examines some of these factors and relationships within a systemic model of student learning. Previous researchers have already examined models of learning and have developed descriptions of 'how' students relate to their learning. The author has used chapter two to develop an understanding of the

literature and to identify some of the factors that are felt to influence effective student learning within the context of the research.

This programme of research, presented in this thesis, was and still is concerned with investigations into changes in engineering undergraduates' Approaches to Study. While the overall aim is described as 'to investigate the effect of a learning intervention (the workshops) on the Approach to Study of first year engineering degree students', there is necessarily a series of supporting hypotheses, which must be examined in order to fully satisfy the aim and to inform others interested in supporting student learning. Testing of these hypotheses relies on the ability to initially identify the Approach to Study of those students who were the focus of this research. In order to identify Student Approaches to Study an appropriate inventory was used as well as some additional qualitative data in the form of students' essays. Chapter three describes the methods used to collect the data as a precursor to a full analysis in chapters four, five, six and seven.

Chapter three describes the research design, the research methods used and presents a more detailed discussion of the five research hypotheses referred to above. The first hypothesis is directly associated with the research aim in that the workshops were designed to promote 'appropriate Approaches to Study' and to 'help the student adopt the preferable Approach wherever applicable'. This 'preferable Approach', as discussed in chapter two, is the Deep Approach to Study. Hypothesis two was designed to check that a Deep Approach to Study was appropriate in context of local assessment methods, or to put it another way, that the local assessment system was promoting a Deep Approach to Study. Hypotheses three and four were designed to examine if and how Approaches to Study change relative to a course of study and relative to other courses of study. This would help provide information pertinent to designing learning interventions specific to a given course of study. Likewise, hypothesis five is concerned with the differences between differentiated groups of students which if significant, could affect the way interventions are designed for these groups of students.

Chapter four, examines the research instrument and its validity to explain how data was collected using a questionnaire known as the Revised Approach to Study Inventory (RASI)[1]. The Revised Approach to Study Inventory when completed and analysed gives the researcher a profile of a student's or a cohort of students'

[1] Some additional data to that obtained from the RASI was obtained while working with students. This was enabled by asking students to reflect and to write about their experience of learning during their first year of study. The reflective essays are further described within chapter seven and involved students reflecting on their Approaches to Study relative to their chosen course of study.

Approaches to Study. The Revised Approach to Study Inventory was designed at the University of Edinburgh by Noel Entwistle and Hilary Tait, and some background information regarding their findings using the RASI is included as a comparison to the findings from Nottingham using the same inventory. These findings are derived using the statistical technique of Factor Analysis which is also explained in chapter four. Factor pattern data from Edinburgh and Nottingham was examined for evidence that the data collected from the RASI in Nottingham was suitable for subsequent use in addressing the research hypotheses. This involves examination of the RASI structure and reliability which in turn leads to some initial findings and comments regarding the nature of learning within the Faculty of Engineering and Computing.

Chapter five presents the data obtained from the RASI so as to summarise the Approaches to Study being displayed by students within the Faculty of Engineering and Computing. In order to do this, the data has been categorised against local Approach norms. Each of the Approaches to Study are categorised in terms of being either a low, moderate or high level of Approach. This gives the reader some indication as to when a student can be described as taking one Approach as distinct from or in preference to another. Cohorts of students on individual courses within the Faculty have also been compared to distinguish between the relative balance between Deep and Surface Approaches to Study.

Chapter six offers a more rigorous analysis of the data than that presented in chapter five. The RASI data is discussed relative to each of the five hypotheses stated. Presented sequentially, the method used to test each hypothesis is described and the results obtained from the testing reported. These results are then discussed in detail so as to present the author's conclusions regarding each of the hypotheses as based on the evidence available. Throughout this chapter, the discussions are at times, illuminated by relative and pertinent comments as made by some of the students studied. These comments have been obtained from essays the students were required to produce toward the end of the programme of learning to learn workshops. The essays required students to reflect on their Approaches to Study and how these related to the quality of their learning at Nottingham. The essays and the analysis of them is discussed in chapter seven.

Chapter seven relates to qualitative rather than quantitative analysis. In this chapter the method used for analysing the student essays referred to above is described and the outcomes of this analysis discussed. This analysis has proved to be very informative to the author's understanding of the relationship between his students and their learning environment. The general outcomes from both

chapters six and seven reveal the potential consequences for those student unable or unwilling to utilise certain combinations of Approaches to Study within the local context.

Chapter eight, the final chapter, discusses the specific findings to provide a summary of the conclusions from the research presented in this thesis. This naturally leads to some discussion of further research issues that might now profitably be explored, following on and extending the studies described in this thesis.

Following the references and bibliography, the final section in the thesis is a set of appendices containing a copy of the research instrument used, its scoring key and the full scheme of work relative to the author's learning to learn workshops.

2.0 Literature Review

2.1 Introduction

Most recently, Reda Abouserie (1995) has provided some very interesting suggestions regarding the relationship between self-esteem, achievement motivation and Student Approaches to Learning (SAL). Within the first two pages of his paper, Abouserie (ibid) refers to 'student strategies', 'tactics', 'skills and processes'. He then goes on to refer to the 'learning situation', 'cognitive function', 'learning skills', 'study skills', 'cognitive and affective development', 'personality', and 'motive' as all being influential on what is referred to in this thesis as Approach to Study. Further reference is made by Abouserie (ibid) to 'levels of processing' and 'learning styles', suggesting that Entwistle's (1981) Approach to Study Inventory measures such styles. Abouserie's (op cit) work is referred to now because it is an effective example of the range of terminology used by researchers and authors in the field of Student Approaches to Learning (SAL). There seems to be a limited (that is, not a complete) consensus as to the meaning of these various terms as well as the relative importance the associated concepts hold within the literature.

This chapter must therefore provide a view of student learning as well as a set of concepts, working constructs and nomenclature that can be applied to the rest of the thesis. The literature review considers some of the background theories of teaching and learning that have influenced the author's intervention and research. This review therefore takes an initial eclectic look at models of learning. This view is necessary because there are a range of meanings attached to the term *'Approach to Study'* within the research literature and a complementary range of research methodologies associated with these descriptions. The literature review then establishes the concept of student Approach to Study as containing the constructs of student learning most suited to this research and to the development of material explicit in the research aim; *To investigate the effect of a learning intervention on the Approach to Study of first year engineering degree students.* This chapter also examines interventions which are reported in the literature and which have been aimed at working directly with students rather than with the context of their learning. Interventions in this sense are concerned with mediation at an individual or cohort level rather than with the learning situation and context itself which is a very much more extensive and broader issue.

Supporting the concept of student Approaches to Study there is an emerging body of educational literature concerned with the establishment, measurement and support of quality in student learning. Much of this research is supporting a general ethos prevalent in Higher Education at the moment, where institutions are increasingly keen to examine and improve the quality of teaching and learning. This quality is clearly dependent at one level on what has come to be known as the 'learning environment' or the point at which teaching and learning meet. In this respect teaching must be seen as more than just received lectures and seminars, and include 'self' teaching such as learning from texts and research. There are many influences on the learning environment, perhaps the most powerful of which are the various conceptions held by both staff and students about what learning is and the ways in which learning may be assessed. In turn these conceptions are held respective to a system that includes the whole teaching and learning milieu, from institution to individual.

While the responsibilities for the learning environment may be seen to be divided, there is no doubt that it is the perception based reaction a student has to any learning environment that will profoundly affect the quality of learning outcome (cf. Tang 1994). It is only through the study of student perception that we can begin to understand the complex and interactive nature of teaching and learning within the Approach to Study framework. As Tait (1992) suggests:

> *It is again argued that only when students' perceptions of teaching are studied in relation to their approaches to learning and then to their more general orientations to higher education, can the learning environment in part be understood and departments will then be able to evaluate their teaching practices in relation to students' approaches to studying.*

The approaches and general orientations referred to by Tait, are seen by some researchers as environmentally and contextually influenced (although as will be discussed later, the demarcation of these concepts and their constructs are also used in differing ways by different researchers). This is distinct from the inherent abilities any student may possess or demonstrate as suggested by the often misquoted concept of learning *style* (cf. Riding and Cheema 1991) which suggests a transituational structure permanently present within the learner.

In discussing differences in research perspectives Biggs (1993a) refers to descriptions of differing research methodologies which have been associated with various findings and methods of analysis applied to research into student learning.

Biggs (1993a, 1993b) is at odds with some of these descriptions, particularly the way in which questionnaire based research has been described as largely atheoretical (Christensen, Massey and Isaacs 1991). Biggs (1993a) suggests that the inventories developed by himself and Entwistle each have a 'substantial theoretical foundation' (Biggs ibid) in that both have been based on a theoretical framework within which the components of teaching and learning have been described. Both Entwistle (Entwistle, Hanley and Hounsell, 1979) and Biggs (1979) describe the origins of their respective inventories, the Approach to Study Inventory (ASI) and the Study Process Questionnaire(SPQ), as including and certainly alluding to cognitive psychology. Over time, Entwistle (1993) and Biggs (1993a) have modified their inventories in respect of findings from the qualitative research perspective (op cit) so as to include an evaluation of student perception of the learning context. Likewise, Meyer's (1991) work is based on the theoretical model described by Entwistle and also includes student perception within the concept of 'study orchestration'. Nevertheless, the ASI, the SPQ and their theoretical underpinning have been variously criticised (cf. Richardson 1990a, 1993, 1995b) for making quantitative measures of qualitative differences, for being too general, and in particular, the old ASI for being a 'rag-bag' of concepts which 'differ from one another along an implicit-explicit, automatic-controlled dimension' (Richardson 1995). It is against some of these criticisms that a revision of the ASI, the Revised Approach to Study Inventory (RASI) has been designed (Entwistle and Tait 1993), and will be examined within this thesis. This chapter looks at these and other issues to discuss models of student learning appropriate to the author's research.

Running parallel to the quantitative, numerate data analysis associated with the RASI, is the possibility of examining students using techniques that allow them (the students) to describe and explain their actions using their own or adopted concepts, constructs and terminology. So called *qualitative* research is not concerned with statistical measurements (Walker 1985) and is more inclined to examine and describe phenomena in terms of what they mean to the individual being examined. This has previously been described as a *humanistic* approach to research, involving 'first order analysis' (Schultz 1967) meaning that the researcher gains insights into the learner's disposition, attitude and behaviour as a prerequisite to producing 'second order' (ibid), more abstract explanations regarding the relationship between the subject and his or her environment. These are quite clearly different to the more statistically based methods associated with the *positivistic* ideologies where measured causes are said to result in determined and predictable outcomes and effects.

Researchers working with instruments such as the RASI fall into the positivistic tradition in that they are assuming the ability to isolate, determine and quantify the learning behaviour of students even though the RASI is in fact constructed with findings from both statistical analysis and from interviews with students. The RASI is used appropriately when determining and aggregating group empirical data, but when attempting to enquire into the behaviour of individual students a supporting methodology is required. This methodology must be capable of 'describing the world as it is perceived by different observers' (Dey 1993) so as to offer the researcher insight into the learning of the individual student. This is the basis of much of the research discussed in the literature review and thereby described as *phenomenographic*[2]. Much of this phenomenographic research is based around the identification of meaning students may attach to the various concepts that are identified in this literature review. The literature review takes a closer look at phenomenography and the background to this very important research tradition.

It could be argued that a qualitative form of research is an essential requirement for those working in the field this thesis relates to, as the field itself is contextualised. Moreover, the contexts of learning, of student backgrounds, of the teaching system and the cultural domains these reside in are uniquely related to by the individual. For this reason alone it is worth attempting to tap or to access the dialogue the individual has with him or herself and the context in which he or she is operating. Qualitative research involves the interpretation of data in a fundamentally different way to the interpretation of quantitative data. Qualitative analysis necessarily engages the researcher in the very tricky and potentially biased collection, interpretation and publication of data. The researcher may wish to gather information using interviews and observation related to either real or artificial scenarios in order to gain insight into the behaviour of the individual or group being studied.

The importance of contexts when looking at the learning behaviour of students is well established. In deciphering 'learning behaviour' some meaning can be attached to the observed actions of the students studied, and to the reported actions of those students as described by the RASI. Dey (1993) argues that this

[2] 'Phenomenography' is a term created by the so called 'Gothenberg Group' in 1979 and describes a form of qualitative analysis whereby the way in which people experience or think about phenomena is investigated. 'Phenomenographers...make statements...about people's conceptions of the world...on how things appear to people' (Marton 1988). The Gothenberg Group found that phenomena were always understood in a limited number of 'qualitatively different ways' (ibid) This is further discussed later in this chapter.

identification of meaning is essential and that the exclusive use of quantitative analysis at the expense of the qualitative will inevitably 'miss' the full meaning of a student's action. The RASI can identify some of the attitudes of students but it fails to explain the meaning behind their attitudes. Some interpretation is provided in the research literature and this material does go a long way in the explanation of phenomena. However, in order to fully justify student action it is essential to explore and to explain action and attitude using students' own personalised descriptions of their relationship with the contexts they perceive. As Dey (ibid) suggests:

> *In a more literal way, contexts can be seen as a key to meaning, since meaning can be conveyed 'correctly' only if the context is also understood... communication in general involves inferring meaning from the context in which it occurs.*

In effect, three distinct theories of student learning have emerged, phenomenography derived from qualitative analysis of students perceived phenomenal space (Marton and Saljö 1976, 1984, Svensson 1977, Gibbs, Morgan and Taylor 1984), and another from cognitive psychology and quantitative analysis (Craik and Lockhart 1972, Weinstein and Mayer 1986, Schmeck 1988, Riding and Cheema 1991). In turn these have spawned differences between the various learning or study process inventories available to the researcher. The third research perspective is described as 'atheoretical quantitative' (Christensen, Massey and Isaacs 1991), where researchers (cf. Biggs 1987a, Entwistle and Ramsden 1983, Entwistle and Tait 1993, Meyer 1991, Meyer, Cliff and Dunne 1994) are described as using factor analytic techniques in constructing inventories that measure the phenomenographic concept of Approach to Study.

Of the three research perspectives outlined above, it can be argued that there is not one alone that is entirely suited to the research reported here, and that in searching for a suitable model it is more beneficial to demarcate between research into student learning that has evolved from an Information Processing (IP) model, and that which might generally be described as research into Student Approaches to Learning (SAL)(Biggs 1993a). Within the SAL framework, the work of the 'atheoretical quantitative' and the qualitative researchers are both included. The next two sections of the literature review are concerned with these descriptions. The first, concerned with Information Processing, also gives some thought to how the phenomenographic perspective has come to be the dominant research perspective into student learning at this time.

2.2 Research Perspectives in Student Learning: The Information Processing and Student Approach to Learning Paradigms

One influential model of human learning is the Information Processing (IP) model. This model did, for many years, dominate discussions regarding how learners think about and process information received from the environment. Gagné (1974) and others proposed that learners actively attend to stimuli, that they access existing knowledge which they relate to a novel situation, realign the structure of that knowledge into memory, which then becomes accessible in order to explain and interpret new chunks of information. This model suggests that symbols representing information are manipulated into the memory from where action can be initiated if required. This IP model is shown in figure 2.1.

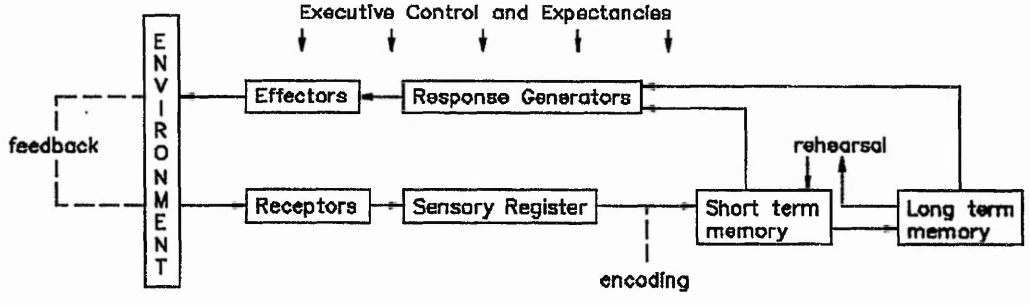


Figure 2.1 The Information Processing Model (Gagné 1974).

A controversial aspect of the Information Processing model from the phenomenographic perspective, has been the notion of encoding and the subsequent modelling of student learning as encompassed in trait-like and habitual learning processes (Craik and Lockhart 1972, Weinstein and Mayer 1986, Riding and Cheema 1991). This has led to the suggestion that in order to be more memorable, information should be processed at a deep level rather than a surface level. In other words it is the difference between syntactic and semantic encoding of stimuli affects how well the information is 'understood' and remembered. In this respect a direct relationship was suggested between 'durability' and the level at which information was encoded within a hierarchy of representations (Richardson 1992). This description of learning has tended to suggest, as Schmeck (1983) does, that a learning strategy is a 'pattern of information processing activities used to prepare for an anticipated test of memory'. This line of argument helps define one of the perspectives within research into student learning which involves itself with issues of cognitive psychology.

Since Marton and Saljö's (1976) original reference to 'surface and deep levels of processing', the implied link between cognitive psychology and student learning has been generally denigrated (cf. Richardson et al 1987). Under such criticism, the responsibilities for the quality of teaching and learning have been firmly placed with the teacher and the context of learning rather than within individual student differences. Nevertheless, it is suggested (Richardson 1992) that some cognitive elements of individual differences may be acommodated by Approaches to Study:

> *"Deep", "Surface" and "Strategic" approaches to learning reflect different strategies which students adopt in response to perceived demands... in so much as they are motivated... of course, the ability... to adopt different approaches... is contingent on the extent to which they regard themselves as being agents of learning and the extent to which they regard learning as an activity under their own control... talking about how learners construe and conceive of learning,... cognitive psychologists have one piece of conceptual machinery in common currency here, and that is the notion of the mental model... a mental model approach is equally applicable to people's perceptions of social systems or situations...*

Dyne, Taylor and Boulton-Lewis (1994) discuss at length the notion of perception in how students react to tasks. In comparing Information Processing (IP) models of learning against the context relative Student Approaches to Learning (SAL) models such as the Approach to Study model used in this thesis, Dyne et al discuss the effects of the Transfer of Appropriate Processing (TAP) model and the learner's ability to distinguish between item and relational information on the effectiveness and relative successes of student learning processes. TAP theory compliments the SAL models by suggesting that 'the value of a particular learning strategy is relative to a particular learning goal' (Dyne et al, ibid). At this point TAP then suggests that there is a need for, and that effective students tend to be able to, distinguish between appropriate ways of encoding material they are learning. Relative to the task in hand, students it seems, are capable of using either *item information* or *relational information*.

Dyne et al (1994) argue that both item and relational forms of information are required by the learner for complete understanding of material and that effective learners are those who are flexible in their ability to select learning processes relative to the task. Chosen appropriately the correct process of encoding will allow efficient use of learned information as and when appropriate. These

assertions draw together many of the models of learning described later in this literature review and imply that the SAL model of student learning can be over zealous in its insistence that a Surface Approach to Study is a pathology. As Dyne et al (ibid) suggest:

> *The Student Approach to Learning perspective tends to suggest that a surface approach to learning is itself a learning difficulty that demonstrates the failure to adopt strategies associated with a deep approach... In contrast the Information Processing perspective suggests that a 'surface' approach to learning is a learning difficulty only when it is applied inflexibly and indiscriminately... consequently this perspective would encourage teachers to support the learner's analysis of demands of individual tasks in order to facilitate the student's identification of appropriate levels of processing... We would suggest that making the distinction between item and relational information available to students would enhance their capacity to engage in strategic information processing.*

Essentially these arguments are suggesting that the SAL model of student learning is inadequate because it does not recognise the beneficial cognitive effects of strategically applying different levels of cognitive processing. In a new description of the student learning, it may therefore be important to adequately describe the ability (or not) to choose between a 'task-appropriate' or a 'task-inappropriate' (Dyne et al, ibid) learning strategy. Romainville (1994) describes these qualities as students 'managing their own cognitive strategies in order to succeed', and further that, 'students must be able to adapt the strategies to their personal characteristics and the context of learning'.

Dyne et al (ibid) have attempted to explain the Information Processing model in a way that relates to the learner's context of learning and in particular the perception the student has of the context. Such respect for the learning context is also one of the fundamental features of the SAL framework. This would suggest that it is fundamentally necessary to examine student learning relative to the environment in which it takes place and from a second order perspective. Researchers such as Craik and Lockhart (1972), Richardson (1987, 1992), Hounsell (1987), Entwistle and Waterston (1988) and Riding and Cheema (1991) have attempted to rationalise both IP based research and SAL based research in order to examine the link between study and levels of understanding, but measuring learning in quantitative frameworks has tended to obscure the complexity and

essential differences in learning outcomes (Saljö 1994). As Entwistle and Waterston (ibid) conclude when attempting to balance the qualitative, phenomenographic *Approaches to Study* with the quantitative, cognitive descriptions of learning:

> *A note of caution is perhaps necessary before concluding that this research demonstrates a close correspondence between research on cognitive psychology and student learning... the process of extrapolating research findings to the context of everyday studying is by no means straightforward...*

This lack of correspondence is demonstrated by Murray-Harvey (1994) who in describing the 'fragmentation of research that has resulted in confusion of definitions', suggests that the cognition based models of student learning are largely inferior to phenomenological models, because information gleaned from such a theoretical background has little application to 'counselling, referral or instructional decisions over time'.

So it can be argued that there are issues concerned with usage prevalent within the descriptions of student learning. The cognitive perspective has tended to provide a view of the individual without at the same time examining how the individual perceives his or her context. It has been argued (Richardson 1992) as already suggested, that the cognitive perspective is changing in order that context variability and perceptions of the context might be accommodated within such descriptions of student learning. Nevertheless, at present this model is of little direct use to the author; it tends not take into account the environment in which students are studying and the relationship between this environment, the student and the quality of learning outcome. For these reasons it can be argued that it is most appropriate for the author to adopt a SAL viewpoint and a corresponding research methodology.

Attempts to research into student learning from the SAL perspective rather than the IP perspective led to the examination of learning in qualitative terms and the assumption that the quality of learning outcome is a function of how students understand the material they engage with. This research perspective represents the opposite to that referred to earlier, involving itself with issues of *phenomenography* (Marton 1981, 1988) or the way in which phenomena appear to students and the concept they then hold of the world around them. Subsequently,

it is the student's intentions when learning which will control his or her quality of involvement, described in the quote above as either a *Deep* or a *Surface* Approach to Study (Marton 1976). These concepts are discussed at length later, though a brief description is offered below (figure 2.2), from Ramsden (1992):

Deep Approach Intention to understand. Student maintains structure of the task:

- focus on what is signified (eg. the author's argument or the concepts applicable to solving the problem).
- relate previous knowledge to new knowledge.
- relate knowledge from different courses.
- relate theoretical ideas to everyday experience.
- relate and distinguish evidence and argument.
- organise and structure content into a coherent whole.

Internal emphasis: 'a window through which aspects of reality become visible, and more intelligible' (Entwistle and Marton 1984).

Surface Approach Intention only to complete task requirements. Student distorts structure of task:

- focus on the signs (rather than what is signified).
- focus on unrelated parts of the task.
- memorise information for assessments.
- associate facts and concepts unreflectively.
- fail to distinguish principles for examples.
- treat the task as an external imposition.

External emphasis: demands of assessments, knowledge cut off from everyday reality.

Figure 2.2 Deep and Surface Approaches to Study (Ramsden 1992)

The terms *Deep* and *Surface* originated from a misplaced analogy with Craik and Lockhart's work (1972)(Entwistle and Waterston 1988, Tait 1992). Confusion about the link between this cognitive stance and the phenomenological description of Deep and Surface have been in evidence ever since as suggested earlier by Richardson (1992, 1993). However, it is clear from intercorrelation studies between inventories based around Craik and Lockhart's (1972) work such as the

Inventory of Learning Processes (Schmeck, Ribich and Ramanaiah 1977) and inventories based around the phenomenographic descriptions of Deep and Surface such as the Revised Approach to Study Inventory (Entwistle and Tait 1993), that there is some overlap between Approaches and other cognitive based sub-scales (Entwistle 1988, Cano-Garcia and Justica-Justica 1994). It would seem that the two perspectives of learning, the phenomenographic and the cognitive may at times be compatible and reconcilable even though they both attempt to describe student learning from two very different perspectives (cf. Richardson 1992).

Methodological and theoretical contradictions and similarities are widely discussed in the literature (cf. Richardson ibid, Murray-Harvey 1994, Biggs 1993a, Wenestam 1993). Wenestam (1993) suggests that researchers must distinguish between either a phenomenographic or a cognitive perspective. The problem it seems is that what is reported by the subject (the student) is not identical to what is being processed cognitively, leading Wenestam (ibid) to say that:

> *Following this, there is a lot to gain from a closer look at phenomenographic, phenomenological and hermeneutical research methods and the way such approaches take care of qualitative variation in meaning...*
>
> (if a phenomenographic perspective is to be taken) *the first step is to establish each subject's way of understanding... that is what qualitative differences exist... this supplies the researcher with the necessary instrument by which further* (outcomes) *can be evaluated... within this suggested framework, each subject is viewed as a dynamic system, creating its own way of understanding... any inferences made about cognitive processes must be made within this system.*

Biggs (1993a) amongst others (Entwistle and Marton 1984, Speth and Brown 1988, Entwistle and Waterston 1988, Richardson 1992) has attempted to unpack the differences (and similarities) between the IP, cognitive theoretical framework and the SAL, more phenomenographic theoretical framework. Biggs (1993a) refers to the SAL model as a system of teaching and learning and says that:

> *Research into student learning has been based on two main theoretical sources... IP and SAL. The cross fertilisation has been valuable but it has ambiguities and misunderstandings... about constructs, methodology... and the development and interpretation of inventories of learning/study processes. The basic issues revolves around a conception of student learning as taking place within the student as IP models appear to assume or within*

the teaching/learning context as the SAL tradition emphasises. It is suggested that student learning is best construed within a teaching/learning context that functions as an 'open system'...

In following the same argument at a later date, Biggs (1994) describes the 'open system' of teaching and student learning (discussed later in this chapter), but stops short of suggesting that his interpretation of the SAL system and phenomenography are so similar as to render the differences negligible. Biggs (1994) does for example, offer a discussion on perception as indicative of the differences between phenomenographic studies and studies that include general distinctions between individual differences, saying that:

Phenomenography... takes as the only reality the student's perception of the task... There are two consequences. First, individual personality factors are ruled out... however, there is considerable evidence that perceptions are altered by personality factors. Second... if each individual's perspective is unique, you are left with an infinite number of perspectives...

Taking this kind of debate into account, and the associated different research perspectives, suggests that some stance is needed by the researcher enquiring into Student Approaches to Learning in order to develop interventions, to research the effectiveness of these and to then construct any sensible conclusions from his or her enquiries. This means that a paradigm or model of teaching and learning is desirable within this thesis in order that a learning intervention might be targeted and then evaluated within a realistic and acceptable conceptual framework.

What follows in this chapter therefore is a review of the literature available on Student Approach to Learning which clarifies the author's perspective (and terminology), which may at times refer to both phenomenography and cognitive psychology. Neither have yet been shown to be the only legitimate theoretical framework within which student learning can be examined, though it is fair to say that many researchers tend to work from students' phenomenological personal constructs of learning, even though they may use quantitative methodologies within that framework as well as the qualitative methodologies favoured by Marton and Saljö (1976, 1984). The literature really is riddled with inconsistencies and ambiguities as referred to by Biggs (op cit) and as suggested by Meyer (1995) and Richardson (1995). In this respect it is important that this review examines the concepts and constructs central to the Student Approach to Learning perspective and in doing so, the institutional and personal models of student learning to which the author subscribes.

Leaving the basic Information Processing model behind still leaves the author with the thorny problem of having to present a realistic theoretical model of student learning that is generally based on phenomenological, phenomenographic or otherwise experiential research findings. In doing so the author is referring to a typology already described as *Student Approach to Learning* (SAL). Approach to Study has come to be referred to a specific construct within this framework, namely an intentional element which explains what a student intends to do with the material he or she is attempting to learn. Entwistle (1992) therefore reports the difference between a *Surface* Approach to Study and a *Deep* Approach to Study as being a difference in intention:

> *The crucial defining feature of the approach lies in the contrasting intentions shown by students. A Deep Approach depends on an intention to reach personal understanding of the material presented. It appears that this approach has its roots in an intrinsic educational orientation and a sophisticated conception of learning. In adopting a Deep Approach, the student has to interact critically with the content, relating it to previous knowledge and experience, as well as examining evidence and evaluating the logical steps by which conclusions have been reached. In contrast, a Surface Approach derives from extrinsic orientation and a simple conception of learning as memorisation. It involves an intention merely to satisfy task or course requirements, seen as external impositions largely remote from 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 memorising those details.*

Entwistle is describing within this quote, a range of constructs: 'orientation', 'conception of learning', as well as 'approach'. Likewise, Morgan (1993) refers to a series of elements that are prevalent within the 'system' of teaching and learning which should be examined to understand learning from the learner's perspective. Morgan (ibid) says there are at least five interrelated factors such as:

- Orientation to education (or study)
- Conceptions of learning
- Approaches to learning (or study)
- Outcomes of learning and students' change and development
- Organisational constraints and the assessment system

The next section reveals some of the issues associated with Morgan's factors. As we will see later in this chapter, the factors listed above have been described by

various researchers in varying ways. In order to help unravel some of the inevitable confusion, the author has chosen to present two distinct but related sections in that both are concerned with the SAL rather than the IP model. The first section examines the background and constructs of the factors listed above under the heading of phenomenography. The second section applies the factors within a model of student learning which is appropriately described as a system.

2.3 Student Learning Within a 'Phenomenographic' Type Model

Approaches to Study

Saljö (1994) provides an overview of research conducted into human learning from which much of the concepts associated with Student Approaches to Study were derived. The impetus for the initial work was the effective failure of cognitive based research to account for learning outcomes within specific learning and social environments. As Saljö (1994) describes:

> *... there was an explicit questioning of the assumption that learning can be understood as an abstract phenomenon without taking into account the demands and social definitions of what counts as learning in different environments. Thus, one of the basic questions pursued was: What do people do when they study? A second assumption of the work, which can also be described as an attempt to follow a phenomenological credo, was to pay attention to what people learn and how they interpret the texts, concepts, and skills that are assumed to have been acquired and remembered over time.*

Following the work of Bartlett in 1932 (Dahlgren 1984, Saljö 1994) work by researchers such as Marton and Saljö (1976), Svensson (1977) and Dahlgren (1984) developed and promoted the concept of memory as depending upon the reconstruction of meaning. So developed a construct of learning that describes learning as about *what* is learned more than how much is remembered. This represents an important switch from viewing learning outcomes in quantitative terms to viewing them in qualitative terms. Such attention to what people learn and how they interpret the task of learning can be argued to offer raison-dêtre for interventions into the student level of learning, ostensibly by asking students to reflect on what they do when they study.

Over a series of research studies (Marton and Saljö 1976, 1984, Dahlgren and Marton 1978, Svensson 1977, Gibbs, Morgan and Taylor 1984, Dahlgren 1984,

Beaty 1987) differences in qualitative student learning outcomes have consistently been found. Described as *levels of outcome* (Dahlgren 1984) and as a 'form of hierarchy' (Morgan 1993), there were variations in levels of outcome. Thus, a student questioned with the intention of eliciting his or her understanding of a particular concept, could depending on the responses given, have his or her responses categorised within a set of hierarchical categories ranging from a simplistic description to an elaborative conclusion. A similar pattern was identified by Hasselgren (1981) in a study of student teachers' abilities to analyse video-tape of children at play. Hasselgren labelled the highest level of outcome an *abstracting description* and the lowest level of outcome a *fragmentary description*, with *chronological* and *particalistic* descriptions being between these two.

These terms were useful in describing learning outcomes in qualitative rather than quantitative terms. Marton and Saljö (1984) then posed the question, 'how can we account for the qualitative differences in the outcome of learning...?' Their answer centred on the notion of *learning process*, stating that (ibid):

> *If the outcome of learning differs between individuals, then the very process of learning that leads to different outcomes must also have differed between the individuals... The most obvious explanation of the differences in outcome should derive from a description of the differences in the process that led to the different outcomes.*

Such 'differences in process' have been largely established as dichotomies, initially being based on the work of Craik and Lockhart (1972). Whilst Craik and Lockhart (ibid) were working from a cognitive perspective, an independent analysis of the same data helped establish a more qualitative interpretation by Svensson (1977) who attempted to demarcate between the process of learning facts as a mechanistic skill and the learning of 'organised wholes' within which facts will be embedded. In doing so, Svensson (ibid) undertook several inference based studies where the type of learning outcomes described above were associated with atomistic or holistic thinking. In other words, Svensson inferred that because a student produced a low level of outcome, he or she must be thinking and organising content in what he called an atomistic way. Conversely, to understand the fundamental aspects of a concept of phenomenon requires holistic thinking, leading Svensson (1984) to state that:

> *A shift from an atomistic to a holistic approach thus constitutes the most significant of any improvements in understanding and learning.*

Marton and Saljö (1976, 1984) opted to have students describe to them their engagement with a particular learning task (reading text) which would then hopefully account for the differences observed in levels of outcome. This in effect was the phenomenographic methodology already referred to earlier in this chapter. Marton and Saljö (ibid) found that levels of outcome were related to whether students focused their efforts on the text and its constituent parts or on what the text was about, its meaning. This gave a dichotomy between students attempting to memorise the text and its content, and those attempting to find relationships between the text and other elements such as real world phenomena. The same type of dichotomy was found in separate studies in the UK (Entwistle 1981, Entwistle and Ramsden 1983, Marton, Hounsell and Entwistle 1984, Morgan, Taylor and Gibbs 1982) and Australia (Biggs 1976, 1978, 1979). This dichotomy in process tied in neatly with the notion of levels of outcome, being given the parallel term of *levels of process*, and subsequently these being differentiated into the now familiar *Deep* and *Surface* levels of processing. These terms were chosen on the basis of a metaphorical resemblance to Craik and Lockhart's (1972) concepts of levels of processing (Marton and Saljö 1984). Combining the work of Marton, Saljö and Svensson described above, led Marton (1988) to describe the logical structure of student Approaches to Study as being based within both *what* the student does (outcome) as well as *how* a student structures a task (the process or Approach taken). Marton (1988) presents these descriptions of the student experience within a framework as in figure 2.3:

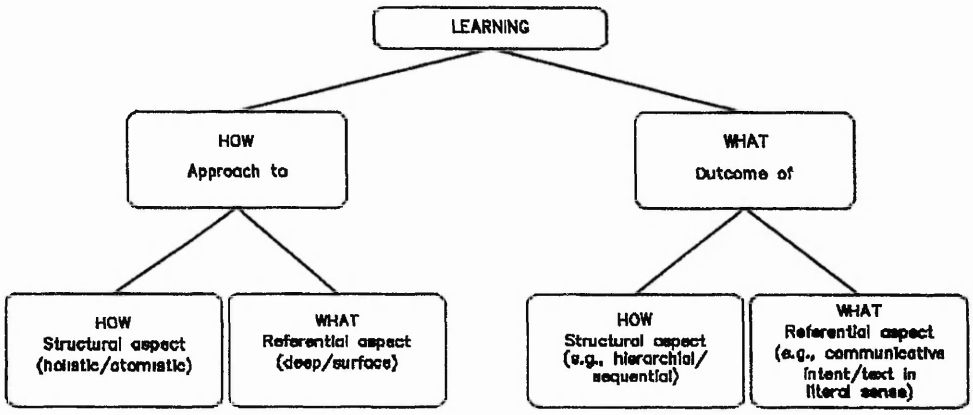


Figure 2.3 A Framework for the Experience of Learning (Marton 1988)

The 'how' and 'what' aspects of learning in figure 2.3 are further broken down to describe structural and referential aspects of Approach and outcome. In turn these are seen by Marton (ibid), and described in this review as parallel. For example,

a holistic approach will tend to coincide with a hierarchical outcome; an atomistic approach will coincide with a sequential outcome.

The 'how' and 'what' have to be considered together for it makes no sense to consider how a student structures a task in isolation from what the student is intending to structure (Ramsden 1992). Likewise it is difficult to attribute meaning to a concept without understanding how that meaning is constituted. Marton (1988, 1984) therefore sees Approach to Study as being a combination of the Deep/Surface dichotomy, emphasising referential (meaning) aspects, and the atomistic/holistic dichotomy referred to earlier thus emphasising the organisational and structural aspects of the task. Marton et al (1993) clarified these aspects:

> *By structural aspects is meant the way in which the phenomenon in question is delimited from and related to its context and to the way in which the component parts of the phenomenon and the relations between them are discerned. The referential aspect is the global meaning of the phenomenon.*

The process and the structure cannot be separated from each other, and are respective of each other; Svensson (1977) and Marton and Saljö (1976) concluded that a low level of process (Surface) correlated with a low level of outcome, while a high level of process (Deep) correlated with a high level of outcome. The associations between the structure and the referential or 'meaning' process are shown in figure 2.4 (from Ramsden 1992):

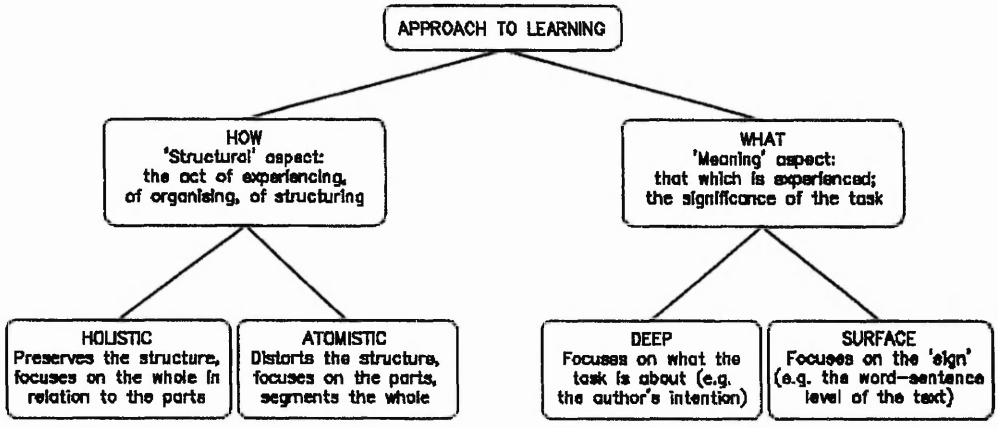


Figure 2.4 A Logical Framework of Approaches to Study (Ramsden 1992)

The terms Deep and Surface Levels of Processing suggest a relationship with Craik and Lockhart's (1972) work and thereby cognitive psychology and the Information

Processing model specifically. This is not the case, and following work by Entwistle, Hanley and Ratcliffe (1979), Entwistle and Ramsden (1983), the terms were broadened to the now familiar Deep and Surface *Approaches to Study*. This change in terminology also recognises the shift occurring from previous cognitive research paradigms to phenomenological based paradigms as ways in which to evaluate the differences between how, what and why students study.

In defining Deep and Surface Approaches to Study, Marton and Saljö are considering 'how the student approaches the subject matter, what he is looking for, where his attention is focused' (Laurillard 1979). The question so far unanswered here is why the student adopts a particular Approach to Study. Studies have shown (Laurillard 1979, Fransson 1977) that the 'why' element indicates a relationship between the Approach to Study dichotomy and motivational aspects of the learner. Motivation has been the focus of several research studies within the Student Approach to Learning epistemology as discussed earlier. However, at this point it is important to explore the original work related to motivation within the Marton and Saljö (op cit) constructs of Approach to Study.

Marton and Saljö (1984) had identified that by changing the 'demand structure' of the students' learning situation they were not necessarily able to change the students' Approaches to Study, stating that:

> *One of the factors contributing to the partial failure of these attempts to induce a deep approach by manipulating the 'demand structure' of the learning situation is the relation between the learners' motives and the way in which they go about learning. Learning or reading out of interest, a wish to find something out (ie. due to intrinsic motivation), can reasonably be expected to be linked with a deep approach. On the other hand, comments from students who had adopted a surface approach showed that they tried to memorize the text because they felt that this was required of them. Surface approach and the motive of fulfilling the demands raised by others (ie. extrinsic motivation) seem to go together.*

Motivation in this sense seems to be either intrinsic or extrinsic to the task in hand, as will be discussed later in the section on orientation to study. Fransson (op cit) was able to show, as was Laurillard (op cit) that these forms of motivation were closely tied to how the student felt about or perceived the task in hand and the subsequent reason for doing the task (did it precede a test of recall for example). So motivation as seen by Marton and Saljö at this time is related to the reason why the student is interacting with the task, and whether or not that

reason is internal or external to the student's aims. The problem associated with this view of motivation vis-a-vis the task in hand is referred to by Marton and Saljö (1984) as a 'paradoxical circular relationship'. In other words, which comes first, the motivation or the adoption of an Approach?

Laurillard (1979) attempted to square the circle by highlighting the most important factors likely to influence a student in his or her 'choice' of approach. She listed these influences as:

- Orientation towards the task
- Perception of teaching
- Perception of the task in hand

and goes on to say that:

> *Synthesising these various relations into a single descriptive model, the learning process can be seen as a decision-making process in which the student chooses his methods of working on the basis of his response to the conditions... his choice of strategy determines whether the student is prepared to do some 'productive' thinking and make an active contribution to what he is doing, or whether he simply reproduces whatever he has been given in lectures. At the cognitive level, he is making decisions about how to approach a task, and about how to structure the subject matter. At the contextual level, his perceptions of the aims of the task, its requirements and the nature of the teaching influence these decisions.*

Orientations to Study

Morgan's (ibid) assertion and that of his contemporaries (Gibbs 1981, Gibbs, Morgan and Taylor 1984, Beaty and Morgan 1992) is that students come to learning with particular forms of motivation, termed orientation; what Morgan (1993) describes as 'holistic motivation'. Following the suggestion by Laurillard (1979) about the student's 'orientation toward the task', Taylor (1983) provided the construct of 'Orientation to Study', later termed as 'Educational Orientation' (Gibbs, Morgan and Taylor, 1984), and sometimes interchanged between 'Educational Orientation', 'Orientations to Education' and 'Orientation to Study' (Morgan 1993). Hereafter termed 'Orientation to Study' , orientation in this sense describes the student's personal context of study.

Study Orientation (Entwistle and Ramsden 1983), on the other hand, is described in the literature and has come to be used with different meaning by different researchers. Tait (1995) for example, describes how orientation within her current construct of student learning is used to describe a general tendency for a student to favour one Approach or another over time. Consequently, as the scales of the Revised Approach to Study Inventory (Entwistle and Tait 1993) are designed to map-out a broad range of behaviours and attitudes, study orientation in Tait's (ibid) and Entwistle and Tait's (1988, 1992, 1993, 1994) terms, has become a generic description of consistency in Approach to Study and the existence of Approach, motivation, and orientation to study in combination, in a similar way to Biggs' (1987, 1993a), motive-strategy congruence discussed later in this chapter. It could be argued that using the term study orientation is one consequence of the factor analysis favoured by Entwistle and Tait in their research at Edinburgh; in some analyses scales that cover orientations to study, motivation, study preferences and Approach to Study are combined to typically produce the meaning, achieving and reproducing study orientations often described by the Edinburgh researchers (Tait 1992). Taylor, Morgan and Gibbs (1981) give a much more global description of orientation to study... 'all those attitudes, aims and purposes which express a student's relationship with a course and a university'. Other researchers such as Schmeck (1988) have used the term orientation to describe clusters of cognitive tactics and strategies a student may use, though in that his descriptions are based in the cognitive research traditions, Schmeck (ibid) is using orientation in a sense that is context free and is based largely within a personality model. Such a description is not immediately applicable in this research given the author's interest in the relationship between the student and his or her perception of the learning tasks required of them.

Biggs (1987, 1993a) discusses a relationship between motive and strategy within the concept of 'motive-strategy congruence' on which his recognisable theory of student learning has been built and his instrument for identifying Approaches to Study have been developed. Motive in Biggs' (ibid) terms is the reason why a student is engaged in study, but rather than a global description as offered by Taylor, Morgan and Gibbs (op cit) motive in this sense describes three specific types: intrinsic, instrumental and achieving which are associated with Deep, Surface and Strategic Approaches to Study respectively. In Taylor's (1983) terms however, a motive is still the explicit purpose students have in engaging with study in university, but is categorised by two elements; the general description of the student's purpose in study (Beaty and Morgan, 1992), and a description of the student's main interest. Four orientations to study have been identified empirically (Gibbs, Morgan and Taylor (1984) termed *Personal, Vocational,*

Academic, and *Social*, the first three of these each having either an *intrinsic* or *extrinsic* level of interest. Thus orientation to study is a personalised motive for being in higher education. Orientation is also seen by Morgan et al (op cit) to be context dependent and open to modification. Orientation assumes an active and explicit form of motivation, suggesting that some potential intervention might be made into the learner's orientation, and thereby the functional relationship between it, Approaches and outcomes (Entwistle and Marton 1984).

The combination of orientation and interest reveals the aim the student has with respect to education and life within the institutional context. This in turn affects the concern the student has with the course of study. These descriptions of orientation are quite accessible and offer a realistic description of the aims and concerns of students in higher education. They help explain the notion of a tendency on the part of a student to adopt a general approach to his or her studies (Ramsden 1992) described by Morgan (1993) when he says that:

> *Holistic descriptions of students give insights into the details of students' study processes and the problems they encounter... orientation to education provides a conceptual framework for understanding the learners' realities of studying.*

Orientation	Interest	Aim	Concerns
Vocational	Intrinsic	Training	Relevance of course to future career
	Extrinsic	Qualification	Recognition of worth of qualification
Academic	Intrinsic	Following intellectual interest	Room to choose stimulating lectures
	Extrinsic	Education progression	Grades, academic progress
Personal	Intrinsic	Broadening or self-improvement	Challenge, interesting material
	Extrinsic	Compensation or proof of capability	Passing course, feedback
Social	Extrinsic	Having a good time	Facilities for sport and social activities

Figure 2.5 Orientations to Study (Gibbs, Morgan & Taylor 1984)

Orientations to Study, their associated interests, aims and concerns are listed above in figure 2.5. It is these 'learners' realities of studying' that became the focus of the first aim of the author's learning interventions. Following the argument put forward by Morgan et al in a series of papers referred to above, it is possible to explain student motivation as orientation to study. Asking students to explore their orientation may generate insights into why they are attempting to engage with study. This is the main reason for including in the learning to learn workshops the first objective:

> *To promote appropriate orientation to study by enabling students to become more aware of the values and attitudes they may have in relation to higher education, and to recognises appropriate priorities and intentions.*

Gibbs, Morgan and Taylor (1984), Beaty and Morgan (1992) have suggested that orientation to study is developmental. In other words an orientation is not invariable, will relate to the learning context, and may change and develop over time (Gibbs, Morgan and Taylor, ibid). Moreover, various studies (Fransson 1977, Laurillard 1979, Marton and Saljö 1984, Entwistle and Marton 1984, Martin and Ramsden 1987, Prosser and Trigwell 1990, Trigwell and Prosser 1991, 1991a, Lublin and Prosser 1994) point to relationships between the concept students have of learning itself, the quality of engagement and the eventual quality of outcome. Given these relationships, the author's interventions were designed with the intention of impacting on features which have been described as potentially open to modification. With respect to this, the second objective for the author's intervention was:

> *To promote appropriate concepts of learning by making explicit an understanding of what effective learning is,*

whilst the third objective, and the one on which this research is focused, followed the relationship previously described in prompting students to examine the quality of engagement with the learning task in terms of Approach to Study, hence:

> *To promote appropriate approaches to study by describing and explaining these different approaches, so as to help the student to adopt preferable approaches wherever applicable, and to see the implications of doing so.*

Constructs inherent in the author's objectives have been variously established within the literature. For example, Saljö (1975, 1979) reported individual differences within cohorts at both a process and outcome level even though the

cohort was presented with external factors aimed at eliciting a deep process and outcome (see also Tang 1994). Marton and Saljö (1984) argue that these variations must be due to differences in preconception and perception of the task. This means that Marton and Saljö's model of student learning now contains three interrelated factors:

- Conceptions of Learning
- Levels of Process
- Levels of Outcome

The first factor, conceptions of learning are what accounted for the intra-cohort differences in levels of process and outcome reported by Saljö (ibid). Thus any variation within the same context and same cohort is likely to be closely linked with a variation in the student's conception of learning at a more general level. This forms some justification for including conception in the second of the author's learning to learn objectives.

Conceptions of Learning

Saljö (1979) identified a series of conceptions held by students in relation to learning. Marton and Saljö (1984) argue that these differences in conception that account for differences in Approaches within a task that is effectively the same from an external point of view. In other words, students' concepts of learning, their understanding of what learning is, underlies their Approach to Study. This was confirmed by Van Rossum and Schenk (1984) and later by Martin and Ramsden (1987) and Marton et al (1993). Saljö (1979) found five ways in which learning was conceptualised by students (figure 2.6):

1. A quantitative increase in one's knowledge.
2. Memorising and reproducing.
3. Acquiring facts, procedures, etc which can be retained or utilised.
4. The abstraction of meaning.
5. An interpretative process aimed at understanding reality.

Figure 2.6 Student Conceptions of Learning (Saljö 1979)

These conceptions have been described (Marton and Saljö 1984) as preconceived ideas held by students of what it takes to learn. Gibbs (1992) describes the five different conceptions well and their relationship to Approaches to Study:

Stages 4 and 5 are clearly qualitatively different from stages 1 to 3. Students who understand what learning is at levels 1, 2 or 3 have trouble comprehending what a deep approach consists of and are very unlikely to take a deep approach to learning tasks. Students who are at levels 4 or 5 can take either a deep or a surface approach, depending on the task and their perception of its demands. The connection between these underlying conceptions of learning and the approach students take to specific learning tasks is so strong that it is possible to predict the quality of learning outcomes directly from students' conceptions of learning. All you need to know about a student is that she has a conception of learning at level 1, 2 or 3 and you can be fairly certain that she will only derive a superficial or fragmentary understanding from, for example, reading a chapter.

Gibbs is describing the demonstrated (cf. Van Rossum and Schenk 1984) split between the first and the second conception, and the fourth and fifth conception. Marton and Saljö (1984) suggest that the close link to the Surface and Deep Approaches is demonstrated by the coupling of the lower and higher conceptions respectively. Thus, an increase in knowledge (1) is achieved by memorisation (2) which demonstrates the Surface Approach to Study. Likewise, a Deep Approach to Study encompasses the understanding of reality (5) which is achieved through the abstraction of meaning (4). At this time, Marton and Saljö (1984) describe the third conception as appearing to 'intermediate between the others'.

Subsequently (Van Rossum and Taylor 1987, Marton, Dall'Alba and Beaty 1993, Entwistle and Entwistle 1991) have revised this view and established the existence of a sixth conception. This conception has been termed 'changing as a person' describing how a developing view or insight into phenomena means that one may develop a new way of seeing those phenomena and 'seeing the world differently means that you change as a person' (Marton et al, ibid). Marton et al (1993), describe the first three conceptions as being held by students who see knowledge as external packages waiting to be picked up or otherwise acquired. The last three conceptions are held by students who see learning as the constitution of meaning. Thus, Marton et al (ibid) describe the division between conceptions 1 to 3 and 4 to 6 as a 'watershed'; the watershed between the lower and higher levels being the establishment of *meaning*.

Entwistle and Entwistle (1991) describe the distinction as the difference between the reproduction of information and the transformation of information in the process of reaching understanding. Conceptions of learning and their relationship to process therefore appear as below (figure 2.7):

1. Increasing one's knowledge.
2. Memorising and reproducing. *REPRODUCING*
3. Utilising facts and procedures.

.....

4. Developing an initial understanding.
5. Transforming one's understanding. *TRANSFORMING*
6. Changing as a person.

Figure 2.7 Conceptions of Learning (Entwistle & Entwistle 1991).

Outcomes of Learning

Conceptions are based on the specific content of learning and the ways in which that content is handled by the individual within a contextual framework. Other authors (Biggs and Collis 1982) have generalised such conceptions further to describe the ways in which outcomes can be classified according to a taxonomy that reflects qualitative differences in the way a task has been approached. Thus the Structures of Learning Outcomes (SOLO) Taxonomy (Biggs and Collis 1982) was born. The SOLO Taxonomy (ibid) describes the range of responses possible in answering a given question. Each level of the taxonomy describes increasingly sophisticated responses. Biggs (1988) suggests that the SOLO Taxonomy differentiates between learning outcomes on the basis of 'level of abstraction'. In this respect, a low SOLO level describes a response to a task with an inappropriately low level of abstraction, typified by the use of irrelevant information. The five levels of the SOLO Taxonomy are shown below in figure 2.8.

1) PRESTRUCTURAL	Use of irrelevant information, or no meaningful response.
2) UNISTRUCTURAL	Answer focuses on one relevant aspect only.
3) MULTISTRUCTURAL	Answer focuses on several relevant features, but they are not co-ordinated together.
4) RELATIONAL	The several parts are integrated into a coherent whole: details are linked to conclusions; meaning is understood.
5) EXTENDED ABSTRACT	Answer generalises the structure beyond the information given: higher order principles are used to bring in a new and broader set of issues.

Figure 2.8 Levels of the SOLO Taxonomy (Described in Ramsden, 1992)

Biggs and Collis (1982) report how the SOLO Taxonomy can be applied to differentiate between answers that increase in quality; the lowest level describes an answer that could have been given by a student who had learned nothing from the learning experience; levels two and three describe answers that are still less than adequate but contain more relative facts or information than in level one; level four describes a logical answer with interconnected facts which may or may not lead to overgeneralisations; level five describes an answer with general level abstractions that consider alternative possibilities to those implied in the question. Biggs (1988) also describes how the SOLO Taxonomy can be used actively to develop the structure of a task as well as to evaluate the outcomes.

The SOLO Taxonomy has been applied to describe the conceptual development (Ramsden 1992) of students in a similar way to the that reported by Johansson et al (1985) in exploring the conceptual understanding of mechanical engineering students. It is clear from such studies that some students find it very difficult to move from one level of understanding to the next, however, the reasons for this are unclear. One explanation has been to associate the SOLO Taxonomy with Approaches to Study (Hounsell 1984, Marton and Saljö 1976, 1984, Van Rossum and Schenk 1984, Biggs 1987), the results of which Biggs (1988) describes as closely linking Approach, structural complexity and outcome. In short, levels 1 to 3 are associated with surface processing and levels 4 to 5 with deep processing. There is also a similarity between the transformation type conceptions already described and the final categories of the SOLO Taxonomy, as there is between the reproducing type conceptions and the earlier categories of the SOLO Taxonomy (Entwistle and Entwistle 1991). However, Biggs and Collis (1982) and Biggs (1988) question the ultimate implication that the SOLO Taxonomy is related to stages of intellectual development as for example, described by Perry (1970) and now discussed below.

One aspect of descriptions of reproducing and transforming conceptions not yet discussed here is the developmental nature of them, in other words how do students change over time in respect of their conceptions of learning? Gibbs et al (1984), Gibbs (1992), Ramsden (1992) and Morgan (1993) have all referred to conceptions as being developmental in this way. However, Marton et al (1993) point out that because students may encounter material designed to challenge their preconceptions, empirical reports of changes in conceptions may be reflecting the masking effects of such influencing material.

A series of related reports (Entwistle and Entwistle 1991, Entwistle and Entwistle 1991a and Entwistle and Marton 1994) seem to suggest that conceptions of

learning, particularly what constitutes 'understanding', are dependent on the whole learning environment. At times therefore, there is a tension between the personal understanding a student may wish to achieve, and the understanding he or she is expected to explain and demonstrate, for example, within an examination. It would seem that the two are not necessarily (and rarely) the same. With respect to the developmental aspects of conceptions of learning, this means that at worst, students at levels above level three of Saljö's (1979) conceptions of learning model may abandon their efforts and intention to understand material in favour of reproduction, low-level concepts in a direct response to their perception of the examination (cf. Tang 1994). In the opinion of the author this discussion is not directly helpful to this research in respect of the conceptions of learning students *may* hold. However, it does illuminate the context dependence (at a specific level) of the conceptions students develop and the meaning they attach to 'learning'.

Several researchers (Gibbs op cit, Ramsden op cit, Morgan op cit, Saljö 1987, Martin and Ramsden 1987) have pointed out the parallels between Saljö's scheme of student conceptions and other developmental models such as Hasselgren's (op cit) and notably Perry's (1970) scheme of intellectual and ethical development. Likewise, the developmental view of conceptual understanding parallels the Biggs and Collis (1982) descriptions already discussed (cf. Balla, quoted in Ramsden 1992). Saljö (1987) recognises the impact of Perry by saying:

> *Our drawing insights into this area of subjective conceptions of phenomena such as knowledge and learning, we owe to the pioneering observations of William G Perry. His work... shows that behind the learning difficulties encountered at university there may not necessarily be insufficiencies in 'processing capacities' or 'motivation', but rather conceptions of knowledge which are at variance with those held by the faculty.*

Differences in conception between faculty and student have alluded to under descriptions of conceptions of learning. Perry's study, just as Marton et al's (1993) is a longitudinal study mapping changes in conception over time, and even though he (Perry 1970) did not include women or socio-economically disadvantaged students, he clearly supports the idea that conceptions of learning are related to the quality of student learning processes and outcomes, all of which respond to the specific features of the educational context. Perry (1970) proposed that students progress through a series of changes and move from a position where they view knowledge and learning in absolute terms, to a position where knowledge is seen as pluralistic and complex. Perry (1970) terms these stances as dualistic and relativistic respectively. Hence, Perry's model is concerned firstly with how

students move from a dualistic, dogmatic view of phenomena, to a more relativistic view; and secondly with how students develop personal commitment and responsibility to a relativistic view. The original work describes three stages or periods, within which there are a total of nine positions (Perry 1970), position one being the lowest and nine the highest, hence position one is in the period of dualism, and nine in the period of commitment to relativism:

The Period of Dualism is characterised by the student taking it for granted that knowledge consists of correct answers, one per problem, which are presented and explained by the tutor.

The Period of Relativism is characterised by a student who makes the same assumption as above, but recognises that tutors may present problems and procedures rather than answers. Study is therefore a game involving identifying or guessing the answers based on the theory that is presented.

The Period of Commitment in Relativism is characterised by a student who believes that answers are only right within the context they apply to, and that these contexts can vary. Thus an interpretation of an event can be made that may be legitimate 'depending on how you look at it'.

Clearly the effect of these stances is for students to make very different meanings of an experience depending upon the period of development they have reached. Perry (ibid) argues that there is a growth from position one to position nine. Saljö (1987) confirms that:

> *there is a functional relationship between the mode in which people subjectively construe learning and the way in which they go about dealing with learning tasks...* thus ... an *absolutistic conception ...* is *associated with a surface approach...*

The most interesting aspect of Perry's work with respect to the author's research is the application of the scheme that has been made by researchers to engineering students. Fitch and Culver (1984), Pavelich and Fitch (1988) and Kurfis (1988) found no engineering students graduating with a conception of learning above position four on Perry's scheme, and most at position three. It is salutatory to think that given the link described by Saljö (ibid), position three of Perry's (1970) scheme may still be associated with a Surface Approach to Study and a reproducing conception of learning.

Wankat and Oreovicz (1993) refer to how highly structured (engineering) courses reinforce the lower positions of Perry's (op cit) scheme. The link between teaching, the concept of learning held, and Approach was explored by Saljö (1987) amongst others (Van Rossum and Taylor 1987, Entwistle and Tait 1990, Trigwell and Prosser 1991, Lublin and Prosser 1994). It is pointed out (Saljö op cit) that many undergraduate students come from school backgrounds which may implicitly promote a dualistic position and a low conception of learning. This may be a result of highly controlled methods of teaching and reward which tend to be used within the school curriculum and syllabus. Gibbs (1992) has described this restrictive form of teaching as 'closed'. Thus what is to be learnt and the outcome expected is completely controlled by the teacher, promoting the student to develop a limited and reproducing ('closed') conception of learning. Alternatively, a student may develop an 'open' conception of learning where the teacher acts as a facilitator of learning rather than a controller. Gibbs (1992) reports that the closed conception of teaching is 'held almost exclusively' by students with a reproducing conception of learning and thereby Surface Approaches to Study.

Toward an Integrative Framework

In an attempt to include Approach dimensions in coherent models of student learning, authors such as Biggs (1993a 1993b), Entwistle (1987, 1988) and Meyer (1991), have developed systemic models of student learning. Biggs' (1993a, 1993b) 'Presage, Process, Product' model is now referred to as an example of such as systemic model and is discussed in the next section. By examining such a model it is intended that some exploration can be afforded of how the various concepts described so far in this review are inter-related. This inter-relationship is primarily between Approaches to Study and academic outcome, both of which are related to orientation to study and to conception of learning. Entwistle and Marton (1984) describe the relationship:

> *It is now possible to trace a chain of functional relationships from orientation or conception, to approach (including perception of the task, intention and process) and on to outcome, with something close to logical inevitability...*

Morgan (1993) suggests that:

> *... in terms of improving students' learning, to engage with them to help develop their conceptions of learning and their approaches to study are some of the 'interventions' which are available to us as teachers...*

In both these quotes and the work already discussed, there is an implied systemic relationship, the idea that orientation, concept and Approach are somehow linked to learning outcomes. The mention of orientation to study, conception of learning and Approaches to Study completes the three objectives of the author's learning to learn interventions reported in this thesis. The objectives are listed again below, with the full description of the intervention found in the appendix to this thesis.

> *To promote appropriate orientation to study by enabling students to become more aware of the values and attitudes they may have in relation to higher education, and to recognise appropriate priorities and intentions.*
>
> *To promote appropriate concepts of learning by making explicit an understanding of what effective learning is.*
>
> *To promote appropriate approaches to study by describing and explaining these different approaches, so as to help the student to adopt preferable approaches wherever applicable, and to see the implications of doing so.*

The objectives above are meant to reflect the desired advancement of 'skill in learning' as suggested by Beaty and Morgan (1992):

> *Skill in learning is a relational concept. The inter-relationship of confidence and competence in learning is intimately linked with conception of learning, approach to study and learning outcomes. These concepts describe learning at increasing levels of generality and provide a holistic description of students' experiences in learning.*

Approaches to Study are formed in relation to the context of learning and will interrelate with other foci of student attention such as academic outcome. The relationship between concepts such as orientation to study, concept of learning, Approach to Study and the outcomes of learning is multidimensional, multivariate and difficult to model. However, some authors (Biggs 1993a, Entwistle 1988) have presented descriptive frameworks. Biggs' (ibid) model in particular has attempted to model the functional relationship described by Entwistle and Marton (1984) above. This is the basis of the 'Presage, Process, Product' or '3P' model described by Biggs (1993b) and Lublin and Prosser (1994); that a student's Approach to Study is a function of the interrelationship between student based factors and teaching based factors, including assessment. Tang (1994) summarises well:

> *... students are differentially responsive to the teaching context factors such as curriculum, teaching and assessment methods, and institutional provisions and restraints, according to their perceptions of the teaching context. Hence, in the actual learning situation, students develop a context-specific 'study orchestration'* (Meyer and Muller 1990) *in response to the perception of the requirements on the learning process.*

So associated with the concept of Approach to Study, there is also seen to be a series of other elements, which appear to be either peripheral or central to a construct of student learning depending on the model one chooses to subscribe to. It can be argued that there are two main theories and models that must be referred to in respect of this. One is an empirical model initially developed by Marton and Saljö (1976); the other a systemic model described by Biggs (1993a, 1993b). Other researchers (Biggs 1976, 1978, Laurillard 1979, Ramsden and Entwistle 1981, Entwistle and Ramsden 1983, Gibbs, Morgan and Taylor 1984, Meyer 1991, Entwistle and Tait 1993) have contributed to the constituents and the interpretations made of these theories and models over the last twenty years, and even though the constructs and terminology have become confused, the basic tenet has remained the same, that the quality of learning is encompassed within and defined by the quality of the relationship between the student and his or her context of learning.

Context Influences on Student Learning

Contextual influences on Approaches to Study, particularly the prevailing assessment system have been widely researched by Svensson (1977), Fransson (1977), Ramsden and Entwistle (1981), Marton and Saljö (1984), Laurillard (1977, 1984), Dahlgren (1984), Meyer and Parsons (1989), Entwistle and Tait (1990), Entwistle and Entwistle (1991, 1991a), Trigwell and Prosser (1991, 1991a), Eley (1992), Gibbs (1992), Tang (1994) amongst others.

Findings have not always been conclusive, particularly in relation to the inventory based identification of Approaches to Study factors and to correlates with student perception of course contextual items (cf. Ramsden and Entwistle 1981, Meyer and Parsons 1989). However, it does make conceptual sense that a student's Approaches to Study will be significantly affected by the context in which the student is learning. Methods and techniques for identifying this relationship have been developed with varying degrees of success and agreement with other findings. The effect of context over Approach was adequately demonstrated by Ramsden (1984), Coles (1985), Newble and Clarke (1987), Griffiths (1992) who all have found

that problem-based courses, more than conventionally taught and assessed courses, were likely to provide a context in which students tend to score higher on Deep Approach scales of the ASI than Surface scales of the ASI.

Some confusion has entered the literature as to what studies of contextual influence on student learning are actually investigating; the context as it stands or the perception a student has of the context he or she is in. For example, it is quite well known (cf. Marton and Saljö 1976, 1984, Tang 1994) that student perception of assessment demands can be entirely different to what the teacher intends to assess. Likewise, alternative forms of assessment, even within the same subject, may promote differentiated forms of Approach. Entwistle (1991, 1987) argues that it is student's perceptions of the learning environment that influence how students learn, not necessarily the context itself. This he argues (ibid) can be demonstrated by the phenomena of students with Surface Approaches to Study preferring, and rating more highly lecturers who provide very controlled learning environments, while students with Deep Approaches prefer challenging lecturers (cf. Entwistle and Tait 1990, Gibbs 1981, 1992).

Marton and Saljö (1976) produced clear experimental evidence that perceived assessment demands influenced the Approach of students, although it was found easier to encourage a Surface Approach to Study than it was a Deep Approach. This was attributed to the demand structure of the task (Marton and Saljö, ibid). Tang (1994) explored the relationship between the type of task and the perception driven approach subsequently adopted by the student, also concluding that student's perceptions of task demands were influencing the Approach taken in preparation for the task. Thus, students studying for a short, factual tests were more likely to adopt Surface Approaches to Study than those preparing for discursive essay-based assignments (cf. Thomas 1986, quoted by Entwistle 1992).

Even though Approach can be seen to be influenced by assessment demands, Approach to Study may also tend to remain stable over time (Entwistle 1991). Some students in Tang's (ibid) study tended to adopt similar Approaches, regardless of the form of the anticipated assessment. These students it seems, were unaware of the demand structure and tended to adopt an Approach to Study congruent with their general study orientation (in the Entwistle and Ramsden, 1983 sense) when faced with a 'new' task. It is argued (Tang, op cit) that the decision made by the student to adopt either a Deep or a Surface Approach to Study, is based on the student's conception of the task as being either quantitative or qualitative, which in turn may be dependent on the student's previous experience. Tang (1994) concludes:

The results indicate an interactive model between the presage personological and contextual influences on learning... the linear effects of presage factors (surface orientation and quantitative perceptions of task demands) on test performance is true up to a certain point. However, deep-orientated individuals orchestrated a deep-memorisation strategy which demonstrated the interaction between the study orientation and perception of the context... many students did not adopt deep strategies, presumably because they did not have the requisite procedural knowledge of strategy to bring to the situation. All these findings indicate the interaction between the personal orientation, perceptions of task demands and the effects on learning.

An important finding from research within natural settings into student perception of assessment demands was the concept of the 'Strategic Approach to Study' (Ramsden 1979) which is conceptually similar to Biggs' (1987) 'achieving motive/strategy combination' discussed later in this chapter. Ramsden (op cit) described Strategic students as those who aimed to deal with course and assessment material in a competitive way so as to achieve the highest marks possible. These students were therefore, constantly engaged in modifying and adapting their Approaches to Study to fit the perceived demands of a particular task. This process would be facilitated by being attentive to the clues and cues a lecturer might disclose about the type and content of assessment. These findings indicated the ways in which some students were influenced by perceived task requirements. Laurillard (1979) produced findings which supported this last notion, inasmuch as over half of the students she studied used different learning strategies at different times. Laurillard (ibid) concluded that because students' Approaches to Study are adopted in response to their perception of the environment, it is difficult to describe a student as 'being' either Deep or Surface, going on to say:

It would therefore be hazardous for an investigation of learning to proceed on the assumption that learning is a process that is independent of other external factors, or that students process inherent, invariant styles of learning. The findings imply that learning should be studied in the context in which it occurs...

The context versatility of Approach described above has been disputed in some instances (Svensson 1977) and supported in others (Saljö 1979). Saljö (1979) found that students had difficultly in generally classing themselves as either Deep or Surface independent of the context in which they worked.

In an attempt to explore the effects of the academic context on student perception, Ramsden (1979) developed the Course Perceptions Questionnaire (CPQ)(later to become the Course Experience Questionnaire, Ramsden 1991). The CPQ had scales designed to indicate students' perceptions of the goals set by departments: relationships with students, commitment to teaching, workload, formal teaching methods, vocational relevance, social climate, clear goals and standards, and freedom in learning. Entwistle and Ramsden (1983) were able to show that high frequencies of Deep Approaches were associated with departments characterised by good teaching and freedom in learning, while Surface Approaches were associated with departments with heavy workloads. Ramsden (1992) was later able to summarise characteristics of the learning context associated with Deep and Surface Approaches to Study (figure 2.9). These characteristics have been variously described elsewhere, for example, Biggs (1979), Gibbs (1992), Eley (1992).

Deep Approaches are encouraged by:
- Teaching and assessment methods that foster active and long-term engagement with learning tasks.
- Stimulating and considerate teaching, especially teaching which demonstrates the lecturer's personal commitment to the subject matter and stresses its meaning and relevance to students.
- Clearly stated academic expectations.
- Opportunities to exercise responsible choice in the method and content of study.
- Interest in and background knowledge of the subject matter
- Previous experience of educational settings that encourage these approaches.

Surface Approaches are encouraged by:
- Assessment methods emphasising recall or the application of trivial procedural knowledge.
- Assessment methods that create anxiety.
- Cynical or conflicting messages about reward.
- An excessive amount of material in the curriculum.
- Poor or absent feedback on progress.
- Lack of interest in and background knowledge of the subject matter.
- Previous experience of educational settings that encourage these approaches.

Figure 2.9 Characteristics of the Context of Learning Associated with Deep and Surface Approaches (Ramsden 1992)

While not entirely overlapping, some correlation was found between the CPQ and the Approach to Study Inventory (op cit)(Ramsden and Entwistle 1981). Surface Approaches were associated with heavy workload; Strategic Approaches with clear goals; vocational relevance with extrinsic motivation; positive course evaluation

with intrinsic motivation. Replicated by Meyer and Parsons (1989), no such relationships were found, except for the Surface Approach link with heavy workload. These outcomes (Meyer and Parsons, ibid) were attributed to the inability of the CPQ to successfully identify course perceptions at anything other than a group level. Subsequently, two research developments took place: Ramsden (1991) modified the CPQ to develop the Course Experience Questionnaire (CEQ), and Meyer (1991) developed the instruments and applied statistical techniques capable of identifying Approach to context relationships at an individual level within his construct of 'Study Orchestration'.

The CEQ elicits from students their perception of five scales deemed indicative of high quality learning environments: good teaching, clear goals, appropriate workload, appropriate assessment and emphasis on independence. Outcomes from the questionnaire can be used to provide indicators of teaching quality at a course level or above. The CEQ has been verified as differentiating the perceived quality of courses in a series of studies (Richardson 1994, Gregory, Thorley and Harland 1994, Solomonides 1994). At this stage, what is of more interest here is the relationship between the CEQ and inventories designed to evaluate student Approaches to Study such as the Approach to Study Inventory. In this respect Ramsden (1991) established the following correlations:

Table 2.1 Correlations Between Approaches to Study and CEQ Scales (Ramsden 1991)

CEQ Scale	Deep Approach	Surface Approach
Good Teaching	0.15	-0.10
Clear Goals	0.10	-0.24*
Appropriate Workload	0.04	-0.45*
Appropriate Assessment	0.17	-0.43*
Emphasis on Independence	0.02	-0.27*

* = $p < 0.05$

Whilst the correlations were not entirely significant, Ramsden (1991) was able to identify through factor analysis two dimensions; one associating heavy workload and inappropriate assessment with a Surface Approach, the other associating good teaching and clear goals with the Deep Approach.

Meyer and Muller (1990) developed the Qualitative Context Inventory (QCI) to obtain course perception data that could be plotted along side a modified version of the ASI. It was found (Meyer and Muller, ibid) that deep perception items tightly clustered around Deep Approaches, and surface perception items clustered

less tightly around Surface Approaches. Measuring perceptions of the context were not central to the author's research, but the findings of Ramsden and Meyer reported here may help explain any findings in respect of Approaches to Study displayed by engineering undergraduates at Nottingham.

Meyer's combination of context perception and Approach was termed 'study orchestration' (ibid). Thus, orchestrations associated with Deep Approaches and deep perception are called 'Meaning Orchestrations', with 'Surface Orchestrations' indicating the surface perception and Surface Approach combination. Other students were identified (Meyer, Parsons and Dunne, 1990) who had less distinguishable orchestrations and tended to experience academic failure. It was concluded (Meyer 1991), that 'at-risk' orchestrations could be consistently identified and associated with academic failure or low achievement. These at-risk orchestrations were described in a negative standard, so that orchestrations indicative of low achievement would be any individual profile *without* an identifiable meaning orchestration.

Other individual at risk orchestrations were identified (Meyer, Cliff and Dunne, 1994) by their lack of a coherent pattern. These 'disintegrated' orchestrations were produced by students who tended to fail their examinations. This work has been verified in separate studies; Entwistle, Meyer and Tait (1991) found that at-risk or failing students had conceptually incoherent inventory responses, and Biggs (1985) found that students who attributed failure to external factors rather than personal factors tended to have inventory profiles which produced no clear factor structure. The main general conclusions from Meyer's (op cit) work is that disintegrated orchestrations are sometimes a product of (besides disastrous teaching and assessment) erroneous perceptions of the context on the part of the student, and that some at-risk students are unable to comprehend Deep Approaches to Study because there 'is no referential basis on which to build' (Meyer 1991) as if these students have never experienced deep-level learning (cf. Tang 1994). These factors may play an important part in the design of interventions into students' relationships with the learning context.

Studies have shown (Trigwell and Prosser 1991, Eley 1992, Lublin and Prosser 1994) that a link can be demonstrated between a perceived heavy workload, inappropriate assessment and the adoption of a Surface Approach to Study, and another link shown between perceived good teaching, clear goals, emphasis on independence and adoption of a Deep Approach to Study. Lublin and Prosser (1994) identified that students rated courses higher in which they adopted a Deep Approach to Study, than in courses where they adopted a Surface Approach to

Study. Eley (1992) and Tang (1994) have studied the differential adoption of Approaches to Study relative to course perception. Both have found it necessary to qualify the assumption that individual students adopt Approaches to Study differentially in respect of discriminative perceptions of the course. Differential Approaches to Study are found, but as Eley (ibid) points out:

> *... the relationship between course perceptions and adopted study approaches seems not so strong as to ensure that changes in the former lead consistently to sympathetic changes in the latter...*
>
> *... the ways in which students study the content of their course depend in part on how the demands and requirements of those units are perceived... a minority* (20 - 25%) *of converse patterns suggest that stronger influences can sometimes prevail.*

These 'stronger influences' are attributed to either erroneous perception on the part of the student or predispositions toward particular patterns of study (cf. Tang 1994, Eley 1992, Meyer et al 1994). With respect to the research reported here, it was also found (Eley 1992) that there was a relationship between teaching that explicitly emphasised cognitive processes associated with effective learning and a Deep Approach to Study. Hence, (Eley ibid):

> *... focusing on the cognitive learning processes of the student, as a deliberate and explicit teaching practice, might quite properly be part of the definition of what it means to teach for deeper study approaches.*

Whatever the impact of the contextual influence on student Approaches to Study it is clear from the literature discussed above, that students do at times respond in differential ways to the academic context. The transituational descriptions of Approaches to Study are inappropriate in this respect, however, there does seem to be an important caveat, that the adoption of a particular Approach to Study may at times be influenced by some factor other than the immediate academic context, such as a predisposition, or a lack of referential knowledge regarding the Deep Approach to Study. In building a realistic model of student learning it is clear that several factors should be attended to as discussed above. Consequently in applying such a model to study interventions, certain mechanisms could be employed to achieve desirable results. Again, Eley (ibid) makes the point:

> *While acknowledging that there are no panaceas, providing student support, defining clear goals and course structures, explicitly discussing how students*

are to learn the presented material, and de-emphasising performance on formal assessments, can all be reasonably expected to result in positive changes in the study and learning of students. And moreover, the unit of influence is the individual student.

This thesis is concerned with one of Eley's (ibid) elements, that of providing student support, and the implied intervention into student learning processes. For an understanding of where interventions might successfully impact, it was necessary to examine current models of learning for points at which the author might intervene. These models and their supporting research are now examined.

2.4 Student Learning Within the 'System' Type Model

Independently from Marton and Saljö (op cit), John Biggs (1976, 1979) in Australia identified similar concepts in describing how students learn within given contexts. Biggs (1993a, 1993b, 1994) reports similarities and differences between his 'classroom level systems model' and the Marton and Saljö phenomenographic type model of student learning reviewed in the previous section. In particular, Biggs (1994) suggests that within his model it is possible to consider learning (and teaching) as being a system of elements which can be examined independently, while within the Marton and Saljö model learning is never seen as an independent process and must always be viewed from the individual perspective. However, Marton and Saljö (op cit) and Biggs (ibid) all emphasise the importance of student perception of task demands and construction of meaning within a contextual framework. In attempting to build a working model of student learning, Biggs (1993a) describes an 'open system' of learning and teaching:

> *It is suggested that student learning is best construed within a teaching / learning context that functions as an 'open system', a model that brings some clarity to the use and interpretation of study process inventories, and that locates their value in yielding functionally useful data...*

Biggs' (1976) original work initiated in the 1960s from an Information Processing standpoint and the belief that academic performance correlated with personality factors. Elements within the 'personality factors' were seen to contribute to study behaviour. Thus, by intervening into student cognitive style, personality and

values, the student's encoding and rehearsal strategies could be altered, which in turn would result in different ways of studying and therefore learning outcome. In the first instance, Biggs (1976) was aiming to develop a Study Process Questionnaire (SPQ) based on these constructs, the outcome of which might then be used to mediate inappropriate study behaviour.

Even though Biggs may have started from a dimensional model of cognitive learning, he has moved distinctly toward a Student Approach to Learning (SAL) framework, as Biggs (1993b) says:

> *My own theoretical framework has shifted from a minimalist constructivism based on information processing theory to one based on the research genre known as 'student learning', which itself has a mixed parenthood, reflected in the vigour, diversity, and sometimes sibling rivalry of its offspring.*

Biggs (ibid) refers to cognitive descriptions of student learning at the individual level, but proposes that the individual can be seen as a sub-system within a broader system of teaching and learning. In this way he establishes a 'normal causal path linking individual and institutional presage factors, with students' learning processes, which lead to particular kinds of outcomes'. At the individual level Biggs (1993a) describes affective and cognitive combinations that contribute to an Approach to Study:

> *... the answer to the question 'Why am I here?' question defines a student's predominant motives, and to 'What am I going to do about it?' that student's general strategy for handling tertiary study.*

These descriptions help define Biggs' (1993b) constructivist notion of Approach to Study. Approach in this sense is seen as a function of both motive and strategy within what Biggs (1978) calls a 'motive-strategy congruence'. This motive-strategy congruence theory (MSC theory) is according to Biggs (1993a) 'in line' with the SAL tradition as exemplified by the originally termed 'utilising' and 'internalising' (later renamed Surface and Deep respectively) scales of the SPQ. Biggs (ibid) rationalises his position within the SAL tradition by pointing out that each strategy is couched in a motivational or intentional component, and that the motive-strategy combination can only be interpreted within an academic context.

Bearing in mind the discussions earlier regarding confusion in terminology Biggs (1993a) discusses the nature of *strategy*, which he then describes as a 'complex fusion of intention and purpose', and as being distinct from the usage of the term

strategy within cognitive psychology. This means that in terms of describing, for example, the Deep Approach to Study, Biggs (ibid) says that the overall strategy is to maximise understanding through the use of various, (more) specific strategies such as generalising themes and principles. Biggs (1979) identifies three MSC categories or approaches:

> *1) Utilising: Affectively there are two interrelated motives: pragmatic reasons for being at university...with a more immediate negative motive of avoiding failure... study strategies are centred around avoiding failure, but doing as little work as possible. Hence the student becomes syllabus bound: he only studies what he has to, and then with a view to fairly accurate reproduction, rather than to transformation and internalisation...*

This means that the student has an instrumental intention 'extrinsic to the real purpose of the task' (Biggs 1993a), and a strategy associated with this motive might therefore be the rote learning of selected content without understanding it.

> *2) Internalising: The affective component is intrinsic: the student has chosen to go to university as his way of self-actualising, and he is interested in the subject matter of study for its own sake... he is syllabus free. He attempts to interrelate material that he reads, placing it in an overall conceptual framework that is meaningful to him... it is likely to be successful... if there is reasonable overlap between the student's self-set learning and those prescribed by the lecturer.*

The intention is to 'engage with the task properly on its own terms' (Biggs 1993) based on intrinsic interest in the task.

> *3) Achieving: The motivational component revolves around winning, in a competitive context, and in general achieving the hallmarks of excellence. Cognitive strategies are therefore directed toward obtaining high grades for their own sake and include high organisation, scheduling..., and in general a cool systematic approach to study.*

The institutionally most adaptive Approach would therefore be a combination of meaning and achieving where the student would seek to control the process to optimise the product (Biggs 1993a).

Biggs (1987a) renamed the utilising and internalising approaches, Surface and Deep Approaches respectively so as to correspond with the categories identified by

Marton and Saljö (1976). The achieving approach (number 3 above) has also been identified independently by Ramsden (1979) and termed the 'Strategic Approach'; indeed recent Approach to Study inventories (Entwistle and Tait 1992) have Strategic Approach as one of their main scales, of which the achieving motivational element 'intention to excel' is a sub-scale, described as 'dispositional' (Richardson 1995).

Within MSC theory Approach is seen as a function of both motive and strategy, the motive directly influencing the learning strategy then adopted by the student. Biggs (1993a) is keen to emphasise that he sees 'motive' as similar to the Taylor, Morgan and Gibbs (1981) descriptions of orientation... the holistic form of motivation for undertaking a course of study. Likewise, the inference that MSC combinations are learning styles is utterly rejected 'on the grounds that learning styles refer to structure, not to process' (Biggs 1993a). Approach to Study within the Biggs type model infers the adoption of a learning process, and any inventory developed from the model is therefore measuring such a process. This quantitative measurement of a qualitative process could be argued to be the major point of departure between the phenomenographic model described earlier and the research undertaken by Biggs and others working with similar models (cf. Entwistle and Ramsden 1983, Entwistle and Tait 1990, Meyer, Parsons and Dunne 1990).

A basis for these differences in research is the nature of Approaches to Study as either processes or predispositions. For example, researchers such as Entwistle (op cit), Biggs (op cit), Tang (op cit) and Eley (1992) view Approaches to Study as the operation of somewhat consistent predispositions which mediate with perceptions of the course of study demands. As already discussed, Entwistle (1988) and Tait (1995) have described these general tendencies as 'study orientations' thus perpetuating the confusion between orientation in the Taylor et al (op cit) sense and their own. Even so, it would be unreasonable to firmly state, as Murray-Harvey (1994) does in discussing the systems model, that 'approaches, like styles and preferences, are stable characteristics of the learner'. This would seem to contradict the extensive evidence available (cf. Svensson 1977, Laurillard 1979, Eley 1992, Ramsden 1992, Tang 1994) about the context dependence of Approach.

The original usage of Deep and Surface Approaches by Marton and Saljö (1976, 1984) was in describing an immediate learning process, as Biggs (1993a) suggests, 'the processes adopted prior to, and which directly determine the outcome of learning'. While this is of course accurate, studies (Biggs 1987a, Entwistle and Ramsden 1983) have shown that students adopt a certain consistency of Approach at a broad level of analysis. These propensities to adopt a particular Approach for

several tasks also indicate the global meaning of study orientations (Tait 1992) and the objective of study process inventories, such as the Approach to Study Inventory (Entwistle and Ramsden 1983), that is, to profile such propensities.

Meyer (1995) and Richardson (1995) continue the debate over Approaches as predispositions or processes. Meyer (ibid) sees process as part of study orientation in a very similar way to that described by Entwistle (1995) and Tait (1995). Thus, the actual doing part comes from the descriptions of process (Marton 1988) and in this sense, Approaches are 'ephemeral and driven by the perceived demands of each learning situation' (Richardson ibid). However, both Meyer (op cit) and Richardson (op cit) recognise and adopt descriptions of Approach to Study as being both a process and a predisposition[3].

Ramsden (1992) also suggests that variability in Approaches coexist with consistency. It could be argued that the paradoxical situation the process versus predisposition debate offers, is partly a result of the different research perspectives discussed earlier; phenomenography based models are essentially concerned with the immediacy of individual perceptions of tasks, while system based inventories look for and measure a tendency to have used a balance of Approaches as viewed retrospectively by the student. Indeed, the descriptions Biggs (1979, 1987a, 1993a) offers for Approaches to Study are based on factor analysis of attitudinal questionnaires, rather than the type of personalised constructs identified by Marton and Saljö (1976). Biggs (1993a) summarises:

> *Through usage then, the term 'approaches to learning* (or studying)' *has come to have two quite different meanings:*
>
> *(i) the process adopted prior to which will directly determine the outcome of learning. This is the sense originally used by Marton and Saljö (1976) in their description of surface and deep approaches in phenomenographic case studies of tertiary students...*
>
> *(ii) predispositions to adopt particular processes, more recently referred to as 'orientations' to learning by Entwistle (1988), as when students are asked by questionnaire how they usually go about learning... Some questionnaires have however been worded for specific occasions or contexts... in which case the process domain (i) above, is likely to be addressed.*

[3] It is argued later in this thesis that 'predisposition' has a largely cognitive association and an alternative term 'pre-process' might be more appropriate.

The Presage, Process, Product (3P) Model

Biggs (ibid) himself sets out to resolve the paradox by including both process and predisposition in a systems model of learning. Biggs (1994) criticises the phenomenographic model for being difficult to generalise beyond the individual student to across teaching and learning situations because of the adherence to the individual nature of student perception. Biggs (1993a 1993b) claims that his systems model is a convenient way of conceptualising the relationship between the student and the interrelated factors already discussed such as context, process and outcome. Perception of the learning system as introduced by Marton and Saljö (1984) and the demonstrated link between perception and Approach to Study (Entwistle and Tait 1990, Trigwell and Prosser 1991, 1991a, Eley 1992) are also included in the model by assuming interaction and feedback between the student and of the teaching context described in figure 2.10 below (Biggs 1993a, 1993b):

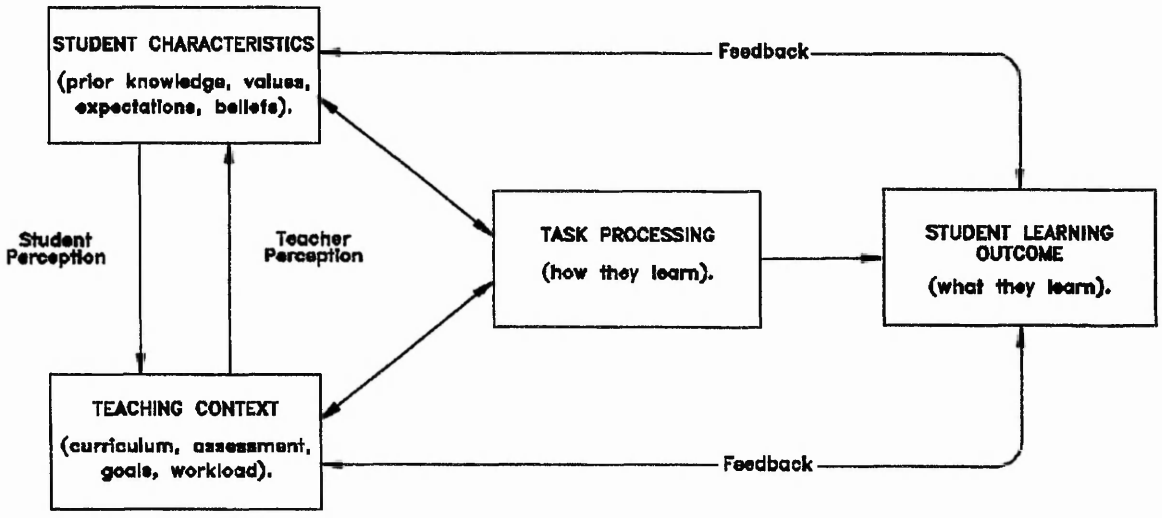


Figure 2.10 The 3P Model of Classroom Learning (Biggs 1993)

The model is summarised by Biggs (ibid) thus:

> *The main thrust of the model is forward, from presage via student learning processes to product... both student and teaching presage factors have been found to relate to ways in which the learning task is processed... Likewise, surface processes lead to poorly structured and low level outcomes, including low grades, and deep and achieving to high level outcomes.*

The systems model is one where an attempt has been made to include many of the factors described so far within a descriptive framework by ordering the components of the system in a coherent way. The systematic nature of the model indicates how

factors such as the context and student learning processes interact as students modify their intentions in view of the perceived task and task demands. An attempt is made in the model above to include those factors which influence the student's Approach to Study prior to the engagement of Approach with the task in hand, and these are described as 'presage' factors.

Student presage factors are described (Biggs 1993a) as relatively stable learning related characteristics, including Approaches to Study as predispositional factors which may in turn include motivational aspects such as the student's general orientation (in the Taylor sense, op cit). Teaching presage factors are the elements of the context described earlier in this chapter, with which student presage factors interact. The outcomes of this interaction are included under the 'process' part of the model, though as was seen earlier, there are a range of potential outcomes depending upon, on the one hand, context factors as influencing levels of process, and on the other hand (in some students at least, cf. Eley, op cit), context factors having a less defined impact as stronger student predispositions swamp the context effect. Either way, the model still represents the relationship between the student and the context as reported in the literature.

Process factors are such that they describe how the student may tackle a task in terms of adopting an Approach to Study. However, process within the 3P model is meant to describe both metacognitive strategies of handling the task in context, as well as the tactics applied. Thus, some students may for example, be in a situation whereby they have recognised the contextual demands of the system and align their tactical stance with their personal characteristics in order to maximise success (cf. Romainville 1994). Some students, particularly those with unsophisticated conceptions of learning, may not be able to align their learning in this way (Romainville, ibid). Biggs (1985) has described such an ability as 'metalearning', and the concept is meant to describe more than 'a second-order cognitive focus on learning processes that reflect motive and strategy' (Meyer 1991). Some students are it seems, capable of consciously controlling their learning processes and their relationship with the context. This would seem to be synonymous with the concept of thematization (Saljö 1979). Meyer (1991) has described a similar concept within his constructs as 'metaorchestration'. One very important consequence of these descriptions for the author of this thesis, is that without the awareness, vocabulary and conceptual framework associated with their learning, students are unlikely to be able of reflecting on, and consciously developing their learning process. The implied need to develop this awareness can be argued as further raison-dêtre for learning to learn intervention. As Romainville (op cit) says:

Learning is such an individual and complicated activity that learners themselves should be able to wonder about its components and reflect on it, to become adaptable to new learning contexts. To describe, to judge and to justify their cognitive strategies is probably the first step in this process.

The comment above helps describe the supposed relationship of Biggs' (1993b) 3P model to the individual learner. In this respect the learner is seen as a dynamic factor within a system which itself is dynamic (cf. Wenestam 1993). This, it could be argued, helps reconcile the 3P model within the phenomenographic traditions of the SAL framework as described earlier.

Whatever processes are used, there will be an outcome as signified by the 'product' factors modelled above. Biggs (1993b) describes three outcomes: quantitative in the form of marks and grades; qualitative in the form and level of understanding (cf. Entwistle and Entwistle, op cit, Biggs and Collis, op cit); and affective, referring to the student's feeling about the experience of learning.

The systemic nature of Biggs' model suggests that inventories that profile students for their Approaches are likely to be indicating relatively stable approaches *within the system itself.* Biggs (1993a) describes the system in equilibrium model and the relationship with inventories, and in doing so uses the concept of 'steady state':

The notion of a steady state is also helpful for understanding how learning / study process inventories may be used to index the quality of the learning that goes on in the classroom.... A predisposition to this or that approach is the individual student's way of achieving balance in the system as perceived by the student...

Such a model has a tendency to describe learning in a linear, 'Newtonian' manner with discrete elements and the assumption that change to a variable will have systemic effects in a similar way to the 'functional relationship' described by Marton and Entwistle (1984). Learning is probably more subjective than this as Marton and Ramsden (1988) suggest while coincidentally referring to Newton:

...learning the definitions of Newton's laws does not imply a Newtonian view of seeing bodies in motion.

Nevertheless, such a model is useful in order that the teaching and learning situation might be explored with the aid of a map. As Biggs (1993b) says whilst reflecting on a comment by Schon (1987):

...one's framework needs to be able map the state of the swamp, and not just the anatomy of its alligators...

The system model of student learning has also provided the author with a model that can be discussed with academics and students. With respect to working within an engineering context, the model and its constructs has a series of similarities with engineering terminology and concepts. For example, 'steady-state', 'feedback' and 'equilibrium' are terms associated with the engineering discipline of system dynamics, and the model itself appears to behave in a way that can be rationalised within the concept of a 'closed-loop system' under the principles of system dynamics. These analogies are very convenient when communicating learning theories to engineering practitioners. The similarities are discussed later in the thesis where the implications for modelling student learning are further explored.

The 3P model is only a descriptive framework, and a relatively simple one at that. It could be argued that a new model is needed, one that attempts to account more explicitly for some of the subjectivity and multivariability present within such a system. The author's attempt to describe such a model is presented below. Other authors such as Tang (1994) report some interesting work using path analysis to analyse the relationship between the 3Ps of the 3P model in students with differing presage factors under either qualitative or quantitative task demands. Such analysis may mark a departure in the research literature toward more complex descriptions of relationships within the 'functional model' (op cit), in a similar way to that facilitated by the type of multidimensional analysis used by Meyer (1989)(see also Richardson 1995b).

2.5 The Modelling and Measurement of Approach to Study Within the Author's Research

The theoretical dimension of this thesis was developed over a period of time; before, during and after the learning to learn workshops had taken place. This was a function of the contractual and time constraints under which the author worked. However, this does not mean the author should refrain from examining his interventions from within a theoretical framework and model. In this respect the literature reviewed above informs the theoretical framework upon which a model of learning can now be built. In doing so such a model can be examined for theoretical accuracy, and the impact of the author's interventions can be judged against the concept(s) of Approach to Study inherent within such a model.

The theoretical frameworks so far discussed are of course open to a certain amount of interpretation, indeed the nature of Approaches to Study for example is described differently by Entwistle (1991) and Marton and Saljö (1984). Marton and Saljö (ibid) use the term Approach to describe a specific study intention and process being used at a given moment in time, while Entwistle (ibid) has tended to use term generically to describe a consistency in intention and process. Ramsden (1992) has no problem reconciling the two positions and accepting that Approach to Study can and should mean both consistent and ephemeral relationships between the student and the context of learning.

The first description offered in this literature review of a recognisable framework showing the relationship between Approach, the student and the outcome was that offered by Marton and Entwistle (1984). It was suggested that there is a functional relationship between orientation, Approach (including perception of the task, intention and process), and outcome (Marton and Entwistle ibid). It is felt by the author that this model as presented is lacking in that it does not reflect the complexity of relationship between its constituent elements. Likewise the notion of 'function' suggests a direct and immutable order in which the student's qualitative relationship with all learning environments is developed.

Other models of student learning have already been discussed in this review. In particular the model by Biggs (1993a) has a certain amount of elegance, but is so mainly because of its structural simplicity (Meyer 1991). Biggs' (ibid) model tends to subsume into its structure all the functional factors referred to by Entwistle and Marton (op cit) without recognising that there may be a series of disruptives or inputs to the system beyond those described in general terms such as 'student characteristics', or 'motive', or 'strategy' (Biggs 1993a). However, there is a problem with attempting to include such variables within a model of student learning as exemplified by Entwistle's work in developing the Approach to Study Inventory (ASI)(Entwistle and Ramsden 1983, see also Trigwell and Prosser 1991a). By doing so and then calling the resulting second order groupings of variables 'study orientations', Entwistle and the Edinburgh researchers have left themselves open to criticisms (cf. Richardson 1993) concerning the broad level analysis the ASI typifies. This is despite the fact that the ASI was specifically designed to access such a range of variables (Tait 1992). The author's thoughts on this are discussed in chapter four.

The argument is somewhat circular in nature. Concentrating only on the original approach processes (Richardson 1993), would tend to ignore other contextual and personal variables, while having the effect of keeping analysis straightforward;

concentrating on study orientation (Entwistle and Ramsden 1983) complicates the analysis, but admits, rather than subsumes the complex determinants of individual qualitative differences (Meyer 1991). As Tait (1992) points out:

> *That the inventory is comprised of an 'uneasy mixture' of scales appears to be something of a vacuous criticism. The scales unquestionably stem from many different origins, and do so because they are intended to map out the range of behaviours and attitudes which together enable student learning to be better described.*

Nevertheless the ASI and its supporting model of student learning have received a number of criticisms (Richardson 1990, 1993, 1995b, Meyer and Parsons 1989, Harper and Kember 1989). These have been mainly concerned with the scale structure of the ASI and the existence or not of an acceptable factor already described as the Strategic Approach to Study, or the Achieving Orientation (Entwistle and Ramsden 1983). What is of interest here is whether such constructs are empirically acceptable so as to be included in this research. For now it is worth assuming that there is a Strategic or Achieving Approach as identified by Ramsden (1981) and Biggs (1987), and that the conceptual support for such an Approach is bound up in the way in which some students efficiently adapt to their learning context using discriminatory and mercenary strategies. This is now discussed.

The Strategic Approach to Study can be identified using the Revised Approach to Study Inventory (RASI) already referred to. Within this inventory there are four sub-scales which are considered by Entwistle and Tait (1993) as reflecting the Strategic Approach to Study. These sub-scales are: Intention to Excel, Alertness to Assessment Demands, Study Organisation and Time Management. These constructs have their basis in earlier work, mainly by Miller and Partlett (1974), Entwistle, Thompson and Wilson (1974), Ramsden (1979) and Biggs (1976, 1979). Biggs (1979) had identified the 'Achieving' dimension discussed previously, the construct of which included a motive to 'do better than others', which in turn necessitated the employment of good organisation and time management skills. Entwistle et al (1974) differentiated various study motivations, including achievement motivation which was combined with other constructs to form the Achieving Orientation scale for his Approach to Study Inventory (ASI)(op cit).

The Achieving Orientation scale included achieving motivation and the 'strategic Approach to assessment' construct identified by Ramsden (1979). Ramsden (ibid) had identified students who were not primarily intent on either understanding

material or memorising it. Instead, these students were intent on dealing with course material in such a way as to maximise their academic grades. This type of context based adaptation clearly showed how some students were profoundly affected by their perception of task requirements as suggested by Laurillard (1979). What is most interesting to the author at this time is the nature of the hereafter termed Strategic Approach to Study, especially in light of previous comments about the discipline subjectivity of Approaches in general. Ramsden (1983) identified that engineering students presented Strategic Approaches to Study that were not characterised by some of the sub-scale variables initially included in the ASI (op cit). For example, 'cue seeking' and 'cue consciousness' were Strategic variables identified by Miller and Partlett (op cit), included in the ASI, but not found to be useful in characterising engineering students (Entwistle and Ramsden 1983), because of the way these students saw the subject and its teaching as highly objective and free from the subjectivity needed as a precursor to cue seeking and cue conscious behaviour.

Later, Tait (1992) pointed out that the sub-scales of the newly designed RASI (op cit), needed to be interpreted against the context in which the research was taking place. It would be typical according to Tait (ibid) to find the Strategic scale overlapping other scales within the RASI, and 'good engineering students' had characteristics made up of mixed factors (cf. Harper and Kember 1989). This phenomenon is reported by Meyer, Cliff and Dunne (1994) who find that while the Deep Approach can be quite clearly defined within a statistical model...

> ... *other qualitatively contrasting forms of learning behaviour have also been manifested, but they have not generally conformed to model-dependent stereotypes or their admissible variants; there has generally been little empirical support for a 'pure' form of 'strategic' or 'surface' approach as typically manifested in the multivariate correlational data structures that have been widely reported in the student learning research literature.*

In this respect, Meyer et al (ibid) take the model of student learning a little further than that postulated by Tait (ibid) by using all the variables of the ASI plus some locally developed variables to construct 'study orchestrations' rather than the so referred 'stereotypes' of pure forms of Deep, Surface and Strategic Approaches. Thus *individual* responses to the ASI are examined so that each student response can be evaluated against the concept of at risk of failing. In this way each individual response is categorised into at risk of failing or not. It is claimed (Meyer et al ibid) that the method of identifying a student being at risk of failing is far more context specific and sensitive than other methods of analysis.

It would seem that, the constructs, distribution and success of Deep, Surface and especially the Strategic Approach only made sense when compared against the context in which they were being adopted. This again ties in with the statements made by Carter (1984, 1985), Sparkes (1989) and Ramsden (1992) about the procedural nature of engineering subjects and the perceived formality of engineering which would tend to render subjective opinion counterproductive. It seems that in engineering, the Strategic Approach was characterised more by students' fastidious attention to detail and criteria, than in capitalising on the clues and cues from lecturers (Ramsden 1983).

It is generally observed that some engineering students at Nottingham refer to past examination papers, and stick rigidly to detail as reported by Ramsden (ibid). These offer valid reason for why the Strategic Approach to Study has been included in the research tool used by the author (the RASI) despite concerns of other researchers such as Richardson (1993, 1995b), and it can be argued that it is expected to combine with other scales during the factor analysis of RASI data, in a similar way to that reported by the authors above. Following the evidence presented by Ramsden (1983, 1992) and Tait (1992) it might be expected that the analysis of RASI data will reveal engineering students who also tend to consider the Strategic Approach to Study as being a useful component in successfully adapting to the demands of the system they find themselves in at Nottingham.

The lack of a coherent and uniquely identifiable Strategic Approach in some research studies (cf. Richardson 1990, 1993, 1995b) may therefore be a function of one or more factors such as: (i) individual or contextual variation in the sample or environment, (ii) method of analysis, (iii) locally made changes to the original version of the ASI, and (iv) lack of conceptual coherence between the constituent variables of the Strategic Approach, it being made up of several unrelated components. There is understandable 'controversy as to whether variously frequently occurring forms of strategic orientations are empirically robust enough to be included in the conceptual model' (Meyer 1991).

It should be remembered though that most of the criticisms of the Strategic Approach have been associated with the inability for the construct to be replicated using (in particular) the widely published 64 item Approach to Study Inventory. The research reported here is using the 60 item Revised ASI which is not yet formally published. The RASI and the ASI are significantly different to each other such that 'research findings that may be obtained with them in the future are likely to be incommensurable with those contained in the established literature' (Richardson 1995b). On reflection, it can be argued that the Strategic Approach

or at least some of its variables, will be recognised by engineering undergraduates, and will help detail some of the processes used by undergraduates in their attempts to pass their course of study.

Developing an Alternative Systems Model

Taking the inconsistencies in argument and findings described in this review, there are at least some concepts that seem robust enough to be included within a model of student Approaches to Study. In particular, perception of the learning environment seems to be fairly well established as a variable affecting Approach to Study at both a group (Entwistle and Ramsden 1983, Ramsden 1988, Ramsden 1989, Lublin and Prosser 1994) and individual level (Marton and Saljö 1976, 1984, Meyer and Parsons 1989, Meyer 1991, Entwistle Meyer and Tait 1991), even though the perception mediated effect may not always be as expected (Eley 1992, Tang 1994). This in turn, points to the effect of student presage factors such as orientation to study and conception of learning having an effect on how students 'see' their role in learning (Gibbs, Morgan and Taylor 1984, Laurillard 1979, Saljö 1979, Marton and Saljö 1984, Entwistle and Entwistle 1991, Marton et al 1993), and the tendency for some students to be heavily influenced by a kind of 'pre-task Approach to Study' described as a predisposition (Biggs 1993a). This may be a function of previous experience in the same way as described by Gibbs (1992) when discussing the effect of 'closed' and 'open' teaching on students' conceptions of learning (cf. Entwistle and Tait 1990, Tait 1992).

The very powerful factors described above filter through the system of teaching and learning to eventually affect student learning outcomes which can be viewed as quantitative, qualitative or affective (Biggs 1993a). Subsequently the process and quality of learning the student has engaged can be identified retrospectively from (in particular) qualitative outcomes as demonstrated by Biggs and Collis (1982) using the SOLO Taxonomy. The perception of outcomes by both staff and students will then affect presage factors, either as set values already present within the system, or as values being introduced into the system such as a new form of assessment. Continuing that already established systemic model allows the author to now present an extension to Biggs (1993a, 1993b) 'parsimonious' (Meyer 1991) model already shown in figure 2.10, which attempts to consider the variables described above in a model with less functional certainty that described by Marton and Saljö (1984) and Biggs (1993a)(see also Lublin and prosser 1994). The author's extended model is presented in figure 2.11. The relationship between the elements within this model and the author's interventions are further discussed in this chapter. For now, let us consider the similarities and differences

between this and Biggs (1993a) model, and the statement by Entwistle and Marton (1984) about a 'functional relationship'.

Figure 2.11 is meant to represent a heuristic model, that includes the elements of learning identified from the literature review, which would seem to affect what students do within a learning environment such as the author's department. It is intended to include the system elements listed above, but without the apparent certainty and functional rigidity of the Entwistle and Marton (1984) description already discussed. It also attempts to tease out the related elements currently subsumed under descriptions like 'student characteristics' within the Biggs (1993a) 3P model shown in figure 2.10 previously. However, inasmuch as an engineering analogy has already been suggested in the notion of system dynamics and closed-loop systems, the author has attempted to describe the model using appropriate convention and nomenclature. This is further discussed in an annotated version of this model (figure 2.12), and in following chapters where the implications for developing such a closed-loop system and model mathematically are considered.

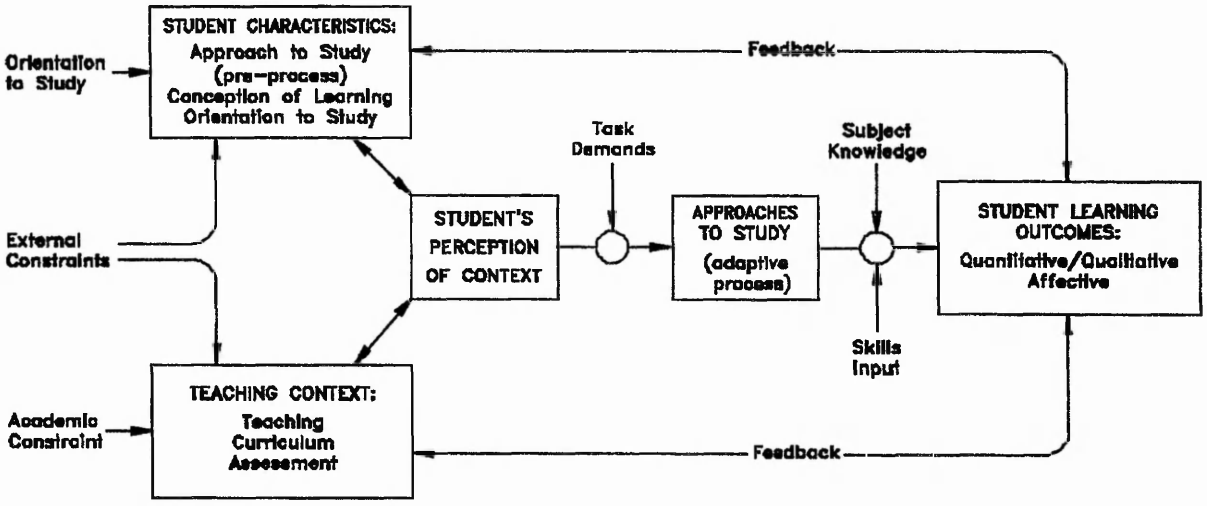


Figure 2.11 The Author's Proposed Model of Student Learning

Within the literature already discussed there is evidence supporting the inclusion of the elements described in the author's model. Orientation to study is present as an initial input into the system, alluding to the overall, pervading motivation and interest for engaging in a course of study as suggested by Gibbs, Morgan and Taylor (1984). Clearly orientation to study is portrayed here as an input into the presage section of the model. This is meant to represent the orientation the student has *before* entering the higher education system; in other words the personal context for study (Gibbs et al ibid). As this can change and develop over

time, it must at some point be admitted into the system where it can then be exposed, as a student characteristic, to any agents of change. Orientation in this sense is an important element in terms of the overall motivation for being in higher education, as well as more specific functional terms of intrinsic and extrinsic interest. These concepts of intrinsic and extrinsic interest or relevance have 'emerged as the most consistent indicators of Surface and Deep Approaches to everyday studying' (Entwistle and Marton 1984). Orientation to study remains as a student rather than context characteristic. Likewise, the conception of learning held by the student and Approach to Study as a 'pre-process' can also be described as student characteristics.

Conception of learning is already well established as a student characteristic within the model described in figure 2.11. Approach to Study on the other hand, has been various described as either a predisposition (Biggs 1993a), a process (Marton and Saljö 1976), or both (Ramsden 1992). The author has chosen to avoid the stylistic and cognitive connotations of Approach as a predisposition (cf. Schmeck 1988) by adopting the term 'pre-process'. This is meant to imply that some students may show a preference and predominance for a particular (or combination of) Approach(es) to Study. This preference may or may not be evoked once the student reaches the point where an Approach to Study is actually applied to the task in hand. For this reason, Approach to Study as applied to a task is described by the author as an 'adaptive process'; the student has adapted to a series of system elements in developing what he or she considers to be an appropriate response to the immediate task and context of study. This may or may not be a metacognitive based response referred to as metalearning by Biggs (1985) or metaorchestration by Meyer (1991), in describing students' awareness of their study processes (cf. Romainville 1994). Norton and Crowley (1995) point out that students who are metacognitive and who thereby are aware of why and how they are adapting to a given context are more likely to be successful:

> *Metacognition involves two separate but inter-related processes, one of which is concerned with the students' own knowledge about their cognitive processes as well an awareness of how compatible these processes are with a given learning situation. The other process involves the students being able to monitor their studying activities and to make appropriate adjustments if they are not proving successful.*

This line of argument becomes increasingly important when one considers the impact of learning interventions on the study processes used by students and will be referred to again in the next section.

The response described above is mediated by the student's perception of the context which can be described in a number of qualitative ways already described in this review (cf. Ramsden 1991, Gibbs 1992). Perceived elements of the context may include the assessment structure, openness or otherwise of teaching, clear aims and objectives and so on. However, in an attempt to include the complexity of factors which affect these so called teaching context elements, the author has described two further 'pre-presage' inputs to the system: external constraint and academic constraint.

Taking external constraint first; this is shown in the model as affecting both student characteristics and the teaching context. This is meant to imply some commonality in constraints affecting both students and staff. For example, this may be some resource based constraint such as a variation in funding which may in turn directly or indirectly affect the characteristics of students and staff as they attempt to compensate for the change. Alternatively, external constraint could be argued to be the established nature of the subject knowledge itself. For example, Ramsden (1984) described how engineering in particular involves attention to detail and procedural knowledge, which could in some instances be described as a Surface Approach inducing context. This was further explored by Griffiths (1992) who provided a problem solving/project based context for engineering students and found a corresponding change from Surface to Deep Approaches. However, it could be argued that the inventory used to evaluate such Approaches tends not to acknowledge the relationship described by Ramsden (op cit), between procedural knowledge and a Deep Approach in engineering. This issue, its confirmation or otherwise, and the development of a context specific inventory could be one of future research and is described as such later in this thesis.

Academic constraints are those issues to which staff are likely to respond and compensate for. These may manifest themselves in terms of the effort and enthusiasm a tutor may show in respect of context variables. For example, in engineering a number of constraints are applied by external accreditating bodies such as the Institution for Mechanical Engineers (IMechE). The IMechE's insistence on summative end of year and course examinations obviously has an impact on the teaching context, beyond that within the control of staff alone.

At a more local level, another constraint which will indirectly affect the student perception of the context is that of time. Engineering degree courses attract a certain amount of popular notoriety for being very full if not overloaded with subject knowledge and corresponding assessment procedures. Students may respond in a variety of ways to such time pressures as described by Entwistle and

Ramsden (1983) and Vos (1991) amongst others. To some extent, the capability or not to deal with time pressures can be associated with the 'skills input' described in figure 2.11. Alternatively, perhaps skills are acquired by the student in past experience. It could therefore be argued that time management skills may affect both the student's perception of the context as well as being potentially modifiable in facilitating 'better' student learning outcomes. However, the link between time management and *academic* outcome is very much open to conjecture as described by Trueman and Hartley (1994, 1994a).

It can be argued that the 'pre-presage' factors described above of orientation to study, external constraint and academic constraint inform in the first instance the teaching context and the student's characteristics. Moving from the left to the right of the model in figure 2.11 and concentrating on the student experience within such a model, it can be seen that the student will develop a perception of the academic context based on more than just teaching and learning. Such external; and in some instances, extraneous influences are also described within systems that are concentric to the student's own system (Biggs 1993a, 1993b):

> *the student system, comprising an equilibrium between cognitive and affective factors, and perceived phenomenal space;*
> *the classroom system, comprising students, teachers and teaching context;*
> *the institutional system, which itself contains subsystems at department and faculty level, each with its potential for enhancing, or as Reid (1987) considers more likely, impeding enlightened practice;*
> *the community system, which has recently in many countries imposed its own constraints on higher education, which have reverberated down to the classroom level.*

Within the model shown in figure 2.11, the author is subscribing to the idea of student perception being the operative element on the Approach to Study the student will then use. It is the student's perception that will affect his or her intention when dealing with a task (cf. Entwistle and Tait 1990, Lublin and Prosser 1994). However, this Approach to Study is likely to be either further influenced by the student's perception of a particular task demand (cf. Marton and Saljö 1984) or not if perception is swamped by a stronger pre-process Approach to Study (cf. Tang 1994, Eley 1992).

For this reason, task demand is described in the model as an input to the system after student perception, but before the student adapts his or her Approach to the immediate context. The author therefore feels justified in describing this Approach

to Study firstly as a process as in the original (Marton and Saljö 1976) research, and secondly as adaptive, inasmuch as it may change in respect of what has come before (ie. to the left) in the model.

Following Approach to Study two further inputs to the system may be seen: subject knowledge and skills input. Subject knowledge is the specific knowledge and subject epistemology the student engages with. The way in which this knowledge is ordered and presented formally may have specific consequences for student Approaches to Study as suggested earlier (Ramsden 1984, Sparkes 1989). The quality of engagement will clearly be affected by the Approach to Study the student has adopted in response to perception of the context which in turn will affect the student's learning outcomes. However, the engagement may be affected by other elements apart from the interface between subject knowledge and Approach to Study. The student will require some skills such as the ability to take notes, to write reports or to solve problems in order to operate on subject knowledge and to produce recognisable outcomes. Skills input may include a heuristic element where the student has access to context specific problem solving skills and methods of enquiry. Competence in such skills could have a significant impact on outcomes assuming that these are in accord with and directed by an appropriate Approach to Study; as Svensson (1984) says:

> *Instances of reading, listening, writing and problem solving... can be considered to represent skills. Such skills are conditions for and parts of learning, and the quality of learning is dependent upon the quality of the skills deployed.*

As already discussed, Svensson (ibid) broadens and deepens the description of skills to differentiate between atomistic and holistic approaches. This is meant to generalise the way in which learners organise the content of the learning task. Svensson (ibid) also argues that there is a place for the development of atomistic skills, as when the student is organising 'progressively larger parts' of the material. A problem may exist it seems (Svensson ibid), when the student moves away (or is moved away) from dealing with progressive, procedural work, to material with more complex relationships; a student unable to shift from the atomistic to the now required holistic approach will therefore continue to rely on memorizing rather than learning to organise (Svensson ibid):

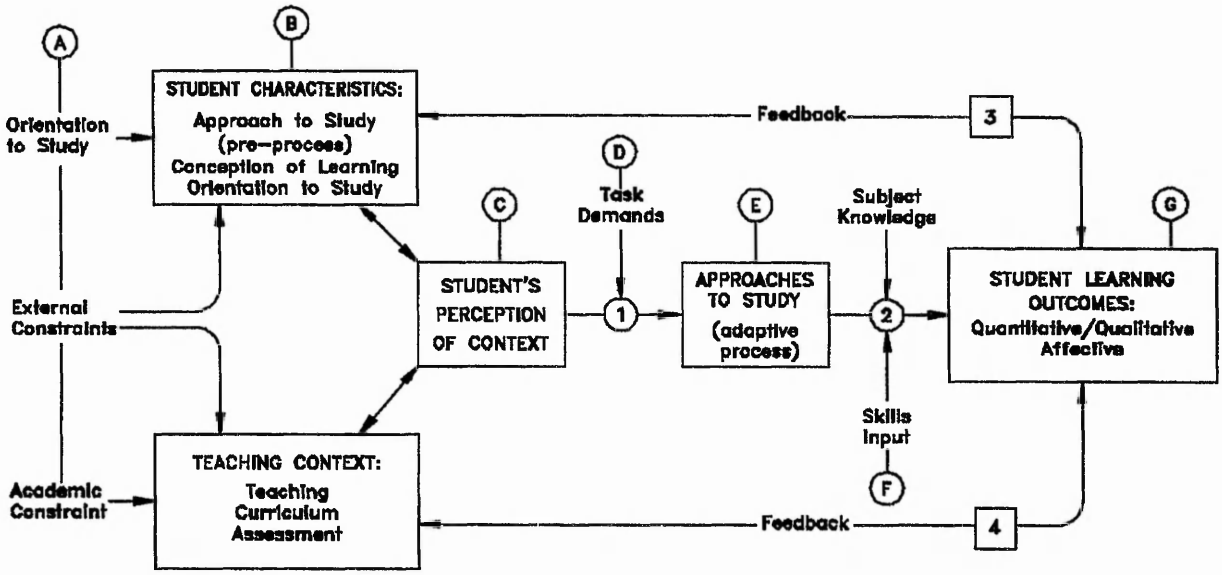
> *The cumulative nature and increased complexity of course content presents considerable problems if the approach adopted is a surface or atomistic one.*

Bearing in mind the comments already made regarding the structure of engineering courses, this phenomenon alone points to a need to examine (particularly first year) engineering courses for the way in which subject knowledge is ordered (cf. Carter 1984, 1985), and further, for learning to learn interventions to have some time set aside for exploring the way in which material is organised by students. It is implicit in this last statement that learning to learn involves developing 'skill in learning' in Svensson's (1984) terms rather than developing study skills alone. However, in that 'becoming a skilled learner' involves a willingness and ability to work from a holistic approach, it is appropriate that at its broadest sense, skills input to the system should be at the same point as subject knowledge; ideally one should support the other. This, and other issues of skills input are discussed to a greater extent in the following section on student learning interventions.

Within the model so far described, we have seen how student perception of the wider learning context and immediate task demands are related to process based Approach to Study, which in turn is related to subject knowledge and heuristics in producing a recognisable learning outcome. For example, Marton (1976) and Marton and Saljö (1984) describe the logical inevitability of a Surface Approach to Study leading to low level qualitative outcomes. However, a Deep Approach does not automatically lead to high level qualitative outcomes; without the necessary skills and knowledge (Svensson 1977, 1984) it is unlikely that a Deep Approach will be 'converted into a Deep outcome' (Entwistle and Marton 1984). Outcomes can be described in the qualitative sense as suggested above and described by Biggs and Collis (1982), while also being quantitative and affective (Biggs 1993a).

To summarise so far, it is useful to draw upon figure 2.12 shown overleaf. This model is the same as the one shown in figure 2.11, except the author has included an alpha-numeric key by which certain points in the model are referred to. The model in figure 2.12 represents the system already discussed, as well as the original inputs to the system prior to the adaption of the system to a prevailing context. In this respect, those elements under point A describe the factors most likely to influence the presage factors described by Biggs (1993a). While it is clear that these will subsumed within the model over time, it is important to recognise these elements as being directly influential on features such as student expectation. It is therefore argued that any intervention into student learning processes must take such 'historical' elements and influences into account. Likewise, there are influencing elements outside the student experience such as accrediting criteria, which in turn, implicitly or explicitly will become influences within the system itself. These are also represented under point A.

Presage factors as already described by Biggs (1993a) are those under point B, and these, on the part of the student, include Approach to Study as a 'pre-process' rather than predisposition (Biggs ibid), Conception of Learning, and Orientation to Study. Combining with these student presage factors, the teaching context will lead the student to perceive the learning environment and its demands in a multiplicity of ways. In this respect, the elements under points C and E are considered to be process factors, in that they have an immediate effect on what the student does in relation to a particular task; in essence, the Approach to Study the student will take or adopt for a particular context. However, at this stage there are seen to be a series of influences, or disruptives to the system, notably the task demand. As this can and does vary, the author feels justified in calling task demands 'disruptives' as changing assessment demands have been shown to affect or disturb student Approaches to Study (cf. Marton and Saljö 1976, Laurillard 1977, Eley 1992, Tang 1994).



KEY:

	A	Pre-system influences
	B	Presage factors
	C	Process factor
	D	Disruptives at point 1 producing a modification to the right of point 1
	E	Process factor
	F	Disruptives at point 2
	G	Product factors
	3&4	Possible feedback access points of actual outcome.

Figure 2.12 Second Version of the Author's Proposed Model

What is interesting about Biggs' model from an engineering perspective is the similarity between it and what is known within system dynamics as a 'closed-loop'

system. It can be argued that the 3P model behaves systematically in a way analogous to a 'closed-loop' rather than an open system (Biggs 1993b). Within the science of system dynamics the term 'open' would be incorrect. A closed-loop system is characterised by feedback mechanisms which provide information regarding the state of the system relative to its original values (in Biggs' terms the original perceptions and conceptions of teaching and learning or presage factors). In engineering nomeculature, these perceptions or original values would be known as 'set-point values'. The automatic regulation and maintenance of the system in equilibrium suggests an element of 'adaptive control', meaning that the system will tend to reach a steady state of equilibrium once any disruptives to the system have taken their immediate effect. Disruptives, could be any external inputs to the system such as skills input or a change in task demands. The feedback received by the student from the system is likely to affect presage factors. Such feedback is known as a 'compensated feedback response'. Continuing the engineering analogy, the set-point values will eventually be altered by such feedback until, after an indefinite number of iterations, the system regains equilibrium. The engineering analogy is not simply anecdotal; there may be implications here for the mathematical modelling and simulation of student learning as discussed later in this thesis.

Using system dynamics terminology allows the author to describe point 1 (the point at which the disruptive of task demands enters the system) as a 'comparator'. Another comparator is seen at point 2, where subject knowledge and the associated skills involved in learning using that knowledge also enter the system. A comparator is the point at which two or more signals are compared and an output signal is produced, so at point 1 the comparison of the student's perception of the context of learning against the input of task demand produces an adaptive study process (E) known as an Approach to Study. Likewise, adaptation is itself modified by other disruptives into the system such as subject skills or knowledge. These are seen to be compared at point 2 so some identifiable and distinguished outcomes can be observed (G). Points 3 and 4 represent the points at which such outcomes can be observed, either through some form of discussion or a mechanism such as the SOLO taxonomy (Biggs and Collis 1982). In engineering terminology, points 3 and 4 would be known known as 'transducers'.

The author's model is an attempt to elaborate on the apparent simplicity of Biggs' (1993a, 1993b) '3P' model. There are identifiable presage, process and product sections; the thrust is still left to right, but the author's model has attempted to include some of the variables affecting the steady-state of the system, and to thereby help identify the point(s) at which interventions into the Approach of

students might be made. It is intended that this will help alleviate the implied functionalism associated with both the model by Biggs (ibid) and the statement made by Entwistle and Marton (1984) and others (Ramsden 1983) about 'the chain of functional relationships from orientation to approach'. However, the models described in figures 2.11 and 2.12, do suggest a broader, coherent pattern in which orientation leads to intention, intention to process and process to outcome. This pattern of events exists within a learning environment which will then continue to interact with and modify the individual elements within the model through the feedback implicit in such a system-model. What now follows is a discussion regarding learning interventions as defined in this thesis and the possible points at which they might impact within the system-model described above.

2.6 Learning Interventions

There is in the literature (cf. Gibbs 1981, Ramsden et al 1986, 1987, Martin and Ramsden 1987, Norton and Crowley 1995) a broad distinction between differing interventions[4] which can be separated into either 'study skills programmes' or 'learning to learn' programmes (Martin and Ramsden ibid). These respectively involve either an attempt to develop discrete learning skills detached from the learning context, or an increased understanding of the learning process and the part it plays in specific subject based learning. The author considers his interventions to be included this latter category.

Attempting to change how students learn, particularly in relation to 'study skills' has an epistemology that is difficult to rationalise within the student learning framework the author subscribes to. There is a history associated with these attempts as Gibbs et al (1980) suggest:

> *Practical attempts to help students develop as learners, particularly in the 'study skills' area, have not always been grounded in any strong conceptual framework for understanding either why students sometimes don't learn, or*

[4] Interventions as defined within this research are taken to be direct attempts to improve the study approaches of students by working with these students in discrete groups within a framework of an explicit, extra-curricular learning to learn programme of study. While the intervention was extra-curricula, considerable effort was made within the resources available, to give the impression of a context based scheme of work that used engineering analogies wherever possible. The 'intervention' and its relationship to this research is further discussed later in this, and the following section.

how they develop as learners. On the other hand, attempts to build conceptual frameworks often seem very distant from students' experience of the problems of studying

This literature review has attempted to 'ground' the author's intervention within an established conceptual framework, albeit, with an emphasis on what may be happening at a specific subject and local context level. Gibbs et al (ibid) point the way to what needs should be considered within 'learning interventions', for example, that interventions take the risk of being 'distant from students' experience' is entirely plausible and probably very easy to succumb to. The author has been careful to consider such warnings in the development of his intervention as will be discussed in the following section. Likewise, the author has considered other authors' attempts at interventions discussed below. In doing so the demarcation between 'study skills' and 'learning to learn programmes' is a sensible starting point. Such contrasts are perpetuated today, for example by Abouserie (1995) who says:

... diversity of methodologies stems in part from a disagreement on the importance of the factors operating in the area concerned. Thus Ramsden (1988) argues strongly that we must focus on the situation within which learning takes place, while others argue that by focusing on the student it is possible to improve functioning regardless of the situation through a development of learning skills, and through and encouragement of cognitive and affective development (Schmeck 1988)... There is however disagreement on the relative importance of each personality variable within the affective domain. Some authorities stress the importance of student motivation, while others stress the importance of students' self concepts...

It can be argued that these distinctions relate directly to counterparts in the research perspectives described earlier; study skills training to experimental or theoretical quantitative (Biggs 1993a), largely cognitive research (cf. Weinstein and Mayer 1986), and learning to learn programmes to qualitative, phenomenographic research and the examination of conceptions of learning held by students. Similar distinctions have been drawn elsewhere by Gibbs (1981), Van Rossum and Schenk (1984), Svensson (1984), Hounsell (1979, 1984), Ramsden, Bestwick and Bowden (1986, 1987), Entwistle and Tait (1992), Norton and Crowley (1995). The general conclusion being drawn by these authors is that there is some evidence for learning to learn programmes (rather than study skills type programmes) having a positive impact on student learning mediated by changes in students' conceptions of learning. However, it is also clear that the extent of any positive effect promoted

by learning to learn interventions may be limited by several contextual and personal influences, such as the perception held by the student of the assessment system she is exposed to.

The reasons for rejecting study skills advice as potentially beneficial are well documented in the literature, for example, Gibbs (1981) refers to 'exposing the scientific basis of training in study skills' which he suggests, is 'like shooting fish in a barrel', while Marton and Ramsden (1988) refer to the deterministic basis of study skills, implying that many study skills programmes are spawned within educational models and paradigms of teaching and learning which are entirely inappropriate given the phenomenographic bias evident in this thesis. Trueman and Hartley (1994, 1994a) report virtually no research into some skills acquisition, such as time-management skills. Although these specific skills are popularly promoted as essential for academic success, Trueman et al (ibid) found no extensive relationships between inherent student time-management skills and academic success. However, Trueman et al (ibid) do point out that further research is needed before concluding that training in time-management skills does not lead to improved academic success. In a separate study Robinson and Blair (1995) report empirical findings related to teaching engineering students writing skills, but there is no attempt to relate the acquisition of these skills to Approaches to Study or to academic outcome, and further the study involved students writing essays of their own choosing under the guidance of English rather than engineering tutors. Jennings and Ferguson (1995) on the other hand, attempt to develop communication skills from an embedded position within a civil engineering curriculum. While reporting positive findings as judged by the students, Jennings et al (ibid) do not suggest that their intervention impacts on Approaches of students, though it is fair to say that they do describe a successful model of integrating interventions into the normal course of teaching.

Biggs and Rihn (1984) report positive changes in Approach (away from Surface and towards Deep) following an intervention programme at Stanford University. This programme focused on both study skills and metacognitive awareness and was supported by counselling on a regular basis. The intervention involved students who could be classed as highly motivated, but lacking in Deep Strategies (Biggs et al ibid). It is suggested by Biggs and Rihn (1984) that the intervention was successful in increasing the Deep Approach to Study as it capitalised on students' high motivation whilst discouraging their Surface Approaches; it is claimed therefore that 'adaptive strategies can be taught and maladaptive ones dropped'. However, in respect to the author's intervention design, Biggs and Rihn's (ibid) caveats are especially noted:

.... the motivational context was right for deep level processing and what they mainly lacked were the appropriate cognitive strategies. Under those conditions, the programme was highly successful. What the outcome might have been with students lacking the motivational context of the deep approach is unknown. It is likely that rather intervention techniques would be necessary, specifically focusing on the affective domain. At the very least then, this study might point the way for the general shape, structure and content of intervention programmes. Two generalisations are worth putting forward:

1) The concepts of deep and surface approach to learning appear to be useful in this context both diagnostically and for defining outcomes.

2) The prescriptions for treating students would depend upon their motivational and strategic profiles.

With these arguments in mind, and following the literature so far discussed it should be clear that the author has a greater interest in context based and sensitive attempts to improving learning than in training students in context-free study skills. Indeed, the evidence available (cf. Gibbs, Morgan and Taylor 1980, Gibbs 1981, 1989, Novak et al 1984, Entwistle et al 1984, Richardson et al 1987, Ramsden 1992, Wankat and Oreovicz 1994, and others above) has suggested to the author that an intervention based on study skills is unlikely to achieve the aims implicit in the research hypotheses. Likewise, the literature cited here has also provided many of the methods of working and heuristics applied and included in the author's interventions. Finally, and should it need to be reminded, the author works in an engineering department, which almost by definition will have students who often have concerns and crises related to their perceived heavy workload and formalised assessment systems. It is unlikely that such a cohort of students are going to be intellectually sustained by out of context study skills such as training in memory, reading or writing essays. It can be argued that the author must therefore base his intervention within context as far as possible. That the intervention should aim to address the orientation students have towards their studies, as well as their intentions when engaged in learning tasks, are also reasons for a context based approach and reflect the willingness of the author to develop interventions that are context specific.

Certainly the author of this thesis was attempting to work from the students' personal frame of reference, but would dispute that this reflects working with 'personality variables' as described by Abouserie (op cit). If Abouserie is suggesting that there is only a choice to be made between working with the situation or the personality, he would seem to be establishing a dichotomy that

makes a simple separation between dimensional cognitive models of human learning and the learning context. As has already been discussed above, there is a model of student learning (Biggs 1993a, Lublin and Prosser 1994) that accepts personal and situational aspects of learning without having to rely on simple dimensional models of learning (cf. Gagné op cit). In this respect, how the student engages with learning is largely a function of his or her perception of what learning is and requires within various contexts. This is well documented within the conceptions of learning (Saljö 1979, Entwistle and Entwistle 1991, Marton et al 1993), and orientation to study (Gibbs, Morgan and Taylor 1984, Morgan 1993) concepts.

Student perception of the academic context is one of the main potential targets for a learning to learn intervention. This is signified by point C in figure 2.12. Likewise, there are a series of points within the model in figure 2.12 that could form the focus of learning to learn interventions in the qualitative tradition (these will be discussed throughout the rest of this section). Attempts to change perception are typified by the work of Meyer (1991, 1993, 1994, Parsons and Meyer 1990, Meyer and Sass 1993, Meyer and Kaschula 1994) who has systematically attempted to alter students' perceptions of the learning environment. Parsons and Meyer (1990) write:

> *Previous research has indicated there is a strong relationship between the approaches to studying adopted by individual students and their qualitative perceptions of the context in which learning takes place... an intervention programme* (was designed) *to produce a qualitative change in perceptions of certain key elements of the learning context... the teacher/student relationship, perceptions of textbooks and notes, and the nature and role of tests and examinations.*

Parsons and Meyer (ibid) go on to describe their intervention programme which is based around a paradigm which 'synthesises phenomenographic, cognitive and empirical studies of student learning', and concentrates on the relationship between motivation, Approach to Study and study process within a contextual framework. Parsons and Meyer (ibid) reinforce the link previously made between the context and the learner by Ramsden (1988) who had suggested, that in order to alter student Approaches to Study or study orchestration, practitioners must concentrate on both individual and contextual aspects of learning. Individual student's Approaches to Study are thereby seen to be responses to a perceived learning context; in their (ibid) terms, *qualitatively different perceptions have been*

consistently associated with qualitatively different study orchestrations. Meyer, Cliff and Dunne (1994) in following the work of Meyer and Parsons (ibid) refer to the inter-individual variation between students and describe these as being (in part) determined by the observed variables used to 'quantitatively externalise the inner perceptions and conceptions of the learner'.

Meyer, Cliff and Dunne (ibid) report two distinct interventions. The first was concerned with interventions at an individual level, the second with the pragmatic application of the same form of intervention at a group rather than individual level. The interventions took place in engineering and mathematics departments respectively. Within the first study students were categorised using methods described earlier into 'low' and 'high risk' study orchestration sub-groups. The statistical findings were supported by confirmatory interviews; both actions were integrated into a first year academic support programme in the learning to learn category which specifically addressed issues aimed at...

> *(a) altering perceptions formed by the student about the context of learning (Parsons and Meyer 1990), (b) altering students' metalearning capacity (Biggs 1985) as well as their capacity for self-regulated learning, and, (c) attributional retraining based on the testimony of fellow students...*

Each student's study orchestration profiles then formed the focus for an 'ongoing learning dialogue' which was to be seen as part of the general support programme. Follow-up interviews suggested that five of the nine students in the high risk category showed 'qualitative improvement in learning behaviour' and passed their end of year examinations as an inferred consequence.

In subsequently trying a compressed version of the above intervention with a cohort of 600 students, Meyer et al (ibid) found that 'no overall phenomenon of improved student learning and student performance has been exhibited', and that the intervention failed to prove appropriate and successful. This is despite the end of year examinations being constructed with the intervention in mind. It is suggested that these outcomes ward against the dangers of committing resources to interventions at the impersonal level. This does not bode well for those wishing to develop interventions for large cohorts of students, though Norton and Crowley (op cit) and Norton and Dickens (1995) do report some successes within their studies of group level of interventions. Nevertheless, at the individual level, Meyer et al (ibid) have demonstrated positive results in changing student conceptions of learning and perceptions of the learning context.

Such perceptions are discussed in research following that of Meyer et al (ibid), by Cliff (1995). Here he (ibid) emphasises the relational role of the learning context in mediating the effectiveness of interventions; the development of a desirable study orchestration or Approach is essentially seen as, on one hand an effect of a successful intervention, and on the other, the retainment of that Approach encouraged by a supportive context. Similar comments have been made by Biggs and Rihn (1984) and Biggs (1993b). Taking the above arguments in account it can therefore be argued that interventions most likely to be deemed successful are those that can effectively attend to the diversity of individual Approaches or orchestrations, while also helping students to maintain desirable learning behaviour in the face of (sometimes hostile) context demands. For some of the students regarded in Cliff's (ibid) study as having positively modified their orchestrations, this maintenance of desirable behaviour is characterised by adopting what might be called a negative standard - the ability to identify and then to avoid factors that could lead to failure. This it can be argued is a very conscious, but risky form of Strategic learning, for example one first year engineering student in Cliff's study reported how he coped with the context of workload pressure by sacrificing one of the end of module examinations to free time to work for and pass the rest of the portfolio of assessment[5].

For many practitioners, the author included, the idea of changing the assessment, workload or any other context of student learning is a luxury that cannot be afforded or otherwise attained. The author works with engineering students in response to his job description, that of Learning Skills Facilitator. While this remains a service role, he is in no position to alter departmental or institutional policy and can only therefore, work with the individual side of the student Approach to Study equation. This fits in with Parson and Meyer's (op cit) and the Meyer et al (ibid) aims; altering the perception a student has of the course without altering the course itself. It is with this philosophy, along with a study of potential targets for learning to learn interventions, that have informed the development of the author's learning to learn workshops. These are based on the work of Gibbs and Northedge (1979) and Gibbs (1981, 1989, 1992) and described in further detail later in this chapter and extensively in appendix two. In essence the workshops were a reactive attempt to improve first year engineering student learning by prompting these students to examine their perception of the learning environment

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5 Since the time of writing (at which the author's interventions were being integrated and evaluated within the then unitised BEng (Hons) Degree Course) this phenomenon is starting to be anecdotally reported by colleagues teaching within the author's department. All degree courses in the department were modularised in 1994. Module assessment regulations effectively allow students up to four attempts to pass a specific module following referral.

they find themselves in, and to be flexible to the study demands that environment makes of them. Norton et al (1995) include this type of intervention as based on the concept of metacognition, and comment:

> *the metacognitive approach has the advantage over the study skills approach because... the former is a flexible and fluid approach changing according to context, whereas the latter tends to remain static.*

Romainville (1994), working from a cognitive perspective reports an initial investigation into the factors that support metacognition within a first year student context. While he had not attempted to teach students metacognitive strategies, Romainville (ibid) presents evidence to suggest that if a learning to learn programme is to be successful (in his terms, promotes metacognition), the following elements should be included in the scheme of work: the promotion of reflection on what students intend to do when engaged in a task and what they aim to achieve when thinking about a particular task; the examination of student conceptions of learning; the examination of the effects of time on the quality of student learning, with particular emphasis on avoiding the tendency of weaker students to attribute poor performance to lack of time spent studying.

Romainville (ibid) suggests there are four main factors which students demonstrate relative to the quality of student learning: conception of learning (as already described); attribution (the ability to attribute learning quality to external factors, non-intentional factors, time and learning strategies used); metacognition; academic performance. In other words, students who are aware of their learning strategies and reflect on the factors influencing them are thereby better able to control their relationship with the context of study are thereby achieve more. This could be argued to be a Deep and Strategic relationship with the course of study. On the other hand this could be argued to be a function of success itself; more successful students are more inclined to reflect on what it is that fosters this success. In this case it is therefore not conclusive that teaching 'successful learning strategies' to less successful students will work.

Metacognitive type interventions have been the focus of several research studies as described above. It is the opinion of the author that his intervention is appropriately described as being of this type and that it is similar to aspects of previous research. Several research investigations in particular are of interest here because of the broad similarities between them and the the author's interventions; those reported by Ramsden, Bestwick and Bowden (1986, 1987), Martin and Ramsden (1987), Meyer et al (1993, 1994) and Norton et al (1995).

Ramsden, Bestwick & Bowden (ibid) researched into the effects of a learning intervention programme on the Deep and Surface Approaches to Study of participating students using an earlier version of the ASI (cf. Ramsden and Entwistle 1981). ASI profiles were also compared between participating and non-participating students. The contents of the intervention programme were aimed at prompting students to consider the appropriateness of their learning tactics and attitudes within the context of their study, as well as developing an awareness of Approaches to Study. This raising of awareness and reflection has been promoted by other researchers (cf. Svensson 1984, Biggs and Rihn 1994, Biggs 1985, Eley 1992, Biggs 1993b, Romainville 1994) who, as already discussed, have suggested that the difference between successful and unsuccessful learners is not a direct function of the study skills used, but more often a function of whether the learners are aware of why they are using a specific tactic or technique within a given context. However, comments such as this must be balanced against the assertions of authors such as Gibbs (1981) who reminds that difficulties in learning are as much a function of inadequacies in teaching as they are inadequacies in students' study patterns. This becomes a warning to all those working in this area as expressed by Martin and Ramsden (1987):

> *Differences...* (between learning to learn and study skills) *are not easy to research because interventions which are part and parcel of a teaching programme are contaminated by the pervasive effect of the normal context of assessment and teaching. However, interventions not so contaminated are not only difficult to arrange with any degree of realism, but will have limited relevance to improving learning in any other normal teaching context.*

In what might be described as a response to this warning, attempts at sophisticated methods of evaluating the effectiveness of interventions have be developed which utilise the theories of student learning already described here as Approach to Study and conception of learning. Martin and Ramsden (1987) observed changes in conception of learning showing a small move towards transforming conceptions by those students involved in a learning to learn programme as opposed to those students involved in a study skills programme. In that transforming conceptions are associated with a Deep Approach and reproducing conceptions a Surface Approach (Svensson 1984, Van Rossum & Schenk 1984) the learning to learn programme would in this instance, seem to offer support for the interventions proposed by the author. However, in a similar study, Ramsden, Bestwick and Bowden (1986, 1987) found that at the end of the first year of study, students who had been involved in a metacognitive type

intervention had inflated Surface Approaches compared to students from the same context, but not involved in the intervention.

The effect of increases in Surface Approach scores found by Ramsden et al (ibid) could not be attributed to background factors and thereby were associated with an increase in 'strategic variability'... these students showed an increased awareness of the variation in contextual demands. In essence, a positive correlation was found between the overall assessment grade and Surface Approach for those students involved in the intervention leading Ramsden et al (1987) to suggest that:

> *In other words, they learned to adapt their approaches to the demands of assessments. Although they may have learned to select 'appropriate' strategies, their perception of appropriateness was presumably different from that of their teachers.*

and that in the context of their research (1986):

> *This suggests that the first year assessments can be successfully negotiated through the use of effectively managed surface approaches.*

The authors (ibid) go on to support this explanation of a strategic adaptation by providing evidence from students who could describe their acknowledgement of using a Surface Approach to pass assessments and yet also recognised that they were doing so in order to attempt to maximise success. In other words the students had applied the content of the intervention in an entirely logical and rational way, despite this being opposite to the aim of the intervention. In short, the increase in Surface Approaches on the part of students involved in the intervention was attributed to a mediation effect of the teaching and assessment generally presented by the main course of study. Further, this increase is seen as 'a strategic improvement in student's capacities to cope with assessment' with students extracting what they think will be useful from the intervention, in this case the tactics to cope with the time and organisational demands of the Surface Approach to Study. This type of effect is documented by Meyer and Sass (1993):

> *'Improvement'... appears to be essentially in terms of a strategic form of learning behaviour, conceptually geared to passing examinations. This is not surprising, and probably indicates the perceived survival adaptation required to cope with the first year. again this interpretation is consistent with conclusions of other studies. Whether this is a desirable form of 'improvement' is open to argument against the well established fact that*

students often pass examinations without understanding what they have been examined on[6].

Various studies referred to here have reported a process adaptation that has either a Deep or Surface focus. Ultimately Ramsden, Bestwick and Bowden (1987) therefore suggest that improving learning is facilitated by the ability to uncover student misconceptions about learning and assessment and then to identify the problems in processing these misconceptions present, perhaps as an antidote to the failure of students to 'see the point of much of the teaching' they are exposed to (Saljö 1987). It can be argued that there is also a natural extension to this, notably the inability of some students to see the point of the assessment system and what it aims to assess. Learning to learn interventions have therefore been designed with content aimed at addressing these issues, namely prompting students to explore their conceptions of both learning and assessment. For example, Meyer, Cliff and Dunne (1994) developed interventions that explicitly address 'awareness of context' (including student expectations and assessment) and 'awareness of learning' (including conception of learning and Approach).

Norton and Crowley (1995) and subsequently Norton and Dickens (1995) investigated the effects of their interventions on both Approach and conception of learning. These interventions also included material on both awareness of learning and assessment demands. The participating psychology students interacted with the intervention as part of their normal course of studies in an attempt to overcome some of the problems associated with context discussed earlier. However, Norton and Crowley (1995) report the eclectic nature of their intervention, referring to the inclusion of both study skills and aspects of learning to learn type activities. The intention here was to introduce students gradually into metacognitive type activities as Norton et al write (ibid)

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[6] However, the 'improvements' described above are at a group level, and it is not until interventions are designed for, and researched at an individual level that both consistent qualitative and quantitative (grade) improvements are found (Meyer et al 1994). This phenomenon has been alluded to elsewhere (Gibbs 1981) but represents an ideal form of intervention requiring substantial resources.

The conditions under which that Ramsden et al's (1986, 1987) intervention was applied were significantly different from those the author of this thesis is working under and, the authors (ibid) are quick to point out that their findings are based only on group level data analysis. This level of analysis is likely to mask any significant effects at the individual level, where some students may indeed have changed in ways not reflected by the research instrument and the overall findings.

It is interesting to note, that not many 'intervention researchers' have recognised the role a group level intervention has in then allowing access to the 'resolution of individual learning needs' which in turn require 'an individual level of engagement' (Meyer et al 1994).

The relative success of this programme may perhaps help to resolve the debate as to whether study skills programmes or learning to learn programmes are the most effective way of enhancing students' learning ability. It would seem that both are needed, with one leading into another.

It might be gleaned from that quote that the programme was considered a success, with a broad shift for attending students from the reproducing towards the transforming conceptions as previously demonstrated by Martin and Ramsden (1987), and identified through the content analysis of student responses to the question, 'What do you actually mean by learning?' (Norton and Crowley 1995). The conceptions of learning improvements for those attending are very impressive with 60% of students reporting transforming conceptions at the end of the intervention, compared with 29% at the start. Compare this with the findings from Martin et al (ibid) showing a similar change from 57% to 66%. Whether or not such a shift is a reflection of a developmental trend is unclear (cf. Marton et al 1993, Wankat and Oreovicz 1994) however, it is suggested that by encouraging such reflection of students' conceptions of learning will not only enhance the conception of learning held, but also academic performance (Norton et al ibid).

Academic performance as above refers to both essay and examination performance. It was reported by Norton et al (ibid), that while an improvement in conception could be identified, improvements in academic grades were identified according to examination results but not for essays; specifically, students with reproducing conceptions achieved comparable essay scores to students with transforming conceptions, while in examination the students reporting transforming conceptions did significantly better than those with reproducing conceptions. The previously identified links between conceptions and Approaches to Study are also explored, but there is no, or very little correlation found in this case.

In profiling their students for Approach to Study, Norton and Crowley (ibid) chose to use a locally devised version of the ASI which was based on a total of 18 items covering Deep and Surface Approaches only. Such an instrument is unlikely to have the reliability or validity of the full ASI or RASI, indeed this is commented upon by Norton et al (ibid) even though they are not explicit about the reliability statistics for their questionnaire nor the construct of the individual variables. While Norton and Crowley (ibid) provide statistics for the relationship between their intervention and examination marks, these are provided for conceptions of learning changes post-intervention and the Deep Approach scale only. With no indication of the relationship (specifically correlation) between the Surface Approach scale and examination mark, it is impossible to draw a complete

comparison between this work and that of Ramsden, Bestwick and Bowden (op cit). Norton et al (ibid) report that there is no significant positive correlation between Deep Approach and measures of academic performance, while there is a small positive correlation between a transforming conception of learning and performance.

In summarising Norton and Crowley's (1995) variety of findings, it can be said that their intervention failed to effectively increase students' Deep Approach to Study, even though the attending students did show an improvement in conception away from reproducing and towards transforming. Attending students saw an increase in their mean end of year assessment scores, though this was more an effect of enhanced examination results than essay performance. However, for those students attending, their findings show attendance at the workshops being positively correlated with essay mark and examination mark and overall mark.

Norton and Dickens (1995) substituted their shorter inventory for the 32 item ASI discussed by Richardson (1990, 1995b) and applied to a modified version of the intervention briefly described above. In attempting to make interventions context sensitive and specific, Norton and Dickens (ibid) adopted the systemic rationale suggested by Biggs (1993a), discussed by Lublin and Prosser (1994), and applied to the research reported here. Implicit and explicit system support was sought by informing all teaching staff of the intervention's aims for learning outcomes and aligning essay and (eventually) examination requirements with these aims. Further, staff were encouraged to reinforce the implicit demands for Deep Approaches to Study by consciously attending to and improving other influential context variables such as feedback. The emphasis of the intervention itself was on encouraging students to develop a metacognitive awareness of their own learning strategies. Outcomes from this intervention and research study can be summarised as: a significantly higher academic performance for attenders over non-attenders; no significant increases in conception of learning for attenders as previously (Norton and Crowley 1995); a significant decrease in Surface Approach and no change in the Deep Approach scales of the inventory profiles for attenders. On the basis of these results it is argued that the intervention had some process benefits (Norton and Dickens 1995) and that there is empirical evidence to suggest that learning to learn interventions can enhance assessment performance.

At first reading these results are difficult to rationalise against each other. However, it should be remembered that 50% of Norton and Crowley's (1995) and Norton and Dickens (1995) interventions were concerned with skills, and in particular *in context* essay writing skills and examination skills. This means that

students attending workshops on essay writing for example, will have been exposed to far more context based information about 'what constitutes a high marking essay', than those students not attending such workshops. Subsequently, it can be argued from the evidence available that these students can be interpreted as displaying a Strategic Approach adaptation in a similar way to that described by Ramsden et al (op cit) and as originally conceptualised by Ramsden (1979).

An alternative conclusion is suggested by Norton and Dickens' (1995) findings. They suggest (ibid) that students may have been in a stage of transition between Surface and Deep; they had begun to realise that a Surface Approach was vilified and so reduced their Surface scores. However, while students saw the obvious contextual benefits of taking a Deep Approach (it would be rewarded), they were at that stage, unwilling to take the initial risk of adopting a new Approach to Study. It seems that the intellectual risk associated with Deep Approach responses (for example, the willingness to extend argument and reach new conclusions et cetera) was initially too frightening for students to chance. They would after all, be quite able to achieve moderate academic success by applying their already successful learning behaviour. In other words, there is some lead-time or otherwise inertia to be overcome in changing student Approaches from Surface and towards Deep. It can be argued that this phenomenon makes a great deal of conceptual sense in the author's department and in engineering generally. Again though, it could be argued that many of the students discussed here (Norton and Dickens ibid) were showing Strategic adaptations, albeit this biased towards the Surface rather than Deep Approach. Neither of the Norton et al studies profiled for Strategic Approach at quantitative or qualitative levels, so any notion of students responding Strategically to these interventions is drawn by inference.

Elsewhere in the literature, engineering students showing adaptations towards a more Strategic forms of learning as they progress into the first year of study have been observed (cf. Ramsden 1992, Meyer and Sass 1993, Meyer et al 1994, Cliff 1995). That this Strategic Approach is coupled with a predominance of either Deep or Surface Approaches to Study is also well documented, for example, by many of the authors already referred to in this section. Evidence of these mixed Approaches is typically reported under factor analysis studies of data from the ASI and its derivatives (cf. Meyer and Sass 1993, Entwistle and Tait 1993). In relation to the author's research, his group interventions were expected to impact positively (that is promote a Deep or Deep/Strategic Approach) on the part of the participating students. This is along the lines discussed by Meyer et al (1994), the presumption that:

A recipe of well-intentioned group-level strategies will adequately allow the individual learner to perceive personal difficulties and their appropriate remedies.

This is however still an unsupported presumption based on the literature discussed here, except perhaps, for the small changes indicated by Norton et al (op cit), though even this evidence is confused and comes from a context very different from that in which the author is working. Martin and Ramsden (1987) do suggest that there is tentative support for further experimental interventions, albeit at a holistic level.

Whatever is suggested it is clear as described by Hounsell (1984) that any intervention should be grounded in an understanding of student experience of learning. What is more this should respect the systemic nature of teaching and learning (Lublin and Prosser 1994). It can be argued that this model must contain and inter-relate concepts already discussed in this section and the rest of the literature review. The assortment of concepts must therefore include: a recognition of past and current student learning experiences, Approaches to Study, including Deep, Surface and Strategic manifestations, conceptions of learning, orientations to study, student perception of the learning context, and learning outcomes. A model of student experience was proposed in figure 2.11 and thereby forms this understanding on the part of the author. In this sense, interventions have been aimed and delivered to specific targets in the system, allowing some reflection as to their effectiveness and impact respective to that system. Likewise, the author's interventions were developed in respect of such a system and thereby would reflect concepts contained within the system itself. Overall the author's aim was to provide a general introduction to the Integrated Engineering course of study which by focusing on students' awareness of learning and studying would promote an improved conception of what learning is, and by providing contact with a student advisor, would give ongoing support for the changes in perception and intention needed in order to successfully cope with the study required.

2.7 The Author's Intervention

Following the discussions above it would seem that there are a series of recommendations that could be made to anyone wishing to develop interventions of the kind intended by the author. Clearly some of these have been referred to

already such as the need for context sensitivity and the inclusion of many of the 'phenomenographic' concepts and factors such as orientation and Approach to Study. An initial list of such criteria is offered by Norton and Dickens (op cit):

1. *The course should be firmly embedded within the curriculum.*

2. *The course should be designed to focus mainly on raising students' metacognitive awareness of learning strategies which would involve some studying techniques.*

3. *The course should be predicated on the principle of a development and not a deficit model of learning.*

4. *The course should be seen as a central and integral part of the department's teaching activities and not some isolated 'add-on' option.*

5. *The principles taught in the course should be strongly reinforced by the rest of the departmental staff in their teaching.*

6. *The principles taught in the course should be actively encouraged by the assessment procedures.*

7. *The course should be seen as a fundamental part of the systemic approach to learning where the importance of the total learning context is acknowledged and acted upon to improve both learning and teaching.*

It could be further argued that this list is incomplete and that additional criteria might include:

1. The course should offer a facility for an on-going dialogue with individual students about their specific strategies (after Meyer et al: various op cit).

2. The course should develop learners' conceptions and perceptions, especially in relation to assessment demands (after Gibbs, Morgan and Taylor 1980, Parsons & Meyer et al ibid, Ramsden 1992, Cliff 1985).

3. The principle teaching method should be based on prompting reflective behaviour on the part of students (after Gibbs and Northledge 1979, Gibbs 1981, Svensson 1984, Biggs 1985, Eley 1992, Romainville 1994).

4. The intervention should itself inform and be informed by the whole teaching and learning milieu; it should support dialogue between members of staff about what their teaching promotes (after Gibbs 1981, Martin and Ramsden 1987, Norton and Crowley 1985, Norton and Dickens 1985).

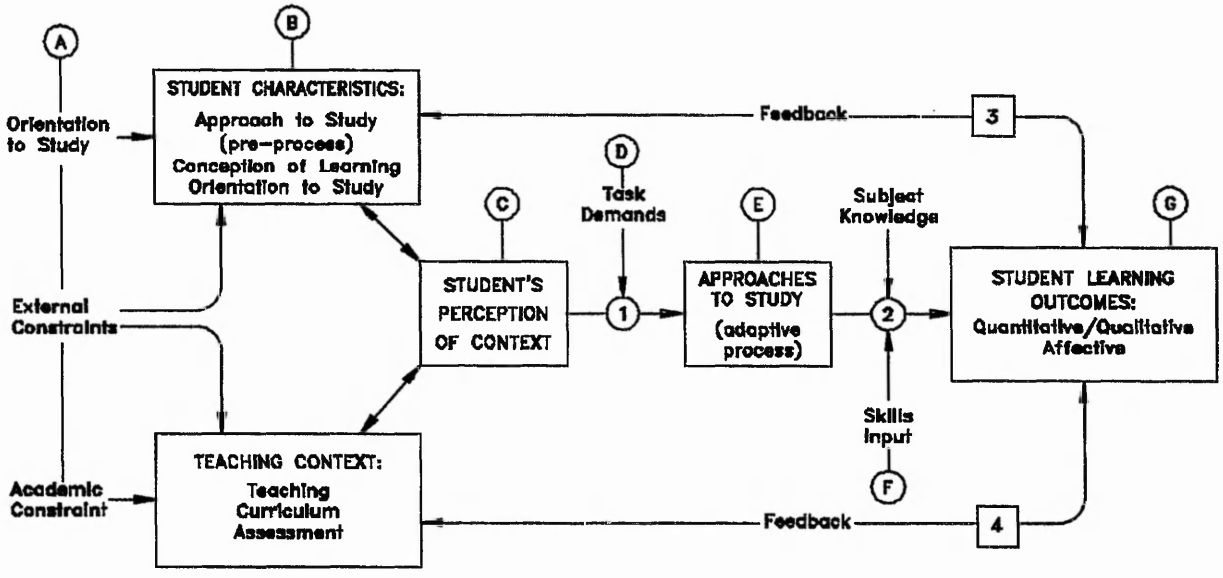
5. The course should be grounded in an understanding of student learning. (after Gibbs et al 1980, Hounsell 1984)

The list(s) are not meant to be exhaustive, they represent the criteria against which the author's interventions can be explored retrospectively. However, it can be argued that many of these criteria were known to the author prior to the development of his scheme of work, though not necessarily in this explicit form.

The rest of this section will explore the design of the author's intervention relative to the criteria above and the model of student learning proposed earlier in figures 2.11 and 2.12. The full scheme of work that characterises the author's intervention is found in appendix one. The nature of interaction with students was based on the work of Gibbs (1981, 1989, 1992) and Gibbs et al (1979) with modifications made for the local context and additional material developed as the confidence of the author increased. Other mechanisms reported elsewhere (cf. Gibbs 1989, 1992) were also employed, such as the application of a short 18 item version of the ASI intended to raise student consciousness to a level where the concepts inherent in the inventory could be discussed. Indeed, discussion characterised much of the author's work with students, a typical session involving the introduction of a issues or polemic statement which could then be explored by all participants. Theories of student learning were introduced to students at appropriate points, usually after some exploration of archaic or immediate experience that could be explained within the theoretical framework. The objectives of the authors intervention are documented as:

> *To promote appropriate educational orientation by enabling students to become more aware of the values and attitudes they may have in relation to higher education, and to recognise appropriate priorities and intentions.*
>
> *To promote appropriate concepts of learning by making explicit an understanding of what effective learning is.*
>
> *To promote appropriate approaches to study by describing and explaining these different approaches, so as to help the student to adopt preferable approaches wherever applicable, and to see the implications of doing so.*

The author's objectives fit adequately into the developmental model of student learning in that the author was not assuming a deficit of such factors, but was interested in promoting a move from inchoate to developed levels of presage elements. Thus it was assumed, that each student could be encouraged to examine their orientation, concepts of learning and Approaches on the route to self-improving these should that be required. In this respect the author was working from a position now stereotyped with the SAL framework; that ideally students should be encouraged to develop Deep Approaches to Learning as supported by a developed concept of learning and by a personally intrinsic orientation to study. The author's intervention was designed to impact on the student learning system at the points where concept of learning and orientation are most exposed. Because the three objectives relate to system presage factors it can be argued that the author's intervention was designed to impact firstly on these and thereafter their dependent elements elsewhere in the system. The author's model of the student learning system is presented again in figure 2.13 below for convenience.



KEY:

A	Pre-system influences
B	Presage factors
C	Process factor
D	Disruptives at point 1 (known as a comparator) producing a modified control signal to the right of point 1
E	Process factor
F	Disruptives at point 2
G	Product factors
3&4	Possible feedback access points of actual outcome (transducers), eg by application of the SOLO Taxonomy.

Figure 2.13 Second Version of the Author's Proposed Model

Intervening at point B had the intention of addressing student perception of the learning context (point C) as well as the factors students attribute to success or failure that are outside the system. Within the system itself, following the student perception of context, the first disruptive to the system equilibrium is seen, namely the task demand at point D. As a consequence of the relationship between factors at points B, C and D, the student is seen to respond and adapt to the system demands by taking a particular Approach to Study to the demands made at point E. In this respect, the author's intervention was intended to promote student thinking about their reaction to task demands and how this reaction will affect quality of outcome. However, Approach to Study at point E is not seen as the only influence of outcome and it can be argued that there is a further disruptive to system at point 2.

Point 2 in figure 2.13 indicates the point at which the process based Approach to Study is seen to react with subject knowledge and skills or heuristic input to produce a recognisable outcome; an analogy might be between the quality of the craftsman and the availability of resources - we might have a highly acknowledged craftsman (having the intention of a Deep Approach) but unless he has the tools and material there is little chance of getting the job done. It is thereby argued that subject knowledge as well as skills associated with that subject's acquisition should also be inputs to the system before an outcome can be achieved. Subject knowledge and skills are seen to input at point F.

The teaching of subject knowledge was not an area the author was qualified to engage in, but he was attempting to provide some skills input, for example by suggesting mechanisms for effectively dealing with time constraints. It should be noted though, that following the discussion within this chapter, the author was not working from the 'deficit in study skills model'. Indeed it was assumed by the author and made explicit to the students that he believed that most students were capable in many basic skills but were more likely to benefit from reflection of *why* they used particular skills within particular situations; typically students were offered polemic statements or questions like, "Why go to lectures when it's all in the books anyway?" to focus their attention firstly on quality of engagement with the lecture (point E), and secondly on tactics deployed within the lecture such as taking notes. Explicit study skills were not taught extensively within the intervention.

Student learning outcomes at point G were explored in the author's intervention by introducing students to the SOLO Taxonomy (Biggs and Collis 1982) and discussing the relationship between this and quantitative academic outcome.

However (and now it seems naively), the author attributed high quality outcomes at a local level with high assessment marks without evaluating the actual assessment structures for the Approaches they promoted. In this sense students were encouraged to believe that high quality learning outcomes were their primary goal and that they could expect these would be rewarded by high academic marks.

Finally, the author explored the feedback at points 3 and 4 in the system. At an intervention level this was characterised by asking students to discuss how they felt about their relationship with their subject and the methods of teaching and learning. Further, towards the end of the intervention and the first year, students were encouraged to reflect by being asked, "What do you need to succeed on this course here and now?" as a basis for a crude needs analysis. The outcomes from this exercise provided an informal contract between the students and the author who encouraged students to refer to these outcomes from time to time when engaged in mainstream subject study without the support of the author. Whilst this exercise is exclusively student based, it is important to realise that the author's intervention should have been seen to inform teaching practice as well. The nature of the intervention was such that it offered a forum for discussion regarding the students' relationship with the course, the subject and the methods of teaching. It was hoped that such a 'go-between' would help contribute to the systemic criterion suggested by Norton and Dickens (op cit). However, this aspect of the author's intervention was not the focus of the research and does not contribute to any of the hypotheses.

The format for the author's intervention was a series of one-hour workshops presented over the first two terms of a degree course. This format was deliberately chosen within the constraints of the timetable available to firstly intervene before students adopted a habitually inappropriate Approach after several iterations of the system (Entwistle and Tait 1993), and secondly to provide support over a period of time when students would be adapting readily to the demands of their course. At times between workshops, individual students took advantage of, or were encouraged to utilise the author's open door policy for tutorials so that the attending students received far more intervention than that contained within the learning to learn scheme of work. It can be argued that this formed, for some students at least, the basis of an on-going dialogue as referred to previously.

So to summarise, the author based his learning to learn interventions on the theoretical background and epistemology associated with what is described here as Student Approaches to Learning (SAL). Moreover, this perspective is made accessible and can be explored through the development of some kind of systemic

model of student learning so that the impact of any intervention or disruptive can be articulated and examined. It can be seen that the author's intervention was aimed to impact at a variety of points within this system now represented by figures 2.11 to 2.13, and that this system model is based on the constructs and factors established in this literature review as suitable for including within and informing the author's research. The question now remains as to how the intervention's effects on Approach to Study were evaluated. These methods are discussed in the following chapter.

3.0 Data Collection and Research Stages

3.1 Introduction

Data collection involved two techniques. A quantitative methodology was used in the application and analysis of a questionnaire to profile student Approaches to Study. A qualitative methodology was used in the analysis of essay scripts produced by students at the end of the learning to learn workshops. These scripts were produced in response to a question asking students to reflect on the Approaches to Study they were taking to their course of study and its demands.

Questionnaires can be rapidly applied to large numbers of students and the vast amount of data needed to address the hypotheses of this thesis can be acquired without much disruption to students and staff. The questionnaire used was Entwistle and Tait's 'Revised Approach to Study Inventory' or RASI. A discussion regarding the validity and choice of this questionnaire in respect of this research is found in chapter four. The evidence provided by questionnaire responses was supported by additional and qualitative evidence drawn from essays written by students at the end of the sequence of workshops. This research would be incomplete without examples and analogies from students which might support or contradict questionnaire evidence. The qualitative methodology is briefly mentioned below and fully reported in chapter seven. This chapter sets out the design of the research, describing the initial data collection with further discussions in chapters four, five, six and seven.

3.2 Research Method

The RASI was used to collect data for addressing the research aim and the five hypotheses set out in the introduction to this thesis and reported again here for the convenience of the reader:

Aim. *To investigate the effect of a learning intervention on the Approach to Study of first year engineering degree students*

1. *Learning to learn workshops or similar material will have a positive effect on student Approach to Study.*

2. *A Deep Approach to Study is a requisite for success at academic study as measured by formal methods of assessment.*

3. *Students on the Integrated Engineering degree in this Faculty develop an appropriate Approach to Study as they progress through the course.*

4. *Students on the Integrated Engineering full and part-time degrees display a more appropriate Approach to Study than those on other degrees within the Faculty.*

5. *There are relative differences in Approach to Study between differentiated groups of students, eg male and female.*

The research aim refers to 'the effect of learning interventions', a series of 'learning to learn' workshops discussed to in chapter two. The full scheme of work for these workshops is found in Appendix Two, to which the reader is referred for further details. Briefly, the workshops comprised of eight hours tuition for 53 incoming full-time Integrated Engineering Degree students at the start of the 1992-1993 academic year. These workshops, mainly based on previous work by Gibbs et al (1979) and Gibbs (1981, 1989, 1992) were intended to develop students' Deep Approaches to Study, and to generally orientate students toward the study methods and attitudes expected to correlate with academic success.

In order to examine the effect of the workshops, a programme of supporting research was developed. This research, apart from being the focus of post-graduate work, would enable the examination a professional concern related to the content of learning to learn workshops. It was recognised that there were likely to be a series of issues regarding how best to organise and present learning to learn information for engineering undergraduates. The research hypotheses listed above would thus enable the examination of how well targeted and effective the workshops were, as well as informing the consideration of future developments and redesign of the learning to learn workshops for undergraduate engineers.

The research necessarily focuses on the cohort of 53 full-time Integrated Engineering undergraduates accepted on to the course in 1992. Essentially, these students would be profiled for their Approach to Study before, and then after the sequence of learning to learn workshops. In order to examine the difference in Approach to Study between these students and students not exposed to the learning to learn workshops, it was also necessary to profile a selection of other students for their Approaches to Study.

Figure 3.1 overleaf offers a schematic representation of the data collection and research stages. The broken lines at the bottom of the diagram suggest possible future research areas. The time scale of the research is indicated on the right

hand side of the diagram. The circles indicate the number of the thesis chapter in which a particular stage is discussed.

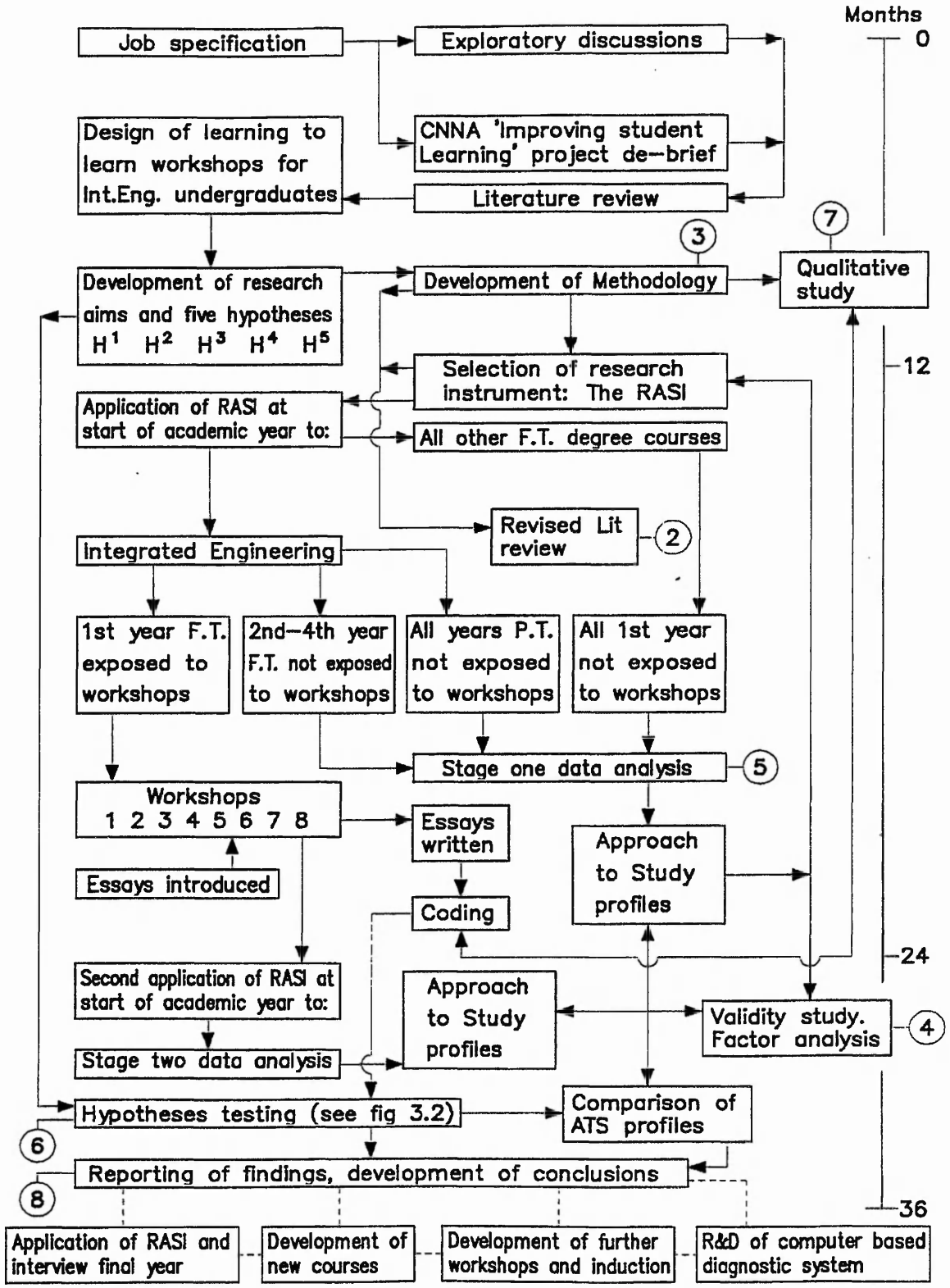


Figure 3.1 Outline of Research Stages

RASI profiles of Approaches to Study were obtained from all first year students in the same Faculty as the Integrated Engineers. This would give an indication of any differences in Approach to Study between different courses and differentiated groups of students. Data was also obtained from students in the second and final years of the Integrated degree in and from all years of the part-time Integrated degree. This meant that some comparisons could be made between students exposed to the workshops and those who were not while still taking the same or similar degree programmes.

Before using the RASI to obtain data for quantitative analysis, it was necessary to establish how many students needed to complete the inventory. Several options for establishing sample sizes are available to the researcher (Child 1990) which range from 'guestimation' to scientific method. Child advocates the use of Baggaley's method where sample size is calculated using the number of variables in the inventory and an estimation of the likely correlation between all the variables. Using the correlations as reported by Entwistle and Tait (table 4.1, chapter 4) and then removing the negative signs produces an average figure of 3.0 which can then be used in conjunction with a set of tables (Child op cit) to estimate the sample size. This advocates a sample size of as low as 120, but there is a popular notion that the sample size should be ten times larger than the number of items in the inventory, which in this case would require about 600 returns.

573 completed questionnaires were initially completed and returned. One course (Microelectronics) only returned 6 questionnaires and these were removed from the analysis (as they represented only 23% of that population). Of the 567 left, 53 profiles were from the entire 1992[7] full-time Integrated Engineering Degree intake (representing 100% of the course intake), 75 students in the second and final years of the same degree (representing 97% of that population), and 58 from the part-time Integrated Engineering Degree years two, three and four (representing 86% of that population). The 53 full-time students were those subsequently exposed to the learning to learn workshops. Twelve of the original 53 students undergoing the intervention withdrew in the first academic year to leave a sample of 41. Following the workshops, these 41 were profiled again. This produced an overall data-set comprising of 608 completed RASI questionnaires. The sample size is in excess of that suggested earlier and nearer the figure of 600 previously quoted.

[7] It is worth noting that all students starting the Integrated Engineering Degree in 1992 were allowed access to the workshops, rather than artificially restricting access to form a control group. This approach was thought to be more ethically sound.

As described, having applied the RASI prior to the learning to learn workshops the Integrated Engineering students were again profiled in 1993. This was 12 months after the first RASI application and 6 months after the end of the learning to learn workshops. This re-application was to elicit a direct comparison between the student Approach profiles pre and post workshops, and was conducted sometime after the intervention so as to allow any longer term system effects to proceed.

The Revised Approach to Study Inventory is a fairly large inventory producing 60 main raw data variables representing only the Approach to Study scales. A copy of the RASI and its scoring key are found in Appendix One. Basic computations are applied to this raw data to produce sub-scale and scale scores as described in chapter four. To handle data efficiently and to produce analysis, the Statistical Package for Social Sciences (SPSS) was used. SPSS is capable of storing, sorting and manipulating very large quantities of data to the level of multiple regression and factor analysis. SPSS has all the statistical analysis procedures needed for this research, including distribution, means and standard deviations, t-testing, correlation, and Cronbach's alpha, which will be described at relevant points in the following chapters.

In addition to the statistical measurements and tests used to address the research hypotheses, there was also an option to obtain and use qualitative data. This was obtained from the students exposed to the workshops in the form of a summative essay and is discussed in chapter seven. Initially as suggested at the start of this chapter, the qualitative research was intended to be as a support for the quantitative outcomes, but in effect the essays revealed very interesting and powerful data.

3.3 Summary

First Year Integrated Engineering students attended a series of learning to learn workshops. These students have been surveyed as described for Approach to Study using an appropriate research tool, the RASI, and then re-assessed for any shift in Approach. Some students have also reported qualitative information in the form of reflective essays. When compared to RASI profiles provided by students not exposed to the workshops, it will be possible to detect any fundamental changes in Approach as indicated by the RASI scales and sub-scales. This will form the basis for addressing hypothesis one; *learning to learn workshops or similar material will have a positive effect on student Approach to Study.* Hypothesis two, *a Deep Approach to Study is a requisite for success at academic study as measured*

by formal methods of assessment can be addressed by comparing the RASI profiles for the population sample against academic outcomes. Likewise the hypotheses three, *students on the Integrated Engineering degree in this Faculty develop an appropriate Approach to Study as they progress through the course*, and four, *students on the Integrated Engineering full and part-time degrees display a more appropriate Approach to Study than those on other degrees within the Faculty* can be addressed by comparing data from the first and successive years of Integrated Engineering cohorts and Integrated Engineering in general against other cohorts and against academic outcome. Addressing hypothesis five, *there are relative differences in Approach to Study between differentiated groups of students, eg male and female*, relies on the ability to identify differentiated groups from the sample population and to compare them against each other relative to main RASI profiles. Figure 3.2 summarises the link between the hypotheses and the research aim.

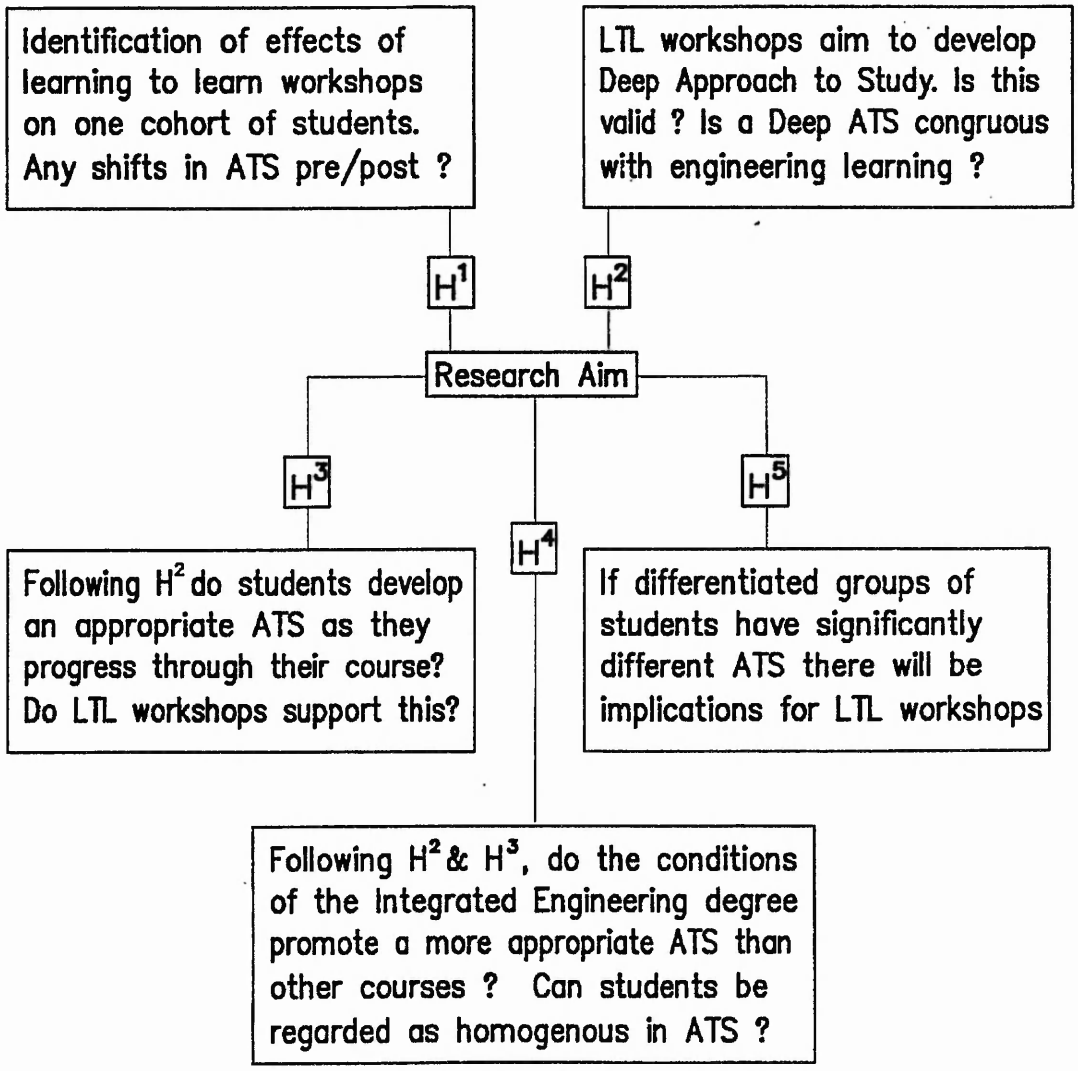


Figure 3.2 Hypotheses Relative to the Research Aim

4.0 The Measuring Instrument and its Validity

4.1 Introduction

'Most of the original research in Approaches to Study used a qualitative, interview-based methodology' (Richardson 1993). Richardson would seem to be commenting here on the type of work conducted by Marton and Saljö (1976) and Svensson (1977), who obtained their research evidence through interviews with students. These methods of identifying individual differences in Approaches to Study are involved and time-intensive and must be handled with a great deal of integrity and sensitivity so that the researcher elicits reliable information in a way that is non-threatening to the interviewee. Although their methodology has been criticised for being limited in range and number of subjects studied, there is no doubt that Marton and Saljö (ibid) provide the foundations of one of the most useful constructs regarding student learning and the subsequent development of inventories described here.

There are a range of inventories used by researchers for examining the learning characteristics of students. The instrument used for this research was the Revised Approach to Study Inventory (RASI)(Entwistle and Tait 1993). This chapter explains the practical and theoretical reasons for using the RASI in this study. The RASI identifies student Approaches to Study as a consequence of how students have responded to a series of sixty statements. These variables contribute toward scales which in turn relate to the Approach to Study dimensions described in chapter two.

Entwistle and Tait (1993) have conducted a validity study in relation to the use of the RASI in the context of some Scottish Higher Education departments. This chapter reports some of their findings against the validity study performed using the data obtained in Nottingham. The results of this, mainly from factor analysis and Cronbach's alpha testing are reported in this chapter. Whilst performing the factor analysis the opportunity was taken to explore some of the underlying factor structures of differentiated groups of students. These groups were comprised of those students described as passing their course and those described as 'at risk of failing'. The RASI was developed partly with the intention of identifying students 'at risk of failing'. It would therefore be reasonable to expect that the RASI differentiates between successful and unsuccessful study patterns. The validity of the RASI to do this is also explored in this chapter. Finally a summary is offered

in which the validity of the RASI is supported and in which some discussion of the comparison of passing and failing students is offered.

4.2 Selection of the RASI

In selecting a questionnaire from those available, the parameters it should cover had to be taken into account. Informed by an understanding of the educational demands of the context observed, and by the literature accessed, it was reasonable to assume that students studying engineering were likely to portray certain individual characteristics and to benefit from certain forms of support. An initial list of individual characteristics to be studied was therefore developed. Positively motivated students, keen to attend the course were likely to do better than those with apathetic tendencies. Within the Department, staff were anecdotally reporting students who appeared to be excessively passive. These students were appearing to have little motivation or strategies for working independently. Students who used effective higher order thinking and organisation skills were likely to do well. Metacognition and the ability to otherwise think in a broadly strategic manner was likely to be effective on engineering courses where content and application are highly integrated. Finally, the intention to reach personal understanding relative to the subject was of course considered desirable.

Approach to Study as described in the literature review can involve two independent variables of Deep and Surface Approaches. The Deep Approach has been established here and in the literature reviewed as necessary for understanding. The Surface Approach was identified as being problematic. The pivotal nature of these Approaches in the concept of the quality of student learning meant that the author's research needed to collect data about students' Surface and Deep Approaches to Study. These Approaches are centrally important elements, but the profile is incomplete without a measure of Strategic and Apathetic Approaches discussed previously. These specifications and a serendipitous meeting[8] with Noel Entwistle and Hilary Tait eventually led to the choice of their 'Revised Approach to Study Inventory' (RASI) (1993) as the research instrument. However, there are other inventories that could have been used. There are for example, inventories developed by Biggs (1976, 1987a) and Schmeck et al (1977) of which Biggs' *Study Process Questionnaire* (SPQ) is conceptually the

[8] Following a visit to Edinburgh and discussions with Noel Entwistle and Hilary Tait regarding the identification of students 'at risk of failing' they provided a copy of the 60 item RASI in return for the raw data obtained from the study at Nottingham.

most similar to the RASI. Richardson (1990a) has produced a 32 item inventory that profiles only Deep and Surface Approaches driven by his concern regarding the fragmented factor matrices typically produced by the ASI (cf. Meyer and Parsons 1989, Richardson 1990a), but considering the arguments already presented in the literature review and the changes initiated by Tait (1992) to produce the RASI, this would not appear to cover all of the sub-scales that might be considered significant variables within the performance of engineering students. Indeed Richardson (1995) has recognised that the scale of 'Achieving Orientation' previously found within the ASI has been amended and elaborated in the RASI to focus more specifically on the elements thought to contribute to a Strategic Approach to Study. Entwistle (1995) defends the inclusion of a Strategic Approach scale by referring to Schmeck (1983) and Biggs (1987a) who have both found conceptually equivalent dimensions using different theoretical standpoints in different countries in the form of Achieving and Methodical Study respectively.

Nevertheless, there is an opportunity in this research to examine the robustness of the Strategic scale given the various criticisms previously reported. Indeed the robustness of all the scales should now be examined, given the limited application of this relatively new inventory within research studies in the United Kingdom. The RASI is not a widely published instrument and has not undergone the rigorous validation studies previously applied to ASI, so some examination of robustness and validity is appropriate here.

4.3 The Approach to Study Inventory and Development of the RASI

Evidenced by the number of research papers referring to it, one of the most commonly used questionnaires on student learning is the Approach to Study Inventory (ASI). Developed by Entwistle et al (1979, 1983) the original ASI was based around psychological understanding of motivation, study methods and personality. Entwistle et al used evidence from their research and from the work of psychologists such as Pask (1976), Eysenck (1952) and Hudson (1966) and Parlett (1970) to develop the scales now associated with the ASI, though many of the initial personality variables were dropped from the ASI during its development in the early 1970s (Entwistle and Ramsden 1983) along with the scales difficult to demonstrate empirically such as the constructs of Globetrotting and Improvidence (Tait 1995). Likewise, the scales relating to Pask's serialist and holist learning styles were dropped given similar concerns. Tait (1992) extended this work to examine the variables within the ASI in the light of more recent phenomenographic work discussed in the literature review to produce the RASI.

Work carried out in 1974 subsequently reported by Tait (1992) had identified three motivation scales, fear of failure, intrinsic and achievement, (to which extrinsic motivation was later added) as correlates with academic outcomes. These were included with scales identified by Eysenck (neuroticism and extraversion), Marton (deep and surface), Ramsden (strategic) and Pask (comprehension learning, operation learning, globetrotting and improvidence). Entwistle also used dimensions reported by John Biggs (1976) who had identified differing forms of motivation as precursors to the learning process students would use.

Reported by Entwistle and Ramsden (1983) the original ASI was completed by over 2000 students and subjected to factor analysis to identify the correlates associated within it. The development of the scales did not rely entirely on Factor Analysis, the defining features of each scale being based on interviews with students (Entwistle, Meyer and Tait 1991). In this sense Factor Analysis was used to establish the conceptual coherence of the three main Approaches to Study already discussed in the literature review. Identified in the original ASI are three factors making up three orientations, Meaning, Reproducing and Achieving, as well as one less well defined orientation entitled non-academic orientation. These dimensions have been variously replicated in Factor Analysis studies by Watkins (1986), Clarke (1986), Newble & Clarke (1987), Newble et al (1988), Trigwell and Prosser (1991) and variously criticised for lack of replicability by Clarke (1986), Harper and Kember (1989), Parsons and Meyer (1989) and Richardson (1990a, 1993, 1995b).

Most studies reported here have confirmed two factors representing the Meaning and Reproducing scales of the ASI being repeatedly found in data sets. However, the Achieving and Non-Academic Orientations are less replicable, depending to some extent it would seem on the context, as their existence and composition varies from sample to sample (Richardson 1990a, Tait 1992). Some differences in findings may be attributable to small data sets or single subject area or both (cf. Meyer and Parsons op cit); some are questionable given the parsimonious use of the ASI sub-scales (Trigwell and Prosser 1991); some to changes in conceptual coherence given the re-scoring of the inventory and re-grouping of variables (Ramsden, Bestwick and Bowden 1986, 1987, Richardson 1990a, 1995b), while other findings have been questioned given the inconsistencies in application and interpretation of Factor Analysis by previous researchers (cf. Richardson 1990a, Meyer et al 1989). Given the widespread re-interpretation of the ASI and variations in the methods of analysis, it is hardly surprising that inconsistencies in results have been found. In this respect some of the 'rules' set out by Richardson (1990a) regarding research rigour were noted by the author and were

applied to his research, while the advice of Meyer et al (ibid) in 'attempts at verifying the ASI should be based on large samples... and for achieving and failing students before any suggestions are made for reorganising the scales' was also followed for the analysis of the RASI. The nature of Factor Analysis and the methods applied to the data set for this research is reported later.

The original Approach to Study Inventory comprised of four scales derived from sixteen sub-scales derived from sixty-four main items. Subsequently several inventories based on the original have been developed ranging from 18 to 64 items and from 2 to 5 scales. However, all of these were developed from the original Approach to Study Inventory, and it was not until 1992 that Entwistle and Tait (in preparation) began to revise the inventory to produce the Revised Approach to Study Inventory; the RASI as reported in this thesis. Entwistle and Tait (1993) reported the need to revise the ASI because 'aspects of the original instrument need clarification'. This centres around both 'conceptual clarification and redirecting the focus towards the identification of study difficulties' (Entwistle, Tait and Speth 1994) (see also the criticisms and inconsistencies reported above). In order to do this some of the original scales were subsumed into others while scales such as those for the Strategic Approach were elaborated in order to address problems identified by Meyer and Parsons (1989) and Richardson (1990a). At the same time the confusion brought about by the ASI profiling 'study orientations' (Entwistle and Ramsden 1983) was relieved by ensuring that the RASI main scales corresponded to the descriptions of Deep, Surface, Strategic and Apathetic Approaches to Study offered in the literature. The RASI incorporates a section of sixty items which are a series of statements about learning. The respondent is invited to indicate their level of agreement or disagreement with each statement on a five-point Likert scale. Variable scores can then be aggregated into scales and sub-scales as shown below.

Deep (16 Items, 4 for each of:)
Intention to Understand
Active Learning
Relating Ideas
Use of Evidence

Surface (16 Items, 4 for each of:)
Intention to Reproduce
Passive Learning
Unrelated Memorising
Fear of Failure

Strategic (16 Items, 4 for each of:)
Intention to Excel
Alertness to Demands
Study Organisation
Time Management

Apathetic (8 Items, 4 for each of:)
Lack of Direction
Lack of Interest

Academic Self Confidence (4 Items)

Figure 4.1 RASI Main Scales and Sub-Scales

4.4 Other Approach to Learning Inventories and Their Constructs

Biggs (1993a) makes the distinction between inventories based on the Information Processing model of cognition such as Schmeck et al's (op cit) *Inventory of Learning Processes* (ILP) and those based around a combination of cognitive and phenomenographic theories as found in the Approach to Study epistemology such as Entwistle's ASI and Biggs' SPQ.

Both these latter inventories have been variously criticised for this combination of cognitive and phenomenographic stances (cf. Schmeck 1988, Minnaert and Janssen 1992, Richardson 1992). This has lead to ASI being described as a 'mixed bag' (Tait 1995) of concepts, particularly in relation to the Strategic Approach scale. However, it can be argued that the Strategic Approach does not contain the same type of constructs as Deep and Surface. Deep and Surface represent intention and process rather than (for the most part) the strategies and skills inherent in the Strategic Approach to Study. In this sense the Strategic Approach to Study can be argued to be verging conceptually on metacognition since it requires students to be insightful and knowledgable about what is expected of them (Tait 1995). It can be argued therefore that the three main Approaches to Study are not adequately explained by either cognitive psychology nor phenomenography alone. This argument and the corresponding implications for research are pursued by Parsons and Meyer (1989), Minnaert and Janssen (op cit), Abouserie (1995), Richardson et al (1987) and Richardson (1990, 1992, 1995b)

The Study Process Questionnaire (SPQ) was initially based around ideas relating to the correlation between personality and academic outcome. Believing that there was a link between cognitive style, personality, values and learning strategies, Biggs (1976) developed a questionnaire that might identify styles of learning and therefore academic outcome. A fundamental flaw with this initial approach and indeed with an aspect of the information processing (IP) model, is the assumption that there are fixed and immutable learning styles and strategies and that these are part of the learner's permanent internal structure.

Schmeck's ILP (ibid) is also based on this and the levels of processing framework (Craik and Lockhart 1972), in particular within the two main scales of Deep and Elaborative processing, prompting Richardson (1995) to suggest that it has 'no special advantages over other inventories for research purposes by virtue of its supposed theoretical underpinning'. As discussed in the literature review, the levels of processing framework is somewhat discredited given its failure to offer explicit descriptions of information processing, despite being based within the IP

model, and also for the inherent circular nature of the levels of processing framework. The problems of 'theoretical underpinning' are not to be confused with broader notions of the IP model, rather, Richardson (1995) is specifically referring to the levels of processing model in saying that:

> *...levels of processing is still a useful concept, but... it's clearly not enough on which to build a general account of student learning, and so Schmeck's approach is not particularly convincing... the ILP is no better (or worse) than any other inventory, because it can't seriously point to research in cognitive psychology to bolster the conceptualisation of student learning on which it rests.*

Having established the idea of the presage, process product (3P) model as shown in figure 2.10, Biggs recognised and began to subscribe to the idea that the strategy of learning adopted by students was part of the process of learning and was contextually dependent rather than being a permanent and fixed attribute. Hence the SPQ was re-developed to emphasise and identify the process part of his 3P model. This produced a questionnaire that identified three learning style factors, each with a motive and a strategy. Biggs named the three factors *Utilising, Internalising and Achieving*. These were later renamed Surface, Deep and Achieving (Biggs 1987). Again it can be argued that these have more than just a passing reference to both cognitive and phenomenographic research given the motive-strategy congruence discussed in the literature review. This MSC theory demands a concordance between cognition (what you are trying to do) and motivation (why you are trying to do it)(Richardson 1995).

It can be argued that there is some indication that the SPQ and the ASI are similar instruments measuring the process and predisposition of student learning as described in student Approach to Study theories. In this respect there was little to choose between them in informing the current application of an inventory useful in identifying the Approach to Study of engineering undergraduates. However, given the various criticisms described above and in the literature, and the ready availability of information and data relating to the ASI and RASI it was decided to use the RASI as the research instrument. The RASI has also been substantially modified compared to the 64 item ASI and given the problems associated with many of the other inventories available (cf. Richardson 1995b for a review), the RASI seemed to offer a viable alternative. Using the RASI would also afford some exploration of its structure and reliability along the lines advocated by Richardson (1990a, 1993, 1995b) and Meyer et al (1989), which in turn would help inform the future development of the inventory.

4.5 RASI Structure and Reliability

Having obtained a large raw data-set as described in chapter three, it was possible to explore the structure of the RASI to see if it could identify the scales expected. A quantitative measure of the reliability of the instrument could thus be made and compared to the data and results from Edinburgh. These tests require two techniques: Factor Analysis and Cronbach's Alpha.

Cronbach's Alpha

Cronbach's Alpha is an estimate of the correlation expected between the scores actually obtained for a set of variables and a hypothetical perfect variable score (Frude 1993) giving a measure of internal consistency. This indicates the degree to which variables making up a sub-scale or scale successfully meet their intended purpose. It is expressed as a correlation coefficient so that a score of +1 would indicate perfect reliability. Cronbach (quoted in Youngman 1979) asserts that internal consistency does not need to be perfect for a test to be interpretable, and figures of 0.5 and above are frequently quoted by researchers as being acceptable. As used within the RASI scales, Tait (1992) suggests that this figure is not arbitrary and is based on alpha values for scales that can be replicated by the Eysenck (1952, 1963, 1966) personality scales. When reported in this thesis, Cronbach's Alpha is referred to as 'Alpha'. Previous published Alpha values for the old ASI have ranged from 0.29 to 0.78 for the sub-scales (Richardson 1990a).

Factor Analysis

Factor Analysis allows the systematic simplification of large amounts of data. The data is searched for similarities and characteristics that define one factor from another. Thus it may be found that a certain number of the variables within a data set correlate together and are seen to be relating to an identifiable concept or phenomenon (a factor). This research was concerned with seeing if the data obtained from the RASI fitted the conceptual model identified in the research literature. It was expected therefore that the data would correlate to form four and possibly five factors relating to the scales of the Deep Approach, Surface Approach, Strategic Approach, Apathetic Approach and Academic Self Confidence. This is the nature of replicability previously mentioned in this chapter (cf. Meyer and Parsons 1989, Richardson 1990a). Factor Analysis is therefore used here to confirm or refute the combinations of sub-scales that are intended to group together in defining the five scales listed above.

Following a pilot study at The University of Edinburgh with Psychology and Engineering students a Factor Pattern Matrix was produced in which the sub-scales and scales of the RASI are clearly defined. Entwistle and Tait's (1993) factor matrix is shown below as table 4.1.

Table 4.1 RASI Factor Analysis Matrix (Entwistle and Tait 1993)

	F1	F2	F3	F4	Alpha
Deep Approach					**.83**
Intention to Understand	.	.	.	53	.51
Active Learning	.	.	.	41	.60
Relating Ideas	.	.	.	66	.59
Use of Evidence	.	.	.	69	.64
Surface Approach					**.79**
Intention to Reproduce	.	.	57	.	.28
Passive Learning	.	.	52	.	.60
Unrelated Memorising	.	.	58	.	.41
Fear of Failure	.	.	77	.	.79
Strategic Approach					**.77**
Intention to Excel	.	29	.	.	.55
Alert to Assessment Demands	.	36	.	.	.77
Study Organisation	.	85	.	.	.44
Time Management	.	74	.	.	.57
Apathetic Approach					**.79**
Lack of Direction	43	.	.	.	.66
Lack of Interest	98	.	.	.	.68
Academic Self Confidence	.	.	-58	.	**.73**

Factor Correlations		F1	F2	F3
	F2	-.2		
	F3	.3	-.2	
	F4	-.3	.5	-.3

Maximum Likelihood Oblimin Factors explained 56% of the variance. Loadings below 0.3 are omitted. Decimal points removed. Alpha refers to Cronbach's Alpha for each of the scales and sub-scales. n = 366.

The Entwistle and Tait (ibid) study and further exploratory studies produced the inventory used in the research this thesis reports. Comparisons between the reliability and discriminatory figures obtained from the Edinburgh data and the data obtained in Nottingham, are further discussed in this chapter.

The Factor Analysis reported by Entwistle and Tait (1993) showed that the RASI was indeed identifying separate Approaches to Study. The scales (with the exception of Intention to Excel) were loading significantly on separate factors and

the great majority of the scales and sub-scales were above the required .50 consistency coefficient (Cronbach's Alpha). The failure of Intention to Excel to load appropriately in the data from Edinburgh suggest that the robustness of the Strategic scale in particular should be examined in the data from Nottingham[9].

To confirm the expectations above using Factor Analysis it was assumed that the data from Nottingham would contain patterns of data linked to the five scales described above and previously identified by Entwistle and Tait (1993). In other words, it was expected that a structure that has been previously identified both conceptually and empirically and which will consist of at least four main factors as reported by Entwistle and Tait (ibid), would be confirmed.

Whilst Entwistle and Tait (1993) used a method of Factor Analysis known as principle components factor analysis in the analysis of questionnaire responses, there is some question as to the validity of this method in replicability studies (Richardson 1990a). The author therefore chose the preferential common factor analysis which is concerned with the variance that is common to variables making up sub-scales, rather than simply to all variables in the data set. This helps to allay the criticisms of earlier factor analysis studies (cf. Clarke 1986) set out by Richardson (1990a).

Following Entwistle and Tait's research reported above four factors were expected to be extracted from the data. However, there may be more or less factors to which the Nottingham data is related. In order to establish how many factors to extract there are some rules that can be applied (cf. Richardson 1990a). Currently the most common of these is to extract the number of factors whose *eigenvalues* are greater than one. This rule has attracted an increasing amount of criticism, so in preference the *Scree Test* (Youngman 1979, Child 1990, Richardson 1990a, Tait 1992) was used in this study whereby the *latent roots* or eigenvalues are plotted against the number of factors present in the data set to produce a Scree Plot as in figure 4.2.

From the plot below it can be seen that the so called 'scree' starts after factor number four where the curve begins to straighten out. The kink in the curve

[9] Entwistle and Tait (in preparation) have since revised the scale constructs of the RASI in order to address the failure of the motivational aspect of Strategic Approach to load significantly on the factor. This has resulted in the term 'Strategic Approach' being dropped altogether in favour of 'Organised Studying'. Effectively this is the narrowing of the Strategic Approach called for in the conclusions to this thesis and suggested independently of Entwistle and Tait's modifications.

following factor three is characteristic of scree plots and is helpful in determining the start of the scree as this kink appears about two or three factors before the scree begins (Child 1990). This evidence would suggest that the Factor Analysis program should be run so as to extract not less than three and no more than five or six factors from the data.

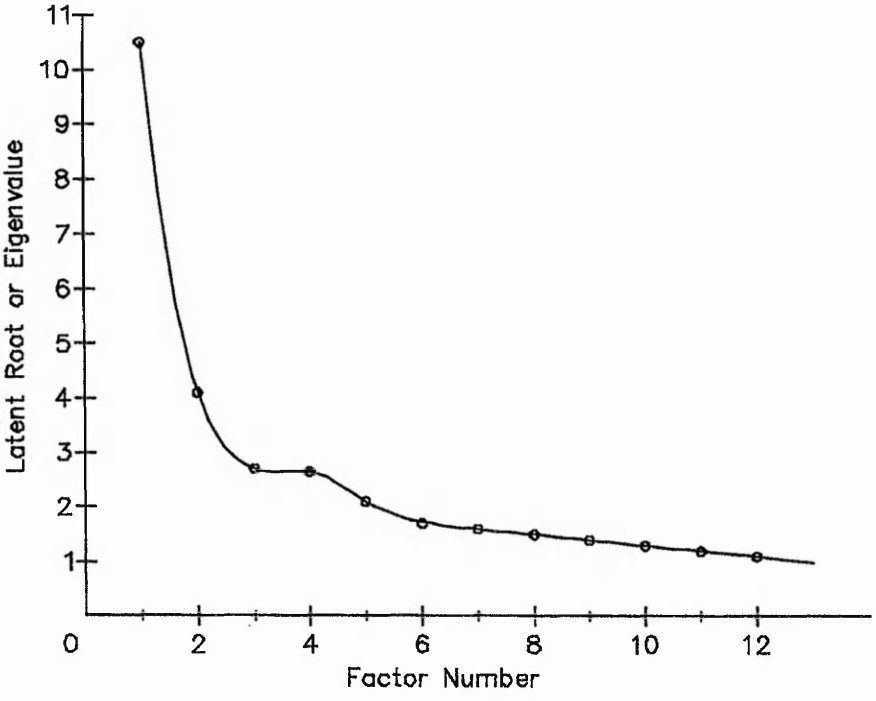


Figure 4.2 Scree Plot for the Nottingham RASI Data

The most appropriate number of factors turned out to be four as expected[10]. Three factors over compressed the data, five factors produced similar results to the four factor matrix, and six factors fragmented the data. Thus the analysis was set to four factors and then the variables within the RASI correlated against these factors. This correlation between the variable and the factor concerned and is known as the *factor loading*. Just as in other correlations this loading can range between -1 and +1 and it is important to determine which factor loadings are significant to be thereby known as *salient loadings*. Many researchers use a 'rule of thumb' to determine salient loadings and will generally choose a figure of plus or minus 0.3, there is however a mathematical determination that takes the

[10] Even though it seemed appropriate to extract four factors from this data which are presented here in the main text, care was taken to range the number extracted to see if this produced notable differences.

number of variables into account. This is the Burt-Banks formula (Child ibid) which involves initially determining the significance level for correlations within populations and then correcting this number for each of the factors obtained. Initial significance for different sample sizes can be obtained from an appropriate ready-reckoned table. The salient loading for this study is in the range 0.16 to 0.2. This is below the rule of thumb value of ± 0.3 and is such because of the large number of cases studied. For the purpose of this study therefore, it is reasonable to set the salient loading at ± 0.2 and therefore factor loadings of ± 0.2 could have been reported. However, it is noted that many researchers would prefer to report loadings above the ± 0.3 level or even ± 0.4 as frequently used by Richardson (1990a, 1993, 1995), largely because of the relatively low numbers of cases in his studies.

Other considerations made in this study, related to aspects of Factor Analysis, are the *method of rotation*, the type of *factor matrix* that is reported and the *percentage of the variance* extracted. The method of rotation can be *Varimax*, an orthogonal rotation implying that there is evidence to suggest that the factors are not correlated and thereby independent of each other (cf. Biggs and Rihn 1984), or more appropriately here, *Oblimin* which is an oblique rotation used to take into account the likely inter-correlations between the various RASI scales, after all, it is likely that different Approaches might well be produced by 'overlapping psychological processes' (Richardson 1990a, Meyer and Parsons 1989). Once extracted, factor analysis matrices reveal correlations between each of the inventory variables or groups of variables and the factor. The resulting matrix is known as the *factor structure matrix* and/or relational coefficients known as the *factor pattern matrix*. It is this latter matrix that is generally reported.

When reported, factor analyses refer to the *percentage of variance* extracted as already mentioned. This figure gives some idea of the contribution of the factors in explaining the total variance in the population (Child op cit). The closer this figure is to 100% the better. However this is only a real concern when dealing with principal components analysis rather than the common factor analysis reported here, as common factor analysis reveals the percentage of variance associated with one or more variables.

Entwistle and Tait's study in Edinburgh (1993) identified a four factor structure for the RASI. Their results have already been described in table 4.1. The results from this Nottingham study, carried out in the same way as Entwistle and Tait's (1993) are presented below in table 4.2 for comparison with that matrix.

Table 4.2 Oblimin Analysis Matrix for the 60 Item RASI (all full-time and part-time students)

	F1	F2	F3	F4	Alpha
Deep Approach					**.83**
Intention to Understand	.	.	.	79	.47
Active Learning	.	.	.	67	.60
Relating Ideas	.	.	.	81	.55
Use of Evidence	.	.	.	70	.63
Surface Approach					**.78**
Intention to Reproduce	.	.	69	.	.38
Passive Learning	.	.	62	.	.45
Unrelated Memorising	.	.	74	.	.58
Fear of Failure	.	.	70	.	.74
Strategic Approach					**.80**
Intention to Excel	.	.	.	43	.42
Alert to Assessment Demands	.	55	.	.	.65
Study Organisation	.	75	.	.	.56
Time Management	.	75	.	.	.75
Apathetic Approach					**.81**
Lack of Direction	.	-52	51	.	.62
Lack of Interest	.	-42	52	.	.76
Academic Self Confidence	.	.	-97	.	**.70**

Factor Correlations

	F1	F2	F3
F2	-.4		
F3	.4	.0	
F4	-.3	.5	-.3

Maximum Likelihood Oblimin Factors explained 60% of the variance. Loadings below 0.3 are omitted. Decimal points removed. Alpha refers to Cronbach's Alpha for each of the scales and sub-scales, n = 567 (representing all full-time and part-time students).

The Cronbach alpha values reported in table 4.2 are very similar to those reported from the Edinburgh study. If anything the Intention to Reproduce figures are slightly better. From these figures the reliability in respect of internal consistency of the inventory can be taken as suitable for the purposes of this research.

The factor structure in table 4.2 is relatively clear, but there are problems for a few of the sub-scales. Tait (1995) suggests that the evidence for Apathetic existing totally separately is 'rather weak' and that 'conceptually it is rather similar to a reversed Strategic Approach'. This seems to be evident in the negative figures loading on F2. Likewise, the loading of Apathetic sub-scales on the Surface factor (F3) also makes sense. In future though, interpretations involving the Apathetic sub scales will need to be evaluated carefully considering the split loading and the

failure to load on a discrete factor. This is though, not such a concern as the Intention to Excel loading. It was expected that this would form part of the Strategic factor (F2), indeed that this would *define* the Strategic factor in so far as this sub-scale represents the motivational element of the Strategic Approach. Care will need to be taken when interpreting results around this scale.

Table 4.3 Varimax Analysis for the 60 Item RASI

	F1	F2	F3	F4
Deep Approach				
Intention to Understand	.	.	.	77
Active Learning	.	29	.	68
Relating Ideas	.	.	.	79
Use of Evidence	.	.	.	71
Surface Approach				
Intention to Reproduce	.	.	69	-39
Passive Learning	.	.	66	.
Unrelated Memorising	.	.	75	.
Fear of Failure	.	.	67	.
Strategic Approach				
Intention to Excel	.	35	.	45
Alert to Assessment Demands	.	67	.	29
Study Organisation	.	75	.	.
Time Management	.	75	.	.
Apathetic Approach				
Lack of Direction	.	-54	55	.
Lack of Interest	.	-46	56	.
Academic Self Confidence	97	.	.	.

Varimax Orthogonal Factors explained 60% of the variance. Loadings below 0.3 are omitted. Decimal points removed. n = 567 (representing full-time and part-time students).

To further check the structure obtained from oblique rotation of the Nottingham data a Varimax factor matrix was also extracted (table 4.3). This is justified in that while the oblique, oblimin rotation is commonly used in the construction of scales, when trying to replicate factor structures the need for greater demarcation may be called for. Youngman (1979) says that '...the need to maximise differences adds weight to the use of orthogonal techniques in cognitive structuring' - the identification of differences in student cognitive processes being central to the aim of this research. The resulting factor matrix can be seen above where there is again a clear loading on the Deep and Surface Approaches. Likewise the Self

Confidence scale is well defined. The Strategic scale loads separately on a factor though two of its sub-scales load positively on the Deep factor. The Apathetic scale loads negatively on the Strategic factor and positively on the Surface factor.

This Varimax factor structure identifies Approaches to Study from the data in a very similar pattern to the previous Oblimin one. Both extractions and rotations fit a recognisable conceptual model of learning. Strategic and Deep learning are intercorrelated and Apathetic is negatively and positively correlated as might be expected with other scales. This pattern fits the Approach to Study paradigm so far described. The Strategic variables are associated with more than one factor. They load on their own factor (F2), but are also clearly linked to the Deep factor (F4). This may suggest that there is a link between the Deep and Strategic Approaches within the Nottingham data. Negative loadings for Apathetic on the Strategic and Deep factors might be expected and are present. The spread of data is expected given the use of Varimax rotation. Imposing such a solution will spread variance across the extracted factors and will tend to sacrifice the simple structures found in the Oblimin solutions. For these reasons the Varimax solutions are not pursued any further.

4.6 Assessment Outcomes and the RASI Factor Structure

At the end of the 1992-1993 academic year of the 567 students profiled, 509 full-time students originally profiled using the RASI completed their end of year assessments. These marks were quantified using a five-point scale and included in a new set of factor analysis matrices to in an attempt to discover if Assessment Outcome was linked to any of the factors already identified. This would help reveal any links between Assessment Outcome and Approach to Study taken, and help support any arguments surrounding hypothesis two: *A Deep Approach to Study is a requisite for success at academic study as measured by formal methods of assessment.* The first of these matrices is shown overleaf.

Table 4.4 Oblimin Analysis Matrix for the 60 item RASI at the end of the 1992-93 academic year (full-time students).

	F1	F2	F3	F4
Deep Approach				
Intention to Understand	.	.	.	67
Active Learning	.	.	.	59
Relating Ideas	.	.	.	83
Use of Evidence	.	.	.	68
Surface Approach				
Intention to Reproduce	.	.	62	.
Passive Learning	.	.	60	-28
Unrelated Memorising	.	.	58	.
Fear of Failure	.	.	51	.
Strategic Approach				
Intention to Excel	.	.	.	38
Alert to Assessment Demands	.	30	.	28
Study Organisation	.	69	.	.
Time Management	.	71	.	.
Apathetic Approach				
Lack of Direction	50	.	.	.
Lack of Interest	91	.	.	.
Academic Self Confidence	.	.	-52	.
Assessment Outcome	.	29	.	.

Factor Correlations	F1	F2	F3
F2	-.4		
F3	.4	-.2	
F4	-.3	.5	-.3

Maximum Likelihood Oblimin Factors explained 48% of the variance. Loadings below 0.3 are omitted. Decimal points removed. n = 509 (full-time students only).

Entwistle and Tait (1993) maintain that one of the main reasons for redesigning the ASI to produce the RASI was in order to produce an instrument capable of identifying 'students at risk of failing'. In that respect and following arguments already discussed by Meyer and Parsons (1989), the ability or not of the RASI to identify differences in Approach profiles of passing and failing students within the Nottingham context, is legitimately part of these validation studies. In order to do this, three matrices were produced: Table 4.4 for the total full-time sample (n = 509), Table 4.5 for students classified as passing (n = 400), and Table 4.6 for those students within the sample classified as failed or referred (n = 109). Maximum Likelihood, Oblimin Rotation factor analysis was again used. Matrices

with four factors are reported as these offered the clearest structure based on scree tests. At five and six factors the pattern began to fragment.

In the first of these for the whole sample as shown above in table 4.4, the previous factor patterns are repeated including the split loadings for Alert to Assessment Demands and the loading of Intention to Excel on the Deep factor. The sub-scales all load discretely on separate factors with the exception of Strategic as already discussed. A further variable entitled 'Assessment Outcome' has been added and this loads (weakly) on the Strategic factor (F2). This variable relates to a measure of attainment as described, in this case the overall aggregated mark for each student profiled at the end of the academic year 1992-1993.

The factor structure reported in table 4.4 above is similar to that from Edinburgh, with the Deep and Surface and Apathetic scales contributing to their respective factors (F4, F3 and F1). One of the Strategic sub-scales contributes to two factors. Strictly speaking one of the Strategic sub-scales fails to exceed 0.3, but Alertness to Assessment demands does just reach 0.3. This, and the loading on two factors is worrying for the integrity of this aspect of the Strategic scale. The Intention to Excel and Alert to Assessment Demands sub-scales load on F4, the Deep factor, while Alert to Assessment Demands also loads on an exclusive Strategic factor (F2) along with Study Organisation and Time Management as expected according to discussions already presented in the literature review. What would seem to be happening here is that the results focus on Study Organisation and Time Management as the core aspects of the Strategic scale. This is similar to the suggestions put forward by Trueman and Hartley (1994, 1994a).

Passing and Failing Students

Factor patterns within the matrix for passing students shown overleaf (table 4.5), are consistent with previous matrices loadings for Deep, Surface and Strategic. There is a lack of discrete loading for Apathetic. In this case the Apathetic variables load positively on the Surface factor. The Assessment Outcome variable loads on the Strategic factor as in table 4.4, and adds weight to the idea that students on these courses succeed in assessments by adopting some Strategic Approach variables in combination with other main scale variables. The loading of Assessment Outcome only on the Strategic factor in table 4.5 reinforces the idea that the students in this part of the study are concerned with Study Organisation, Time Management and an Alertness to Assessment Demands when attempting to pass assessments.

Table 4.5 Oblimin Analysis Matrix for the 60 item RASI at the end of the 1992-93 academic year (full-time, PASSING students).

	F1	F2	F3	F4
Deep Approach				
Intention to Understand	.	.	.	66
Active Learning	.	.	.	65
Relating Ideas	.	.	.	89
Use of Evidence	.	.	.	73
Surface Approach				
Intention to Reproduce	39	.	31	.
Passive Learning	65	.	.	.
Unrelated Memorising	.	.	62	.
Fear of Failure	.	.	76	.
Strategic Approach				
Intention to Excel	.	.	.	37
Alert to Assessment Demands	.	32	.	32
Study Organisation	.	68	.	.
Time Management	.	88	.	.
Apathetic Approach				
Lack of Direction	.	-35	37	.
Lack of Interest	.	.	49	.
Academic Self Confidence	.	.	-52	.
Assessment Outcome	.	36	.	.

Factor Correlations	F1	F2	F3
F2	.0		
F3	.4	-.4	
F4	-.1	.6	-.3

Maximum Likelihood Oblimin Factors explained 52% of the variance. Loadings below 0.3 are omitted. Decimal points removed. n = 400 (representing full-time passing students only).

Tait (1995) describes the Strategic loadings in table 4.5 as also demonstrating 'the deep/strategic nature of your students' and 'the common split of strategic between organised studying and 'cue consciousness'. This split is in evidence in the oblimin matrix where some variables indicate the organised nature of Strategic students while others, particularly those loading on the Deep factors (F4) may indicate an intention by students to pick up clues and cues regarding perceived tutor and assessment requirements. Only intercorrelated variables will appear on the same factors so it would appear that the Strategic Approach variable of Intention to Excel is correlated quite clearly with Deep Approach. This relationship may help explain the weak loading of Intention to Excel in the Edinburgh matrix and the factor correlations which are similar to those previously reported from Edinburgh.

Table 4.6 Oblimin Analysis Matrix for the 60 item RASI at the end of the 1992-93 academic year (full-time, FAILING students).

	F1	F2	F3	F4
Deep Approach				
Intention to Understand	.	.	.	55
Active Learning	-29	.	.	55
Relating Ideas	.	.	.	59
Use of Evidence	.	.	.	32
Surface Approach				
Intention to Reproduce	.	.	45	.
Passive Learning	.	.	52	.
Unrelated Memorising	.	.	88	.
Fear of Failure	.	.	66	.
Strategic Approach				
Intention to Excel	.	.	.	39
Alert to Assessment Demands	.	45	.	.
Study Organisation	.	93	.	.
Time Management	.	70	.	.
Apathetic Approach				
Lack of Direction	54	.	.	.
Lack of Interest	81	.	.	-28
Academic Self Confidence	.	.	.	.
Assessment Outcome	-34	.	.	.

Factor Correlations	F1	F2	F3
F2	.0		
F3	.4	-.1	
F4	-.1	.2	-.2

Maximum Likelihood Oblimin Factors explained 57% of the variance. Loadings below 0.3 are omitted. Decimal points removed. n = 109 (representing full-time failing students only).

Table 4.6 above, the matrix for failing students, still has discrete loadings for the scales on separate factors, in fact these are very well demarcated. This contrasts markedly with results obtained by Meyer (Meyer and Parsons 1989, Entwistle Meyer and Tait 1991) who found almost uninterpretable factor patterns for failing students when using the ASI. This may help support an argument for RASI being a more robust instrument than the ASI, defending the RASI from some of the criticisms previously levelled at the ASI by Meyer (ibid) and Richardson (1990a).

Table 4.6 shows the Assessment Outcome variable loading negatively on the Apathetic factor (F1) rather than positively on the Strategic factor as in the matrix for passing students. This is explained in that students passing the course display

Strategic variables of Time Management and Study Organisation towards assessment so it is reasonable to expect those failing to adopt the opposite to this, that is an Apathetic or dis-organised study orientation which in turn would correlate with a poor assessment outcome. This is the case in the 'failing' matrix above with Lack of Direction and Lack of Interest correlating negatively with Assessment Outcome.

Overall, the factor matrices for passing and failing students are quite similar in structure although significant differences in Study Organisation and Time Management are suggested. This would tend to suggest that the results from the Nottingham data have these two variables as core aspects of the Strategic Approach to Study scale. This conclusion is supported in the literature where, for example (Van Overwalle 1989, Macan et al 1990, Britton et al 1991, Tait 1992, Trueman and Hartley 1994, 1994a, Hartley 1995, Richardson 1995) there is some suggestion that Organisation and Time Management play a large part in the Strategic scale and correlate positively with academic performance. Indeed the matrices reported above, lead toward a more specific notion of academic success that is associated locally with being organised and effectively managing one's time and study. Within all of the factor solutions presented here the Organisation and Time Management scales define the Strategic factor prompting questions as to what this scale is actually measuring. It would seem that an answer at least in part, is found in Time Management and Organisation being more a matter of skill than of motivation. This may now have implications for the validity of the Strategic Approach scale, as the motivational element by which it defined in the literature does not appear to be associated with the other constituent sub-scales.

4.7 Summary

Practical and methodological considerations resulted in the use of the RASI in the study this thesis reports. The RASI has been developed over a considerable period of time using constructs of learning as described in the literature review. Factor analysis has repeatedly been used by Entwistle and other researchers to examine the validity of the ASI in differing contexts. Some of this factor analysis has been replicated to confirm the validity of the RASI as a broadly suitable instrument for identifying student Approaches to Study within the context of the Nottingham study. The Cronbach's Alpha values established the internal reliability of the RASI for the data collected in Nottingham. However, there are clearly, following the analyses above some concerns regarding the broad nature of the Strategic Approach to Study as it stands within the 60 item RASI, the position of motivation

within this scale, and a suggestion that this scale should be narrowed to focus more specifically on the organised study methods it seems to be most adept at profiling. This aspect of the Strategic scale is again discussed later in this thesis.

Replicating the factor analysis done in Edinburgh confirms that the RASI was adequately suited for the intended purpose, but any findings associated with the Strategic scale should be interpreted with a certain amount of caution, and possibly in relation to the individual variables rather than the sub-scales. Table 4.2 confirms this and is further supported by tables 4.4 - 4.6 all of which produce similar results in respect of differentiated groups of students. With respect to these, it was concluded that within the context of this study, the RASI was measuring the scales and sub-scales as intended by Entwistle and Tait with the exception of the Intention to Excel (and thereby the motivational sub-scale of the Strategic Approach to Study) and the Apathetic Approach sub-scales. These sub-scales do not load on either their expected or discrete factors. This is acceptable for the Apathetic Approach given its similarity to a reversed Strategic Approach and the associations that might be expected between Apathetic Approaches and a Surface Approach. It is not acceptable for Strategic sub-scale, particularly in the light of criticism from elsewhere (cf. Meyer and Parsons 1989, Richardson 1990a, 1993, 1995b).

It can be seen from the comparative factor pattern matrices that the RASI as used in this study is broadly replicating the structure found by Entwistle and Tait (1993). The factor analysis results confirm the presence of four main factors within the Nottingham data. The factors exist independently apart from the Deep and Strategic factors which tend to show some overlap. This would suggest that for the students sampled, the motivational element of a Strategic Approach to Study is seen more as a Deep Approach characteristic. This leaves the construct of the Strategic Approach open to some question. However, these findings are somewhat out of context without knowing how they associate with a measure of academic attainment.

For this reason further matrices were extracted for students passing and failing or 'at risk of failing' their respective courses which include a variable, 'Assessment Outcome'; an indicator of the relative academic success of students. Those students described as failing were those who had withdrawn, had outright failed, or who had been referred. Those passing had reached a mark of above 40 percent and could not be described as 'at risk of failing'. The RASI is successfully identifying differences in factor structure between students passing their course and those 'at risk of failing' their course of study in the Faculty of Engineering and

Computing. Students passing the course would seem to utilise more appropriately the skill elements of the Strategic Approach when dealing with assessment than those that fail. Those failing are tending towards an Apathetic Approach which conceptually can be viewed as a negative Strategic Approach. The other Approaches do not seem to be as instrumental in Assessment Outcome loadings, suggesting that: (i) some aspects of the Strategic Approach are influential determining student success or failure, and more worryingly, (ii) that the assessment system at Nottingham is not being seen by students to be rewarding the preferable Deep Approach to Study.

Differences were also evident in the factor correlations between the matrices for passing and failing sub-groups, notably for example, the correlations between Strategic and Surface and Strategic and Deep. In the matrix for the failing students (table 4.6) the correlations are less than half the value of those in the matrix for passing students (table 4.5). The passing students display a strong (0.6) positive correlation between Strategic and Deep and a moderate (-0.4) negative correlation between Strategic and Surface. These are reduced to 0.2 and to -0.1 respectively in the failing student matrix. It can be argued therefore that those students failing have less defined profiles than those who are passing the course as if they are finding it difficult to establish themselves appropriately. These failing students seem to be unable or unwilling to find the Strategic Time Management and Study Organisation links between their endeavours and Academic Outcome. This reflects the findings of Meyer et al (1989, 1990) and Meyer (1991) who found similar disintegrated patterns within data-sets from failing students. However, the fact that the solutions presented here are at least interpretable (Meyer's (op cit) were completely uninterpretable with no recognisable pattern to factor loadings) may suggest that the RASI has a greater degree of internal reliability than the old ASI on which Meyer (op cit) and others (Watkins 1986, Clarke 1986, Newble & Clarke 1987, Newble et al 1988, Harper and Kember 1989, Trigwell and Prosser 1991) have based their replicability studies.

A notable difference between the matrices for passing and failing students is in the loading of the Apathetic Approach. As in matrices for the entire population, the matrix for the failing sub-group loads Apathetic on its own factor. However, in the case of passing students, Apathetic loads on the Surface factor along with negatively correlated Academic Self Confidence. For the whole population, Assessment Outcome, Time Management and Study Organisation were found to load on the Strategic factor. Likewise, students passing the course have a factor matrix with Assessment Outcome also loading on these elements of the Strategic

factor. The correlations between Strategic variables and Assessment Outcome reported in the factor matrices is largely accounted for by the differences in Study Organisation and Time Management variables. This may indicate where future work might resolve some of the inconsistencies in the robustness of the Strategic Approach scale within the RASI; devising scales specifically concerned with Time Management and Study Organisation could be argued to be the best way forward in this respect. This might be done by building in constructs established in other areas of cognitive psychology (cf. Richardson 1992, Trueman and Hartley 1994, 1994a). This would provide a construct of the Strategic Approach that is perhaps more appropriate to Engineering Education than that presently available. Some examination of these issues is beginning to emerge in the literature (cf. Romainville 1994, Cliff 1995) and most interestingly in a paper by Dyne et al (1994) which is discussed in the literature review. Likewise, further research could (should?) now be pursued to question the composition of the sub-scales of the RASI in terms of their constituent items.

In this study, factor analysis and particularly the factor comparison of passing and failing students has revealed evidence of discrete, local patterns of learning within the Faculty of Engineering and Computing. These patterns make psychological sense within the context they emerge from. This is not always the case, as Shackleton and Fletcher (1984) suggest:

> *In factor analysis, as in other topics of psychology, we find that there is no clearly defined answer or best way of doing things. One of the main reasons why there are disagreements about the nature of intelligence or about the number of dimensions which describe personality, is because the number of factors revealed depends on the different factorial techniques used and the number and variety of tests which an investigator subjects to factor analysis... Factor analysis exposes the myth that science is objective and neutral.*

The arguments in this chapter maintain the exposure of Shackleton and Fletcher's (ibid) 'myth' and it would appear that the author, just as other researchers have, is now forced into the subjective interpretation of research outcomes based on the literature and the model of student learning explicit in this thesis. This sees the students reported in this research, as being broadly dependent on either the Apathetic or Strategic Approaches and specifically on Time Management and Study Organisation variables for their academic success within the Faculty of Engineering and Computing. In this respect, academic success can be seen to be less influenced by adoption of either Deep or Surface Approaches and more

influenced by organisational skills. To the author this should be seen as a major concern, as one would have hoped for an assessment system that promotes a Deep Approach to Study. It seems from the evidence so far that students can succeed in assessment at Nottingham by adopting either Deep or Surface processes, and that more of a controlling factor in success is the ability to be organised or not. This argument is strengthened when one considers the Apathetic Approach to be a negative Strategic Approach. In this format, the Strategic/Apathetic Approach continuum and the point at which a student can be placed on it will, to some extent, be indicative of his or her success or failure. This is disappointing considering the huge amounts of literature available supporting the outright need for a Deep Approach to study in achieving meaningful understanding of a subject as discussed in the literature review. It would seem that the assessment and teaching within the Faculty is implicity rewarding effective organisation and time-management as successful skills above and beyond the more desirable intentions and strategies inherent within the Deep Approach to Study.

Subsequently, following the analysis reported here, and further work done in Edinburgh (Entwistle and Tait in preparation) which included the Nottingham data, these scales have been modified to reflect some of the conclusions above. The latest version of the RASI now contains a skill based scale, no longer referred to as the Strategic Approach to Study in favour of a new term 'Organised Studying'. This scale has had the motivation and cue seeking items removed and is made up of four sub-scales: Alertness to Demands, Study Organisation, Time Management and Specific Study Skills. Each of these sub-scales have produced factor loadings on a discrete factor of 0.44, 0.69, 0.73 and 0.46 respectively based exclusively on an engineering sample (Entwistle and Tait ibid). It can therefore be argued that the author's suggestions above have been supported, and that what was previously described as a Strategic Approach to Study within the RASI used in his research is indeed measuring (largely) Time Management and Study Organisation differences. While in itself this is interesting and impacts significantly on interpretation of findings involving the Strategic Approach in this study, it is also important to realise the implications for the Strategic Approach generally within the literature. These findings may also indicate a future need for inventories of student Approaches to Study to be constructed so as to be subject or context specific. In this respect, the constructs of Approaches to Study may be significantly altered by the nature of the context they are meant to relate to (cf. Johansson et al 1985, Ramsden 1988a, 1992, Sparkes 1989, Meyer and Sass 1993)

5.0 Data Presentation

5.1 Introduction

The Revised Approach to Study Inventory was satisfactorily completed by 573 students from the Faculty of Engineering and Computing at the start of the 1992 academic year. This was later reduced to a total sample size of 567, with the removal of 6 Microelectronic student profiles as these only represented a small proportion of the total Microelectronics course. The following chapter presents statistical summaries and some initial analysis of the data set. Each course is designated by an alpha-numeric code. The codes are as follows:

1	COMP SYS.	BSc (Hons) Computing Systems.
2	MECH ENG.	BEng (Hons) Mechanical Engineering.
3	INTE ENG.	BEng (Hons) Integrated Engineering.
4	ELEC ENG.	BEng (Hons) Electrical Engineering.
5	MANU ENG.	BEng (Hons) Manufacturing Engineering.
6	COMP STU.	BSc (Hons) Computer Studies.
7	INDU MAN.	BSc (Hons) Industrial Management.

All students surveyed were from the first year cohort with the exception of Integrated Engineering as described in the previous chapter. Here students were surveyed from the first, second and third years and also from the part time course to provide direct comparisons between Integrated Engineering students either exposed or not exposed to the learning to learn workshops. In the following figures the full-time year two Integrated Engineering cohort is denoted as 3a and the final year as 3b. The part-time cohorts are denoted 3c, 3d, and 3e for years two, three and four respectively.

This chapter presents the data obtained following the activities described in chapter three, the data collection and research stages. The nature of the raw data acquired using the RASI is such that some initial work is needed to establish at which point a student can be described as taking one Approach to Study in preference to any others. The first part of this chapter therefore presents some initial Approach to Study distributions and then describes a technique used to establish local (based on the Nottingham data) norms for the RASI data.

5.2 RASI Main Scale Summaries

Table 5.1 reports the results for the Deep Approach scale. The number of profiles obtained by the author are indicated in the table. The percentage of the total course population these relate to is shown under the column '% of Pop'. The Approach mean scores for all the courses appear similar to each other. However, there are some exceptions, notably Industrial Management with a lower mean score and a wider spread of data, and Integrated Engineering with a higher score and a relatively narrow spread of data. Significance figures are not calculated for these tables. Comparison of means is shown separately within chapter six.

Table 5.1 Summaries of the Deep Approach scale means.

Summaries of DEEP APPROACH	Mean	Std Dev	% of Pop	Cases
For Entire Population	56.1	9.4	85	567
1 COMP SYS	56.8	9.8	87	96
2 MECH ENG	56.3	9.7	74	74
3 INTE ENG (inc a,b,c,d,e)	57.9	7.9	94	186
4 ELEC ENG	56.4	9.9	79	78
5 MANU ENG	55.9	9.2	88	40
6 COMP STU	57.4	8.9	92	39
7 INDU MAN	51.9	10.5	84	54

These differences may be explained by local conditions, for example, Integrated Engineering is reported here as one cohort although it actually comprised of all first and second year full-time students as well as all the part-time students.

Industrial Management is known to recruit some students with a strong interest in Business Studies. The first year of Industrial Management involves a significant amount of engineering studies and this may be contrary to these students' expectations. They may therefore be less inclined to adopt a Deep Approach to their studies. These and other details associated with the spread of data warrant further investigation and are discussed in due course. However, at this stage there is more concern with describing the data. Tables 5.2, 5.3 and 5.4 describe the results for the other Approaches means studied in this research.

Table 5.2 Summaries of the Surface Approach scale means.

Summaries of SURFACE APPROACH	Mean	Std Dev	Cases
For Entire Population	48.1	9.2	567
1 COMP SYS	46.8	11.4	96
2 MECH ENG	49.5	7.9	74
3 INTE ENG (inc a,b,c,d,e)	47.8	9.5	186
4 ELEC ENG	48.5	10.2	78
5 MANU ENG	47.9	7.5	40
6 COMP STU	46.7	9.1	39
7 INDU MAN	49.4	8.9	54

Table 5.3 Summaries of the Strategic Approach scale means.

Summaries of STRATEGIC APPROACH	Mean	Std Dev	Cases
For Entire Population	55.1	9.7	567
1 COMP SYS	54.8	9.5	96
2 MECH ENG	54.9	10.3	74
3 INTE ENG (inc a,b,c,d,e)	55.2	8.4	186
4 ELEC ENG	56.2	9.7	78
5 MANU ENG	57.5	10.2	40
6 COMP STU	52.5	10.7	39
7 INDU MAN	54.4	9.1	54

Table 5.4 Summaries of the Apathetic Approach scale means.

Summaries of APATHETIC APPROACH	Mean	Std Dev	Cases
For Entire Population	16.2	6.2	567
1 COMP SYS	17.1	6.7	96
2 MECH ENG	16.1	6.2	74
3 INTE ENG (inc a,b,c,d,e)	16.1	5.7	186
4 ELEC ENG	15.0	5.7	78
5 MANU ENG	15.4	5.9	40
6 COMP STU	16.5	6.6	39
7 INDU MAN	17.2	6.4	54

5.3 Proportions of Approaches to Study within cohorts.

Cumulative frequency tables were computed for the main scales of the RASI profiles obtained from the 1992 cohort. This produced extensive numerical data. To report this sensibly, and in order to establish the point at which students could be described as taking one Approach or another, it was important to calculate norms for each of the main scale approaches, so as to provide the range of potential scores within which specific Approach means could be categorised.

There are to date no established national norms from other studies or research data based on the RASI. To establish local norms based on The Nottingham Trent University sample, the frequency plots were analysed so that discriminatory values could be established for each main scale. Thus a student could be placed in either a *very low, low, moderate, high,* and *very high* degree of Approach to Study for each scale depending upon the score he or she achieved. This means that each student or each group of students can be further described for the level of Approach they adopt. This method of determining norms from percentiles is based on the way in which Honey and Mumford (1986) and Biggs (1987) and Kember et al (1995) reported their data. 'Very low' represents the lowest 10 percentile group, 'low' the 11-30 range, 'moderate' the 31-70 range, 'high' the 71-90 range and 'very high' the highest ten-percent. The percentiles and norms established are described below.

Table 5.5 Local Norm Values for the Main Scales of the RASI.

CATEGORY	V.LOW	LOW	MOD	HIGH	V.HIGH
DEEP	16-43	44-51	52-61	62-68	69-80
SURFACE	16-34	35-43	44-53	54-59	60-80
STRATEGIC	16-43	44-49	50-60	61-67	68-80
APATHETIC	8-9	10-11	12-18	19-24	25-40
percentile	< 10	11-30	31-70	70-90	> 90
percentage	30 Percent		40 Percent	30 Percent	

As can be seen the relative scores for each scale are described in table 5.5, the scales for Deep, Surface, and Strategic each having a potential score of between 16 and 80, and Apathetic having a potential scores of between 8 and 40. This means, for example, a student scoring 57 on the Strategic Main Scale would be considered as taking a moderate Strategic Approach, would be in the 31 to 70 percentile group along with 40 percent of the entire population. This proportion of 40 percent is indicated in the bottom row of table 5.5 and refers to the normal distribution of data. By aggregating the very low and low distributions, the number of students falling into this category will be 30 percent of the total population. Likewise, 30 percent of the population measured will fall into a combination of the high and very high categories.

Using these values and percentages, the frequency plots for each course were collapsed into low, moderate and high distributions to describe the prevalance of each Approach. Each table is labelled clearly for the Approach referred to. The figures under each of the category labels (Low, Mod and High) represents a

percentage of each course population, so for example, in table 5.6 below, Course 1 COMP SYS, has a profiled population of which 28.9% are reporting a low Deep Approach, 38.3% are reporting a moderate level of Approach, and 32.8% are reporting a high level of Deep Approach.

It appears from the Deep Approach table below that as a whole, relatively more students on the part-time Integrated Engineering course take a Deep Approach when compared to other courses in the faculty. However, this Approach declines significantly as students progress through the three years of the part-time course. Of the full-time courses, Industrial Management has relatively fewer students taking a Deep Approach. Part-time courses and the Industrial Management distributions appear to have a bias towards either low or high categories.

Table 5.6 Deep Approach distribution levels

Course Code	Low	Mod	High	Total	
1 COMP SYS	28.9	38.3	32.8	100.0	n=96
2 MECH ENG	38.0	35.3	26.7	100.0	n=74
3 INTE ENG	30.4	37.8	31.8	100.0	n=53
3a (Yr 2)	21.5	53.2	25.2	100.0	n=43
3b (Yr 4)	39.1	41.9	20.0	100.0	n=32
3c (PT Yr 2)	8.9	43.2	47.8	100.0	n=20
3d (PT Yr 3)	14.6	51.3	33.9	100.0	n=27
3e (PT Yr 4)	39.8	50.9	9.2	100.0	n=11
4 ELEC ENG	31.3	36.2	32.4	100.0	n=78
5 MANU ENG	31.1	35.2	33.6	100.0	n=40
6 COMP STU	29.1	44.7	26.1	100.0	n=39
7 INDU MAN	46.8	35.6	17.5	100.0	n=54

Concentrating on the figures for both modes of the Integrated Engineering degree reveals some concerns regarding a decline in Deep Approach over time. The proportion of the full time degree population (3 to 3b) and of the part-time degree population (3c to 3e) with low Deep scores can be seen to increase considerably over the three years studied. Conversely, the proportion of students from the same courses with high Deep scores can be seen to decrease considerably over time.

The Surface Approach table below (table 5.7) reveals normal or near normal distributions for most of the cohorts. Summing the moderate and high Surface percentage values of, for example, Mechanical Engineering, produces a figure of 80 percent. Eighty percent would seem to be a very high proportion of the students taking a Surface Approach and should be viewed with some concern. However, it would perhaps be more appropriate to first consider this score against the numbers

of students adopting a Deep Approach within the same course. These direct comparisons are reported later in this chapter.

Table 5.7 Surface Approach distribution levels

Course Code	Low	Mod	High	Total	
1 COMP SYS	29.2	39.4	31.4	100.0	n=96
2 MECH ENG	20.4	46.3	33.2	100.0	n=74
3 INTE ENG	23.5	50.9	25.6	100.0	n=53
3a (Yr 2)	23.8	29.7	46.4	100.0	n=43
3b (Yr 4)	19.2	60.1	20.7	100.0	n=32
3c (PT Yr 2)	33.4	42.2	24.2	100.0	n=20
3d (PT Yr 3)	34.5	36.9	28.4	100.0	n=27
3e (PT Yr 4)	37.8	38.8	23.2	100.0	n=11
4 ELEC ENG	26.7	35.5	37.7	100.0	n=78
5 MANU ENG	30.4	48.9	20.6	100.0	n=40
6 COMP STU	37.2	39.9	22.9	100.0	n=39
7 INDU MAN	23.3	40.2	36.5	100.0	n=54

Table 5.8 Strategic Approach distribution levels

Course Code	Low	Mod	High	Total	
1 COMP SYS	32.3	41.5	26.1	100.0	n=96
2 MECH ENG	36.1	32.3	31.5	100.0	n=74
3 INTE ENG	37.9	38.9	23.1	100.0	n=53
3a (Yr 2)	37.2	46.5	16.2	100.0	n=43
3b (Yr 4)	19.7	48.0	32.3	100.0	n=32
3c (PT Yr 2)	0.0	56.2	43.8	100.0	n=20
3d (PT Yr 3)	15.2	54.9	29.8	100.0	n=27
3e (PT Yr 4)	19.6	24.2	56.2	100.0	n=11
4 ELEC ENG	29.9	36.5	33.4	100.0	n=78
5 MANU ENG	27.1	30.5	42.3	100.0	n=40
6 COMP STU	44.5	30.9	24.5	100.0	n=39
7 INDU MAN	25.4	48.3	26.2	100.0	n=54

The Strategic table above shows balanced distributions with some obvious exceptions. It is worth noting the extreme levels of this approach indicated in courses 3c, 3d and 3e (part-time Integrated Engineering). Given that this is a part-time course, the students may be reacting with a mainly Strategic Approach in order to deal with the usual part-time study demands. The Integrated year two (3a) course has the lowest value for high Strategic approach, while the fourth year (3b) has the highest and these may be worthy of further investigation.

The Apathetic table also shows normal distributions. The distributions for 3b (Integrated Yr 4) and 3c (Integrated PT Yr 2) represent the extremities of distribution. These courses have distributions in the combined moderate and high

categories of 90.0 and 46.3 percent respectively. However, when the subsequent part-time years are examined it can be seen that the combined moderate and high distributions increase to give 68.7 (3d) and 75.7 (3e). This would seem to suggest an increasing Apathetic response with time in both Full and Part-time courses.

Table 5.9 Apathetic Approach distribution levels

Course Code	Low	Mod	High	Total	
1 COMP SYS	25.2	39.1	35.7	100.0	n=96
2 MECH ENG	30.1	42.4	27.5	100.0	n=74
3 INTE ENG	30.3	42.2	27.4	100.0	n=53
3a (Yr 2)	20.1	44.3	35.4	100.0	n=43
3b (Yr 4)	10.0	40.2	49.8	100.0	n=32
3c (PT Yr 2)	53.7	40.9	5.4	100.0	n=20
3d (PT Yr 3)	31.3	37.8	30.9	100.0	n=27
3e (PT Yr 4)	24.2	33.3	42.4	100.0	n=11
4 ELEC ENG	41.2	37.4	21.4	100.0	n=78
5 MANU ENG	41.5	33.2	25.2	100.0	n=40
6 COMP STU	36.0	33.3	30.6	100.0	n=39
7 INDU MAN	26.1	36.2	37.6	100.0	n=54

Biggs (1993) has suggested that the Surface Approach is seen as a learning pathology and that we should be concerned about those populations displaying this Approach at the expense of others. Likewise he (ibid) considers Strategic Approach to be a pathology but can be considered benign and less of a concern. In Biggs' (ibid) terms the preferential Approach is associated with the Deep scale. This is of course well documented in the literature as already reviewed. However, locally it would seem that refected in these distributions, the Strategic Approach or some components of it, are more controlling factors than the Deep Approach to Study as known under the constructs of the RASI. Again, as concluded in the Factor Analysis, it would appear that the context of engineering study at Nottingham is not implicitly encouraging a preferential Approach to Study.

5.4 Direct Comparisons of Courses

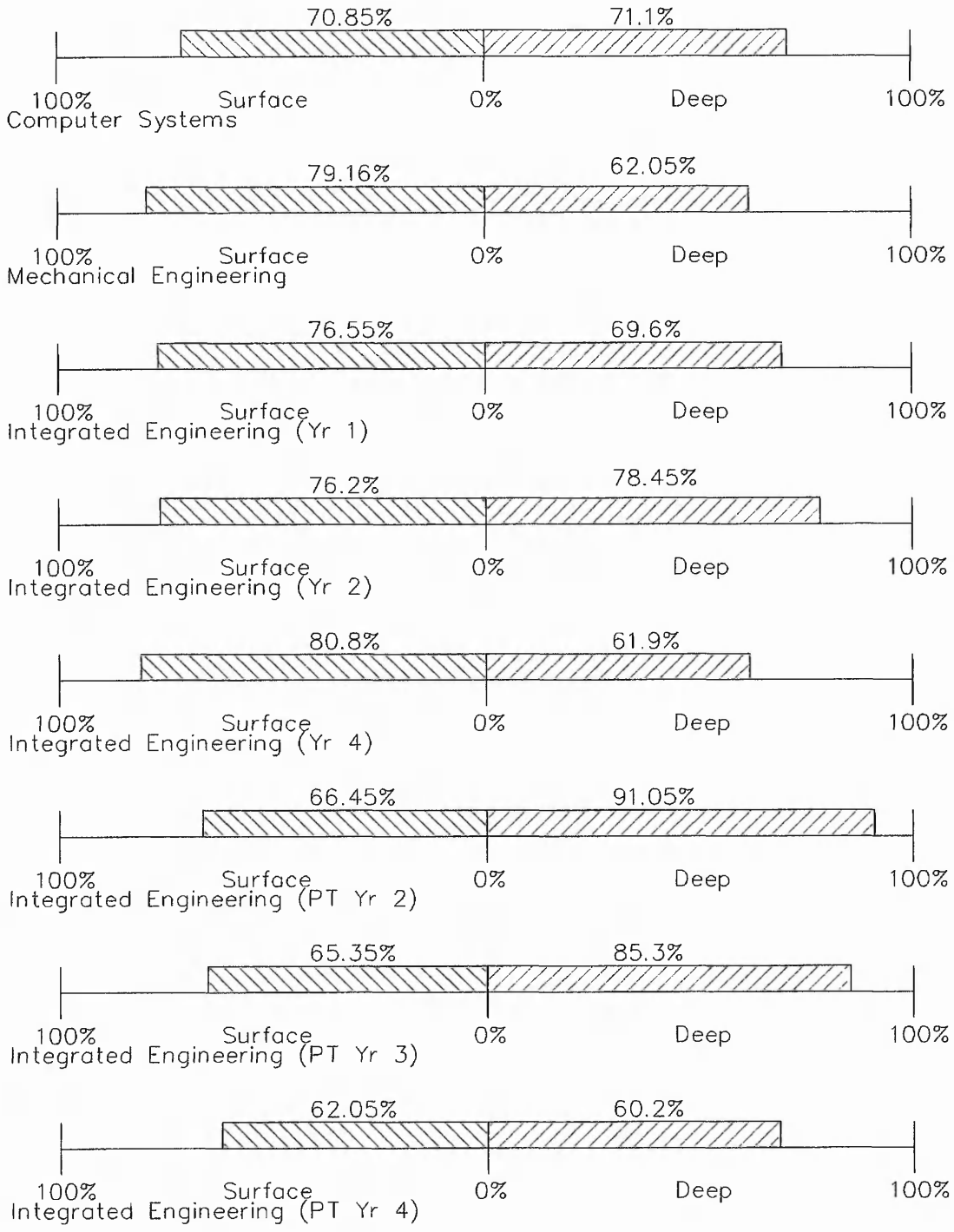
The combined high and moderate proportions reported in the statistics above may give an indication of prevalence of one Approach to Study or another. If for a moment Deep and Surface Approaches are considered to be at opposite ends of a continuum as Biggs (1993) and Eley (1992) suggest, then a direct comparison can be made between the percentage of students taking one Approach or the other.

The comparisons overleaf in figure 5.1 have been presented so as to show the distributions of students taking predominately Surface and Deep Approaches to Study within each course. Presented as a continuous line, the percentage of students adopting a moderate to high Surface Approach is to the left, and the percentage of students adopting a moderate to high Deep Approach is to the right.

Prosser and Trigwell (1990) also attempted to extract a measure of Approach variation between courses using the 1983, 64 item Approach to Study Inventory (Entwistle and Ramsden 1983). They argued that because each of the Approaches refers to unique sets of information about the learner, some overall measure or 'total indicator of study approach' would be useful. To do this they summed scores for high quality Approaches and divided this sum by scores for the low quality Approaches. They are quoted as saying:

> *A quotient rather than a subtraction was used because the Surface sub-scale (a component of the Reproducing Orientation scale) is a different dimension to the Deep and Relational sub-scales (components of the Meaning Orientation scale), and so should not be subtracted from those sub-scales.*

An alternative method to this was applied within the author's research by which a total indicator could be extracted from the *percentage distribution* of Deep versus Surface within courses rather than from the raw scores of individual students aggregated to a course level as in Prosser and Trigwell's (ibid) method. This is discussed on page 128.


70.85%
71.1%
100%
Surface
0%
Deep
100%
Computer Systems
79.16%
62.05%
100%
Surface
0%
Deep
100%
Mechanical Engineering
76.55%
69.6%
100%
Surface
0%
Deep
100%
Integrated Engineering (Yr 1)
76.2%
78.45%
100%
Surface
0%
Deep
100%
Integrated Engineering (Yr 2)
80.8%
61.9%
100%
Surface
0%
Deep
100%
Integrated Engineering (Yr 4)
66.45%
91.05%
100%
Surface
0%
Deep
100%
Integrated Engineering (PT Yr 2)
65.35%
85.3%
100%
Surface
0%
Deep
100%
Integrated Engineering (PT Yr 3)
62.05%
60.2%
100%
Surface
0%
Deep
100%
Integrated Engineering (PT Yr 4)

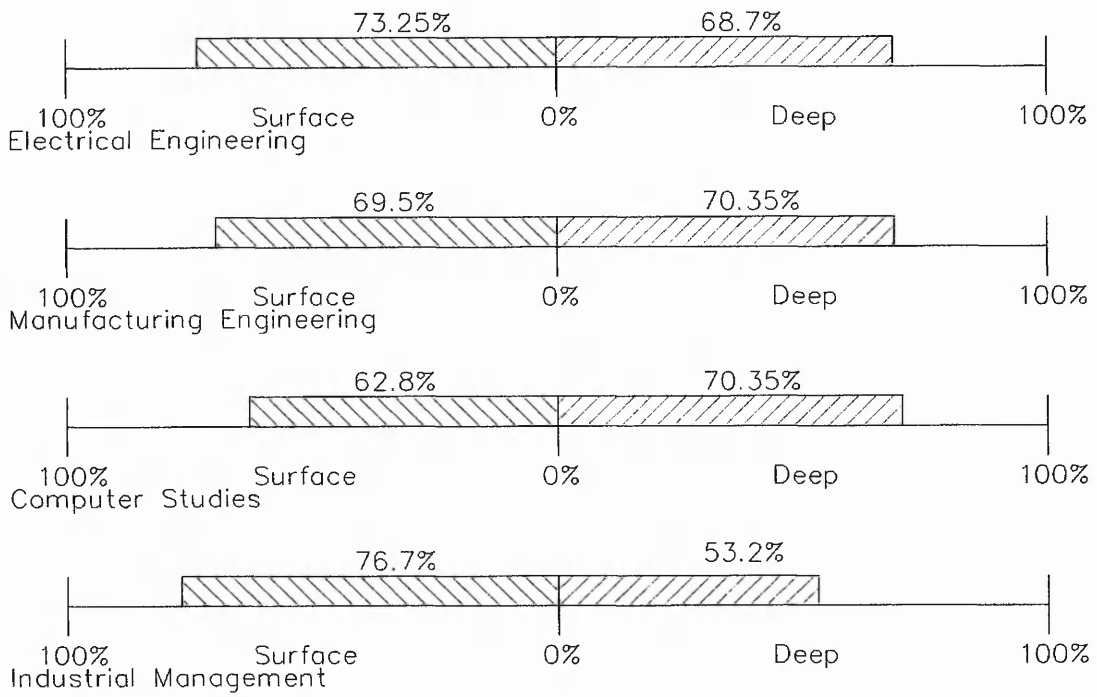


Figure 5.1 Individual Course Surface and Deep Distributions.

While the graphs above give a pictorial representation of Approach distributions, a more powerful indicator is produced when the Surface distribution values are subtracted from the Deep distribution values. The results from this for each of the courses and cohorts measured are reported in the table below. The course codes are indicated in the upper row and the indicators in the lower row of table 5.10.

Table 5.10 Deep minus Surface distribution values.

1	2	3	3a	3b	3c	3d	3e	4	5	6	7
0.2	-17.6	-7.0	2.3	-18.9	24.6	20.0	-1.9	-4.5	-0.6	8.1	-23.5

This technique provides indicators of which courses are populated by students who are tending to take a Surface Approach rather than a Deep Approach. In this respect, negative scores would indicate the population is tending toward a Surface Approach and positive scores indicate a Deep Approach tendency. From the basis

described above, it would be particularly interested in exploring the results for course 2 (Mechanical Engineering), 3b (Integrated Yr 4) and for course 7 (Industrial Management). These negative scores seem to be indicating populations which display a greater level of Surface Approach and its respective motivations than the others surveyed. Conversely, second year part-time Integrated engineers (code 3c) seem to display more of a Deep approach than any other course. However, the severe decline from that year through to the final year would also warrant investigation. Even so, those populations indicating a positive score should not be viewed as unproblematic, only that they are *relatively* better. Table 5.10 should only be viewed as an indicator, and more investigation is necessary to confirm the tendencies suggested here.

5.5 Summary

Identifying the distribution of Approaches to Study within different courses would begin to suggest how students are generally conducting themselves relative to those courses and their demands. The distribution tables revealed Approaches distributed fairly normally across all the courses, with some variation at an individual course level. This variation was manifest in that some courses would have extreme distributions of one Approach or another. To summarise this, the moderate to high Deep Approach distributions were compared with the moderate to high Surface Approach distributions to give an initial indication of which courses were forcing predominately Surface or Deep Approaches to Study. This produced some notable differences, particularly in relation to changes over time.

These course comparisons at this level ultimately may be of great consequence given similar findings of 'spirals of deteriorating study behaviour' (Cliff 1995) elsewhere (cf. Coles 1985, Newble and Clarke 1987, Griffiths 1992, Meyer and Sass 1993). Such findings were associated directly with course contexts; one the whole, problem-based and assessed courses fostering Deep Approaches while conventional courses foster Surface Approaches. As reported here, the Integrated Engineering seems to be implicitly encouraging a Surface Approach to Study over time. Considering also the factor analysis from the previous chapter, it would seem that assessment outcome is not associated with a Deep Approach. These findings in tandem can be argued to be of concern; most local courses do not seem to be promoting, eliciting and rewarding meaningful learning experiences.

6.0 Data Outcomes, Analysis and Discussion

6.1 Introduction

Chapter five presented the data to provide a 'map' of the differential Approaches to Study present within the Faculty of Engineering and Computing in November 1992. Some suggestions regarding the relationship between different groups of data results were also made. In this chapter a more rigorous examination of the data is offered, and the relationship between differentiated cohorts of students commented on. Although the intervention had three objectives specified in the literature review, the research reported here is concerned with just one:

> *To promote appropriate approaches to study by describing and explaining these different approaches, so as to help the student to adopt preferable approaches wherever applicable, and to see the implications of doing so.*

The hypotheses are related to this objective by assuming that impact on Approach to Study will be detected within the RASI statistics. The hypotheses are:

1. *Learning to learn workshops or similar material will have a positive effect on student Approach to Study.*

2. *A Deep Approach to Study is a requisite for success at academic study as measured by formal methods of assessment.*

3. *Students on the Integrated Engineering degree in this Faculty develop an appropriate Approach to Study as they progress through the course.*

4. *Students on the Integrated Engineering full and part-time degrees display a more appropriate Approach to Study than those on other degrees within the Faculty.*

5. *There are relative differences in Approach to Study between differentiated groups of students, eg male and female.*

This chapter discusses each of the research hypotheses in order. Statistical results are presented and discussed. Some discussions have evidence drawn from the qualitative research reported in chapter seven. Here students completed essays which reflected on their perception of Approaches to Studying First Year Integrated Engineering and on the consequences for their learning. Quotes from these essays are included in this chapter where appropriate.

6.2 Hypothesis One

Learning to learn workshops or similar material will have a positive effect on student Approach to Study.

As described previously, the 1992 first year Integrated Engineering students were asked to complete the RASI. These students were exposed to the learning to learn workshops during the course of teaching in 1992/1993. Those students who progressed to the second year of the degree were asked to complete the RASI again at the start of their new year of studies. Forty-one of the original 'learning to learn' students were still on the course at the start of the 1993-1994 academic year. Essentially therefore, a direct comparison is available by testing the hypothesis in relation to two dependent means. In doing so, the same students were surveyed for their Approach to Study before and then after the learning to learn workshops. In this situation the general *null-hypothesis* that there is no difference between the two matched samples is to be tested.

However, there is an opportunity here to be more specific about the general prediction of hypothesis one by specifying what changes in Approach are expected. Taking the literature so far discussed and assuming that meaningful learning should be the aim of educators and the educated at Nottingham, it can be argued that a 'positive effect' will be manifest by an increase in Deep Approach and a reduction in Surface Approach at both an individual and course level (cf. Marton and Saljö 1976, Biggs 1979, Laurillard 1979, Van Rossum and Schenk 1984, Prosser and Trigwell 1990, Trigwell and Prosser 1991, 1991a).

What direction and magnitude of change will constitute positive shifts in Strategic and Apathetic Approaches[11] is open to some discussion. Although positive correlations have been found between some (particularly skill) elements of what is described as a Strategic Approach to Study and academic outcome (cf. Norton and Hartley 1986, Van Overwalle 1989, Chambers 1992, Tait 1992, Eley 1992, Trueman and Hartley 1994, 1994a, Cliff 1995), no research was found which has reported on a direct relationship between this Approach and qualitative rather than quantitative outcomes.

Tentative associations have been suggested (Meyer and Parsons 1989, Dart and Clarke 1991, Tait 1992) that the absence of poor study methods (rather than the

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[11] Conceptually the Apathetic Approach may be considered a negative Strategic Approach (Tait 1992, 1995) and is treated as so within this discussion, however, clearly a drop in Apathetic Approach would be considered a 'positive effect'.

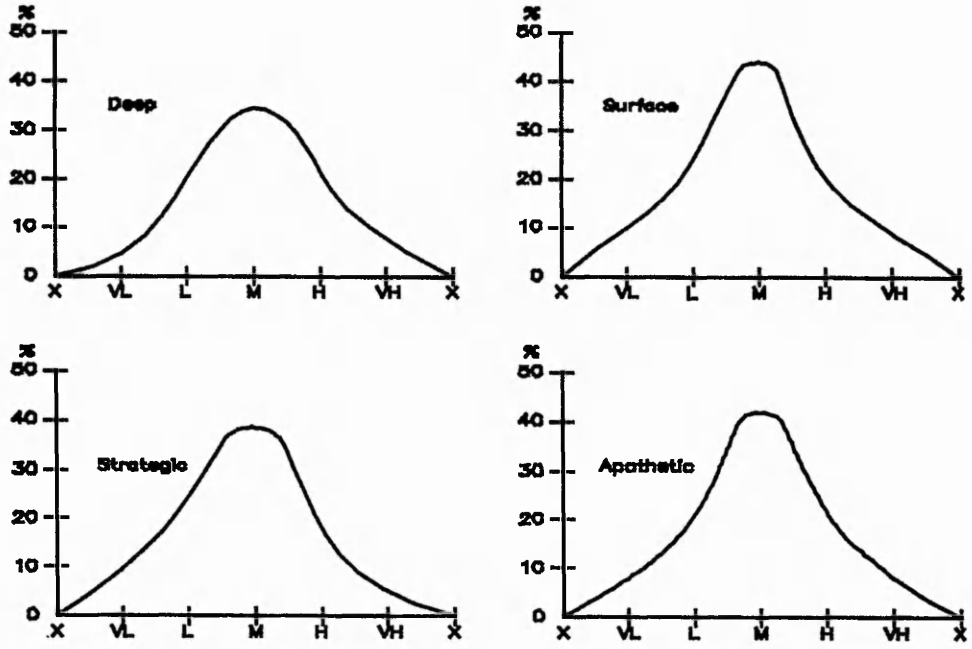
presence of particularly good study methods) coupled with the presence of Deep and Strategic Approaches will lead to higher outcomes. It is difficult to rationalise this within the arguments presented here, so it will be assumed, given the nature of engineering study (Sparkes 1989, Ramsden 1992) that a Strategic Approach is at worst, benign rather than pathological (Biggs 1993), and that in many respects, given the need for engineering undergraduates to organise large amounts of material, despite whether intending to understand or to reproduce, a element of Strategic Approach could even be argued to be beneficial. Overall then, it can be conceptually argued that the 'positive effect' referred to in the hypothesis may include an increase in Strategic Approach, and thereby a decrease in Apathetic Approach. However, there is one very important caveat adequately demonstrated by the findings of Ramsden et al (1986, 1987), which suggests that students only take from interventions that which they believe will be useful in respect of forthcoming assessment contexts. As Ramsden et al (1986) suggest:

> *...the special effort made in the learning skills groups appears to have achieved at best some strategic improvement in students' capacities to cope with assessment.*

This outcome could be only described as a positive effect should the assessment system be calling for a Deep Approach to Study. However, given the findings so far reported here, this seems very unlikely and it can be argued that a Strategic Approach within the context of the Nottingham data is likely to be associated with at worst a Surface Approach rather than the preferential Deep Approach. Norton et al (1995) have reported positive changes in Deep Approach following interventions, but in using only the Deep and Surface Approach scales have been unable to provide any direct evidence as to the relationship of these to the Strategic Approach. This would seem to offer further support for the need of Approach inventories to make some provision for profiling a Strategic Approach within certain contexts.

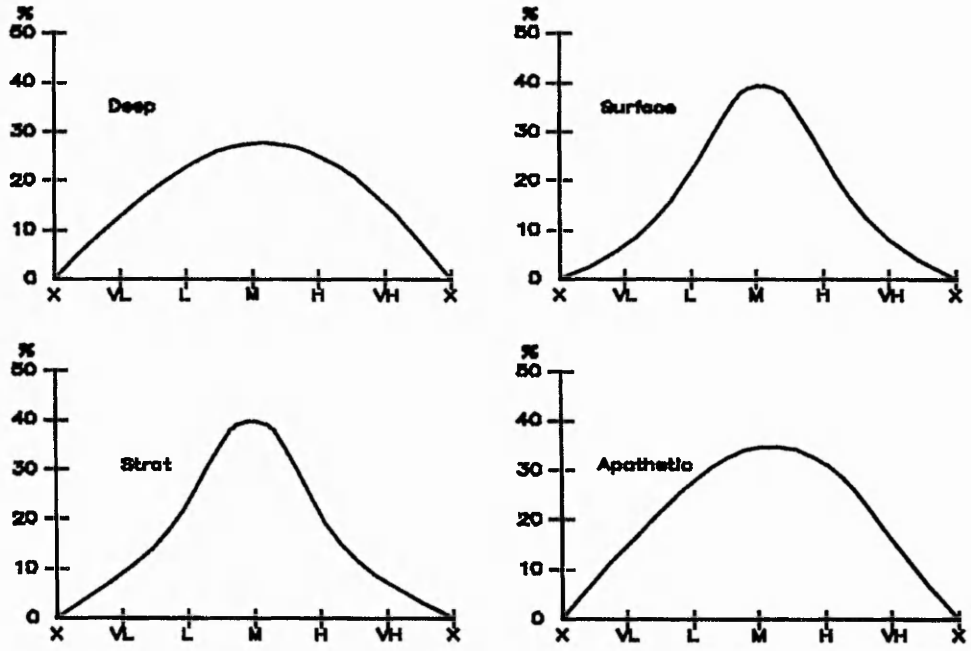
Following these discussions some predictions can now be made. It is expected that following the author's intervention, the participating students will produce RASI profiles that indicate an increase in Deep Approach, decreases in Surface Approach and Apathetic Approaches and either no change or an increase in Strategic Approach. Before moving on to the comparison of pre and post-intervention means, some examination as to the distribution of data is needed.

Frequency plot graphs as shown overleaf (figures 6.1 and 6.2) describe the distribution of data pre and post workshops.



KEY: VL = Very Low L = Low M = Moderate H = High VH = Very High

Figure 6.1 Approach Distributions by Percentage: Pre Workshops



KEY: VL = Very Low L = Low M = Moderate H = High VH = Very High

Figure 6.2 Approach Distributions by Percentage: Post Workshops

The sample groups were all above 30 and within normal distribution, allowing the use of the *paired-sample t-test* in analysis of differences in Approach means. Each frequency plot graph is labelled for the Approach it refers to. The Y axis indicates the percentage of the population adopting either a Very Low, Low, Moderate, High or Very High Approach to Study, which in turn are indicated on the X axis. There were a total of forty-one students who had completed the RASI in both years one and two of the Integrated degree.

6.3 Hypothesis One Results

Table 6.1 presents the results from paired sample t-tests for each of the main scales tested. These are reported according to convention set out by Healey (1990). The main scale means are indicated (MEAN), followed by their standard deviations (STD DEV), the difference between the two means (DIF), and then the level of significance (p) for the difference found; values of $p = < 0.05$ being described as 'significant' and $p = < 0.01$ as 'very significant'. Suffix 'Pre' indicates data taken prior to the learning to learn workshops; 'post' was taken after the workshops. All tests are two one-tailed according to the predictions made above unless indicated as two-tailed thus: [<>]

Table 6.1 Summaries of Paired T-Test Results: Pre/Post Workshops

VARIABLE	MEAN	STD DEV	DIF	p	
Deep Pre	61.6	8.5			
Deep Post	57.5	8.8	-4.1	.000	
Surface Pre	47.5	8.2			
Surface Post	49.9	8.4	3.4	.005	
Strategic Pre	51.3	6.9			
Strategic Post	52.9	10.3	1.6	.124	[<>]
Apathetic Pre	15.5	4.8			
Apathetic Post	17.7	6.0	1.8	.030	

n = 41

There are some statistically significant differences ($p = < 0.05$) between the student profiles taken before and after the learning to learn workshops with a decrease in Deep Approach and increases in Surface and Apathetic Approaches. The Strategic

results indicate an increase, but at p = 0.124 cannot be described as statistically significant. Notably though, there has been an increase in the standard deviation of both the Strategic and the Apathetic scales. This may indicate increasing diversity in the cohort in terms of these two Approaches and therefore suggests that there are extremes of Strategic and Apathetic scale scores present in the sample. An explanation for this could be that while there has been an overall Approach changes as indicated by the means, there may have been a more significant change relative to individual students. The question to be answered therefore is, how has the distribution of students within the cohort changed in terms of Approach level profile?

Table 6.2 Summaries of Changes in Approach Distribution.

CATEGORY	H > M	M > L	L > M	L > H	M > H
DEEP	6	6	1	O	2
SURFACE	3	7	3	1	8
STRATEGIC	1	2	7	0	5
APATHETIC	3	5	3	2	7
	Decreasing Profiles		Increasing Profiles		

Table 6.2 reports the changes of Approach distribution between the Low, Moderate and High Approach groups, the demarcation of which were described earlier (table 5.5). Each column describes the number of students moving from one group to another. For example, the column marked H > M refers to students moving from a High to a Moderate Approach; M > L indicates Moderate to Low and so on. Table 6.2 is split so as to show on the left, the relative difference between net decreases, and on the right, net increases in the numbers of students changing form one band to another. No students were found to have produced a High to Low (H > L) shift.

A distinct drop in Deep Approach is observed as is a distinct increase in the number of students taking a more Strategic Approach. There has been a net increase in Surface and Apathetic Approaches. This effect is compounded in that most of the increase shift has been within the moderate to high categories of the Surface, Strategic and Apathetic Approaches, and most of the decrease shift is in the high to moderate and moderate to low categories of the Deep Approach.

Some of the data reported above appears quite conclusive. The Deep Approach means have reduced following the intervention, while the Surface and Apathetic Approaches have increased, all of which are opposite to the predicated direction of change. The Strategic Approach means have not changed significantly.

Differences between Approach means before and after the workshops were calculated for each case. This revealed that 34 out of the 41 students (83%) displayed a decrease in Deep Approach; 28 (68%) were showing an increase in Surface Approach; 28 (68%) were showing an increase in Strategic Approach, and 26 (63%) an increase in Apathetic Approach. One case reported decreases in Deep and Strategic scores of 9.00 (an 11% decrease) each, while also increasing his Surface score by 21.00 (an increase of 26%) and Apathetic score by 13.00 (an increase of 32%). These are very alarming results for any one individual to display.

Overall there does seem to be a general decrease in Deep Approach and general increases in Surface and Apathetic Approaches. Taking the paired t-test results alone the null-hypothesis will have to be rejected and it stated that there is a difference between the samples at a very significant level with the exception of Strategic where there is a positive shift, but this is not significant ($p = < 0.05$). Taking the rest of the data into account it would appear that this initial analysis is correct. It has to be assumed that the population in general has adopted more Surface and Apathetic Approaches, while reducing the Deep Approach. From this evidence therefore it is concluded that the first hypothesis: *learning to learn workshops or similar material will have a positive effect on student Approach to Study,* is disconfirmed on the basis of the predicted and desired changes.

6.4 Hypothesis One Results: Discussion

It would seem that the workshops do not meet their aims and may even have a negative effect. However, it is more likely that the intervention has had no effect at all on the variables examined as students not exposed to the workshops also have shifts in distribution similar to those shown here. As already suggested by the Factor Analysis and mean distributions, there is probably a greater influence than the author's intervention over the students' differential adoption of Approaches to Study within this context. It is well established in the literature that these influencing factors are likely to be the context of learning (being a conventional rather than problem based course, and with a relatively high workload) and of assessment (implicitly rewarding reproducing strategies). While the effects of context was not part of this study, there is evidence form the student

essays reported in chapter seven that students were responding to the context in these ways, for example, one Integrated Engineering student suggested that:

> *If you know the facts and figures the exams can be taken and passed... it would seem that everyone who wanted to do a degree would be doing more than just learning facts and figures... they would be trying to learn in a understanding way... this sort of learning does not however, seem to be the aim of the course. If a student wants to understand then s/he must make additional unrewarded effort as the 'understanding' would not necessarily lead to higher marks in exams set to test factual knowledge.*
>
> (532, D=H, S=M, St=H, A=M)[12]

Another student commented on the explicit way in which she had been told to learn by a member of academic staff:

> *The ..... actually said to me, that in the first year you should only do the minimum amount of work to pass the year as there is so much work to do. In my opinion the first year of an engineering degree should be encouraging a deep concept of learning... all the course work piles up onto the students and we have little time to dedicate to deep learning; one feels that he or she constantly surface learns.*
>
> (567, D=L, S=H, St=L, A=H)

Whilst another said:

> *The course doesn't really incite you to get interested and motivated in the study material. I feel this is because of the type of lecturing/tutoring that goes on throughout the year... we just take notes, write down the knowledge written on the board with no understanding or time for understanding. It could be argued that tutorials are for this, but by the next tutorial, you are so frustrated/scared by all the unrecognisable knowledge thrown at you, that you forget about it by the next tutorial or you can't face going to the tutorial because you know you're not going to have a clue. One lecturer we're taught by, if interrupted during a lecture with a questions replies, "People should come to my tutorials to find out". Students get so frustrated by him it's no wonder that nobody turns up for his tutorials.*
>
> (542, D=M, S=M, St=M, A=H)

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[12] Each quote is accompanied by the student's code number and respective RASI profile. The RASI profiles are described according to the Low, Moderate and High categories already described and are presented in the order of Deep (D), Surface (S), Strategic (St) and Apathetic (A) Approaches. See also table 7.1, chapter seven.

Some of the context effects on Approaches to Study are suggested by these quotes. This effect of context is discussed further in the next hypothesis. In retrospect, it is recognised that given the breadth of context effects suggested by the students' essays, future work in this area could profit from a measure of context perceptions and Approaches to Study taken at the same time for the same cohort of students. However as discussed in the literature review, at present the statistical overlap between Ramsden's (1991) CEQ and the ASI is limited and reliable methods of identifying perception of context and Approach simultaneously would have to be sought.

Between the start and end of the 1992/1993 academic year over 60 percent of the students moved toward a more Surface/Apathetic Approaches, and over 80 percent moved away from the Deep Approach to Study. Most alarmingly, a significant shift ($p = < 0.05$) was detected towards Surface and Apathetic - results that contradict the aims of the workshops. Taking the evidence so far into account it could be concluded that one, or both of two things may be happening:

1. *Students cannot change from an established instrumental approach; they are so affected by their learning experiences prior to higher education that they cannot without great effort, improve their Approaches to Study.*

2. *The context of the course and the learning environment in general, despite an initial willingness by the students to perceive them in a way conducive to high quality learning, are forcing the students into more instrumental attitudes and methods and therefore away from the Deep Approach.*

To only support the first conclusion it might reasonably be argued that a learning 'predisposition' mediates the Approach to Study taken by the student, in other words the student has a preferred method of processing information which is instrumental in nature. To support the second conclusion while neglecting the first, implies that it is the only the student's perception of the course that will become the determinant of his or her Approach to Study. Thus a student will consciously or unconsciously perceive course task requirements, atmosphere and ethos in a way that leads to a reaction on his or her part - a decision by the student to adopt an Approach to Study based on the perceived demands of the course.

There is no comfortable demarcation between one conclusion and the other. Some students may be arriving into degree courses with a narrow expectation and the perception that the learning context is requiring the simple assimilation of factual detail (cf. Gibbs et al 1980). This may partly be a reaction associated with conception of learning and orientation to study and partly a reaction to course

provision and the context of the learning environment in general. In other words, some of the data reported above is very likely to have come from some students who simply do not have the conception or orientation congruent with a Deep Approach to Study. If this is the case, it is unlikely that workshops of the type reported here will move the student toward a Deep Approach to Study, even though the workshops contain explicit descriptions of the motivations, intentions, learning processes and outcomes associated with Deep learners.

The author's interventions may or may not have developed students conceptions and orientations (these were part of the aim), but there is little evidence that these were 'improved' or otherwise developed. Some students may well have a concept of learning that appreciates the Deep Approach, but are then denied the opportunity to enter into it by deleterious contexts and as a consequence are then forced into more instrumental Approaches. It is suggested to the reader that this is likely to be the case for most of the students reported above as indicated by the shift from an initial Deep Approach, to a more instrumental Surface Approach with time. Further research would be needed to examine such an assumption.

6.5 Summary

The data extracted indicates a broad move by the students surveyed towards Surface/Apathetic Approaches and away from Deep Approaches to Study. This is despite the explicit objective of promoting a Deep Approach to Study via the learning to learn workshops. In this respect the hypothesis stated at the beginning of this section can be reasoned as being untrue.

It seems likely that there are a number of factors militating against the adoption of Deep Approaches to Study, and that these are linked to the overall course design, structure, aims and ethos. However, some students may be less dependent on the context as discussed previously (Ramsden 1984, Eley 1992, Meyer et al 1994). There does seem to be some theoretical support for the idea that for some students, even though they may perceive correctly what is required to interact at a Deep level, do not have the conceptual or cognitive tools required (cf. Meyer 1991, Tang 1994). Others have the tools but are simply denied the opportunity to use them within the constraints of the course as a whole. This last point seems the most likely given the evidence reported here. Further research would be needed in order to comment more definitely on the relationship between the context, conceptions of learning, orientations to study and Approaches to Study of of students examined at Nottingham.

6.6 Hypothesis Two

A Deep Approach to Study is a requisite for success at academic study as measured by formal methods of assessment.

The above hypothesis assumes that local students taking a Deep Approach to study will be rewarded by good assessment results and that there is a *linear relationship* between the variables of Approach and assessment outcome. To test this hypothesis, the RASI main scale profiles (Deep, Surface, Strategic and Apathetic) produced by students were correlated against academic outcome. Support for the hypothesis can only then be made if there is a strong association or *positive correlation* between Deep Approach to Study and assessment results. Previous correlation findings in respect of quantitative outcome and variables conceptually similar to the RASI main or sub-scales are summarised below:

Researcher(s)	**Correlation with Quantitative Outcome**
Ramsden et al (1986)	Deep (0.29), Surface (-0.27)
Van Overwalle (1989)	Organised Study (0.34), Regular Study (0.24)
Britton and Tessler (1991)	Time-management (0.25)
Trigwell & Prosser (1991)	Deep (NS), Surface (NS)
Eley (1992)	Deep (0.22), Surface (-0.23), Achieving (0.35)
Kember et al (1995)	Deep (NS), Surface (NS), Achieving (NS)
Norton et al (1995)	Deep (0.28), Surface (-0.33)

(Significant at $p = < 0.05$, NS = No Significance was found)

Figure 6.3 Approach/Outcome correlations

Generally more consistent and stronger relationships are found when comparing Deep and Surface Approaches with *qualitative* outcomes as discussed in the review (Marton and Saljö 1976, Laurillard 1979, 1984, Van Rossum and Schenk 1984, Hounsell 1984, Trigwell and Prosser 1991, Eley 1992). This hypothesis is concerned with quantitative relationships which will now be examined against the general backdrop of positive correlations between Deep Approach and outcome, negative correlations between Surface Approach and outcome and positive correlations between Strategic Approach (or elements of) and academic outcome (Tait 1992, Ramsden 1992).

To establish such relationships, each variable is correlated against assessment outcome to produce a plot or scattergram and analysis is carried out to establish the *correlation coefficient* (Pearson's r in this case). Pearson's r varies from a strong negative correlation of -1 to a strong positive correlation of +1 thus giving

an indication of the strength and direction of association between two variables on the same case. Squaring this value (r^2) gives and indication of the variance within a population that is explained by the correlation. This is known as the coefficient of determination. Correlations can further be tested for significance and a probability value determined. Values of $p = < 0.05$ are, as in the t-testing, considered significant. A null-hypothesis is again set up which assumes that: 'there is no correlation between Deep Approach and performance'. The opportunity was taken to also examine the correlations relative to the Surface, Strategic and Apathetic Approaches at the same time.

The samples used for correlation testing comprised of all the students surveyed in 1992 and in 1993 using the RASI. The Approach profiles for these students were measured for association with their aggregated assessment outcomes, that is, the overall marks they received at the end of each academic year. As course work constitutes a very small part of engineering assessment at Nottingham (used in 3 out of six subjects, and representing only about 5% of the overall marks), assessment in this hypothesis may be taken to mean an aggregated examination score. The results from this testing are reported in the following plots and figures.

6.7 Hypothesis Two Results

Figures 6.7 to 6.10 present the scattergrams for each of the correlations examined, for example DEEP by ASSESSMENT. In each of the plots the assessment score percentage is indicated on the ordinate axis, and the approach scale score on the abscissa. It is virtually impossible to plot all 509 points (representing all first year full-time students) on each of these plots so the figures indicate the number of points occupying any particular space. Likewise letters represent numbers greater than nine; A = 10, B = 20, C = 30 and so on. The points can be further enhanced by drawing a *regression line* (Healey 1990) which is a straight line touching, or coming as close as possible to all the points in the scattergram. This is plotted by calculating the conditional means of the dependent variable (typically known as the method of least squares). This line summarises the plot and gives an impression of the relationship between the dependent and independent variables. Such a line (or corresponding formula) can be used to predict scores on the Y axis for any value of X, however, the accuracy of this will to some extent be dependent on the spread of data and the extent to which there is a perfect straight line relationship between the correlated variables. It is sufficient at this stage to assume that in the plots below, a horizontal regression line will indicate non-relationship, a positive relationship will be indicated by a left to right upward slope for the line; a negative relationship producing a left to right downward slope.

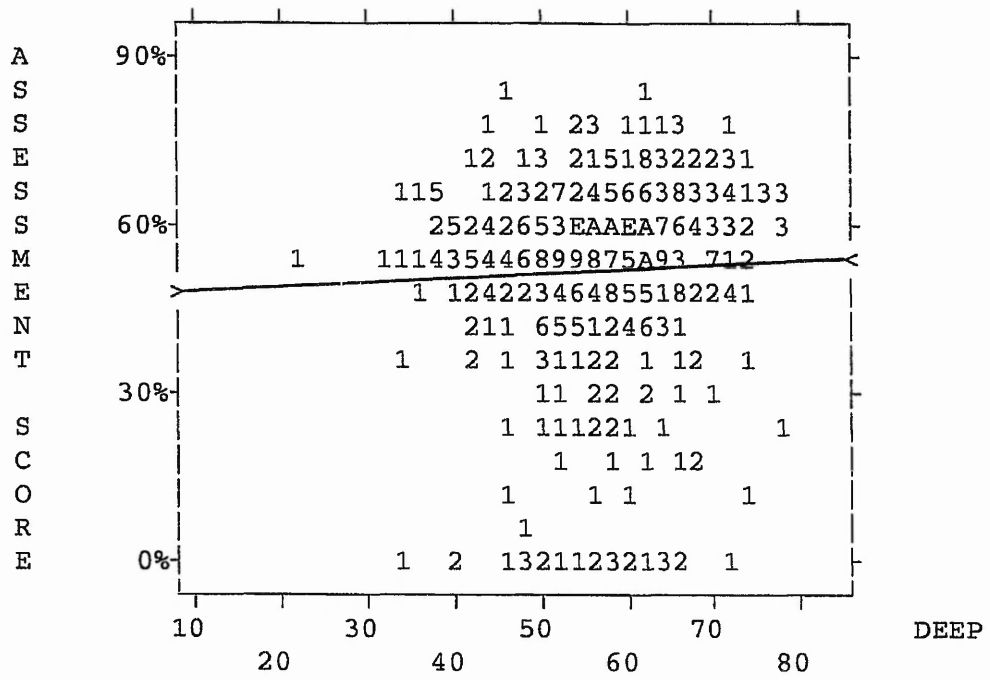


Figure 6.4 Plot of Deep Approach with Assessment Score

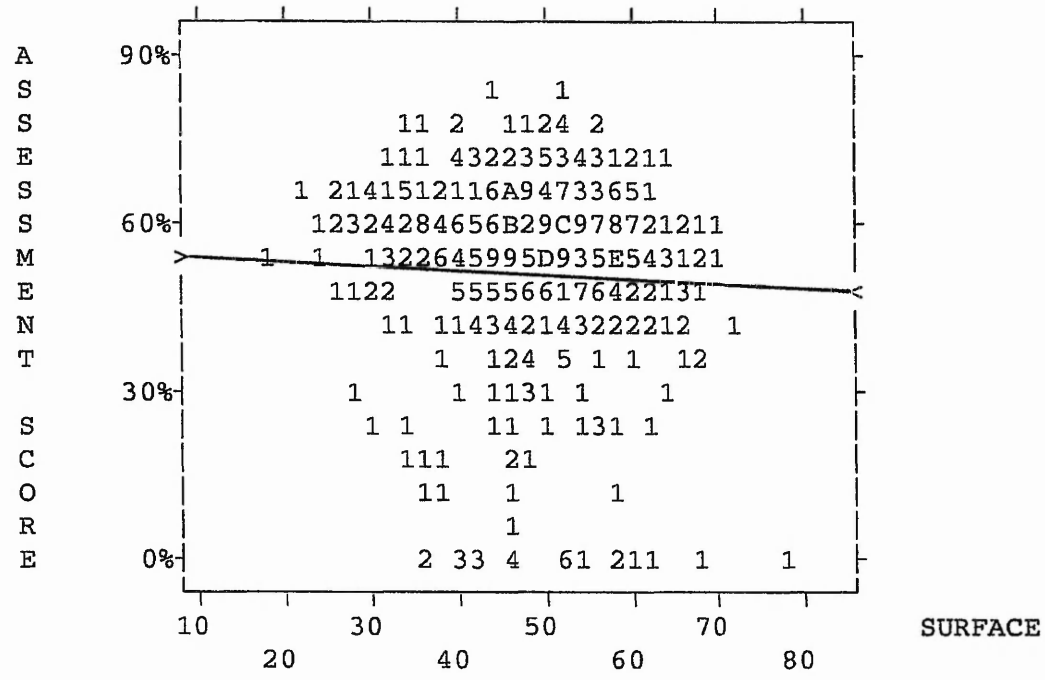


Figure 6.5 Plot of Surface Approach with Assessment Score

The scale on the x-axis or abscissa represents the possible scores obtainable for each of the main scales on the RASI. The Deep, Surface and Strategic scales have

potential scores ranging from 16 to 80. The Apathetic scale has a potential score ranging between 8 and 40.

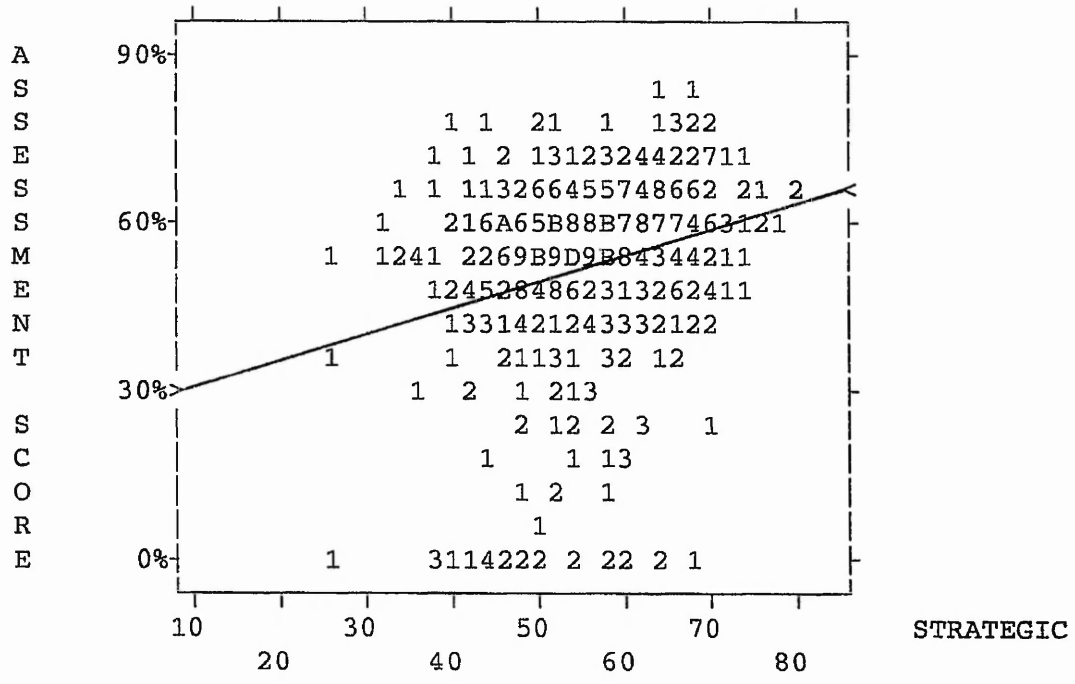


Figure 6.6 Plot of Strategic Approach with Assessment Score

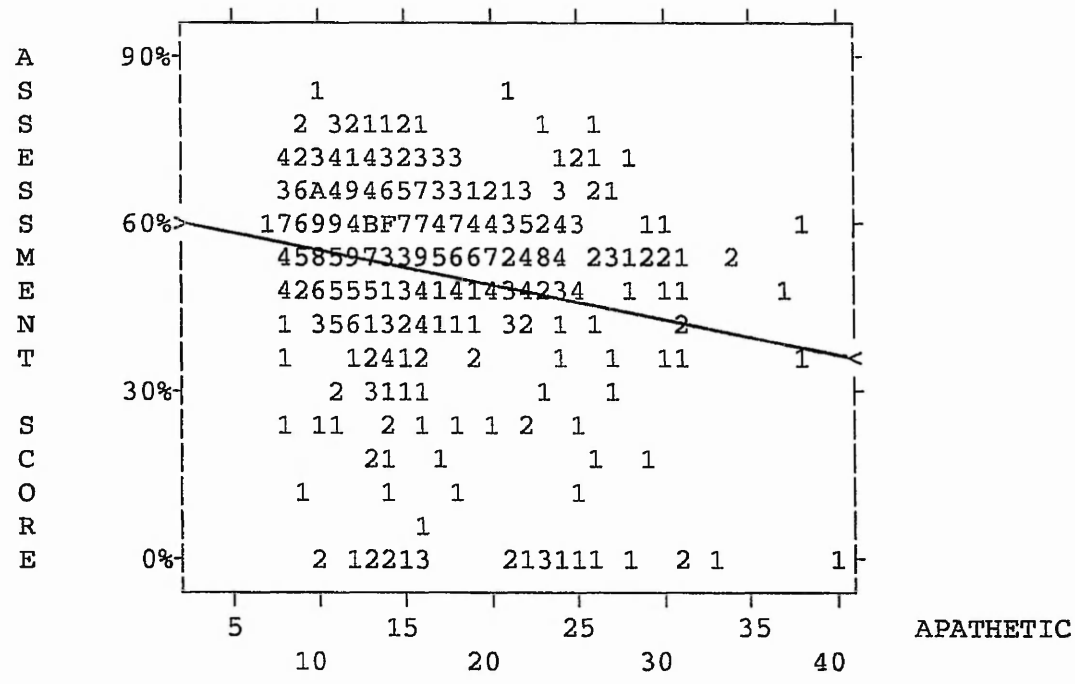


Figure 6.7 Plot of Apathetic Approach with Assessment Score

The plots presented above are further reported in terms of correlation coefficient (r), coefficient of determination (r^2), and the level of probability (p) in table 6.3.

Table 6.3 Correlations: Approach and Assessment Outcomes, first year, full-time students (n = 509).

CATEGORY	r	r^2	p
DEEP	0.08	.006	0.07
SURFACE	-0.06	.004	0.14
STRATEGIC	0.25	.063	0.00
APATHETIC	-0.21	.044	0.00

The plots and summary indicate relatively small linear relationships. Two correlations (for Strategic and Apathetic) can be described as being very significant ($p = < 0.01$), but the percentage of variance explained is only in the region of 4 to 6 percent. However, these figures for Strategic do reflect those typically found elsewhere as discussed above.

Apathetic Approach is negatively correlated with assessment outcome but there is no significant positive correlation between Deep and assessment outcome. A positive relationship is found between Strategic and assessment outcome. In summary, there is a small but highly significant correlation between Strategic Approach and assessment outcome and a small albeit highly significant negative correlation between Apathetic Approach and assessment outcome. These outcomes reflect and serve to confirm the findings evident in the factor analysis studies presented in chapter four. It was suggested then that assessment outcomes in the context of this study are more closely related to the Apathetic/Strategic Approaches than the Deep/Surface Approaches. Again, this would tend to condemn the quality of the assessment system at Nottingham.

Table 6.4 Summaries of the Correlation Between Approach Category and Assessment Outcome (Computing Studies n = 39)

CATEGORY	r	r^2	p
DEEP	0.51	.260	0.00
SURFACE	-0.36	.123	0.05
STRATEGIC	0.41	.168	0.03
APATHETIC	-0.56	.314	0.00

The results for Computing Studies reveal some larger correlations between Approach and assessment outcome (table 6.4). There is a significant positive correlation between Deep Approach and assessment outcome. There is a negative correlation between the Apathetic Approach and assessment outcome. It would seem that academic success *is* related to a Deep/Strategic Approach in Computing Studies. This is the only course that produced such statistics.

In the case of Integrated Engineering Year 1 (table 6.5) there are smaller correlations at much lower levels of confidence and determination than those for Computing Studies. There would seem to be little evidence relating to the Deep Approach being a requisite or prerequisite for success in the context of this and the majority of local engineering courses.

Table 6.5 Summaries of the Correlation Between Approach Category and Assessment Outcome (Integrated Engineering, full-time, year 1 n = 41)

CATEGORY	r	r^2	p
DEEP	0.22	.048	0.12
SURFACE	-0.05	.003	0.71
STRATEGIC	0.28	.078	0.04
APATHETIC	-0.11	.012	0.41

However, there is evidence emerging from this research indicating the possible role of the Strategic Approach in governing academic success. These correlation summaries indicate the relative difference between degree courses in respect of the hypothesis, *'A Deep Approach to Study is a requisite for success at academic study as measured by formal methods of assessment'*. It would appear that in some cases this may be true as shown in Computing Studies, where there is a moderate correlation between Deep Approach and assessment outcome.

6.8 Hypothesis Two Results: Discussion

In the majority of the isolated degree programmes surveyed it was clear that a Deep Approach was not correlated with assessment outcome and the hypothesis is rejected. Why should this be? Presumably, within this hypothesis, the relationship between the process and the context of learning (Ramsden 1988, 1991) is demonstrated. Within Integrated Engineering at Nottingham, the context seems

to be forcing at best a Strategic Approach allowing some students to pass examinations and assignments by identifying and applying the skills that will obtain the grade. At worst, as the student below describes, there is a move toward a shallow passive, almost ambivalent attitude on the part of the students.

> *Facts, formulae, ideas, information, laws and languages are thrust in our faces, un-introduced.... which are viewed in passive uninspired trances....* (The students) *have lost all control of what is learnt and how so, and little do they know of what is being taught, its significance. All they know of their future is that they may fall out of the other end of the institution with 'Mechanical Engineer, Second Class' stamped on their foreheads if they can pluck a little of that once abundant enthusiasm from somewhere.*
>
> (548, D=M, S=H, St=L, A=H)

This is despite the claims of promoting understanding and meaningful learning made for the engineering curriculum and rubric by Jeffery (1993, see literature review). This description could begin to explain the results emerging from the study of this hypothesis and the research generally. There is a small oasis in the somewhat depressing statistics represented by Computing Studies. Future research could examine context conditions which appear to be promoting much more of a Deep and Strategic Approach to learning than within other courses in the faculty.

Such an examination of context does not strictly form part of this research, but the author (1994) conducted a separate (commissioned by the local Staff Development Unit) study using Ramsden's (1991) Course Experience Questionnaire (CEQ). The CEQ questions students for their perception of five teaching scales: Good Teaching, Clear Course Goals, Appropriate Workload, Appropriate Assessment, and (the course) Promotes Independence. Using z-score analysis and plotting the results on a graph, the five CEQ scales were presented against a mean of zero for course perception data obtained from each of the faculties in the university. Thus the average score is made to equal zero, and data relative to each faculty is then plotted against this value. In the graphs overleaf, a figure of ±1.0 therefore represents one standard deviation above or below the z-mean. The results are shown in figure 6.8 where, for example, there is a negative student perception of workload in the engineering faculty compared to other faculty within the institution. Below average ratings in four of the five scales of the CEQ in respect of Engineering are also seen in figure 6.8. When the z-score analysis was repeated at an individual course level, similar ranges in perception were found. Figure 6.9 shows the scores for CEQ course perception items within the author's faculty.

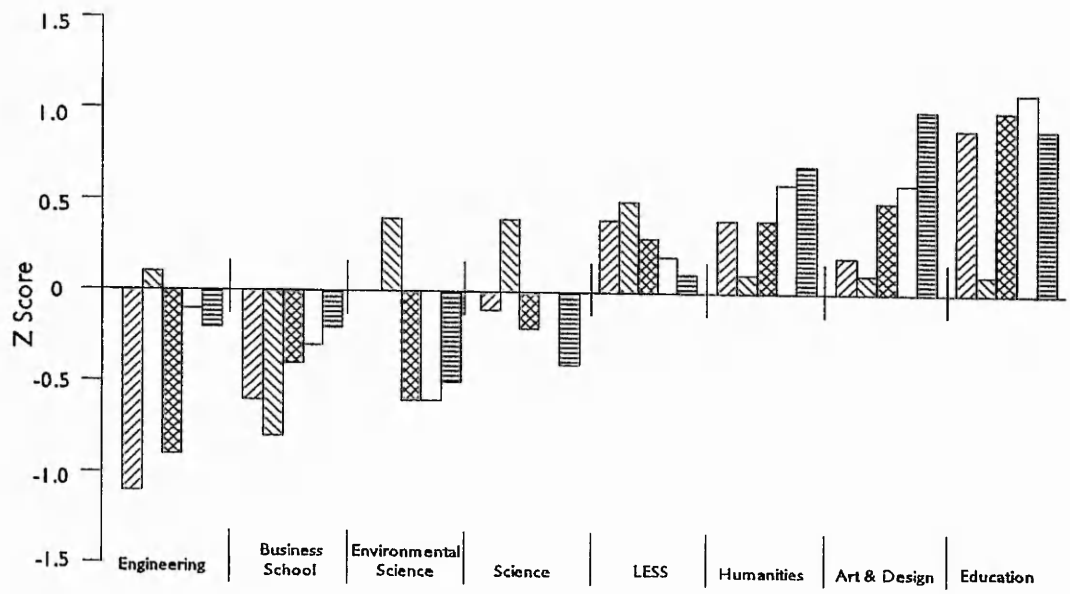


Figure 6.8 **Nottingham Trent University Standardised CEQ Scale Scores by Faculty**

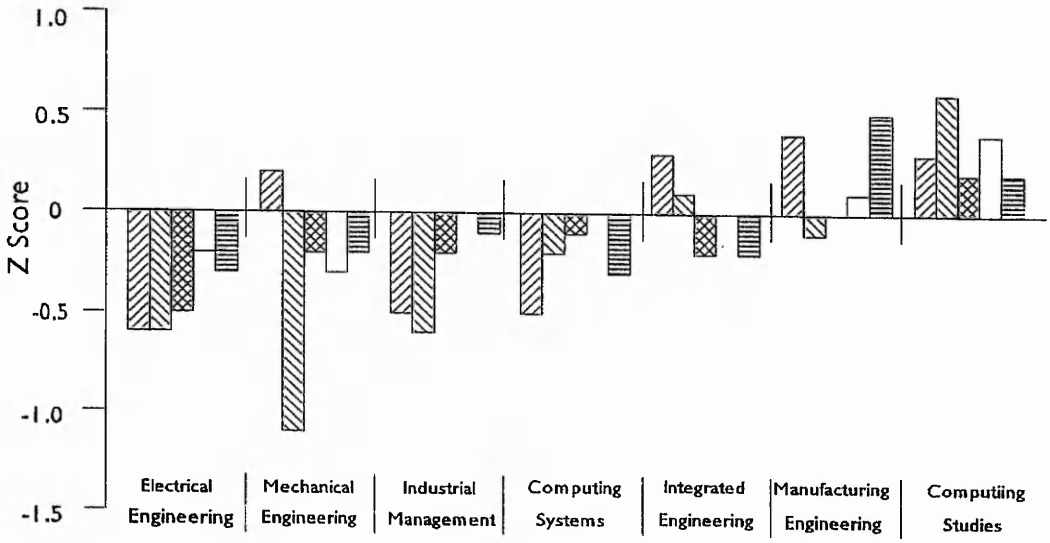
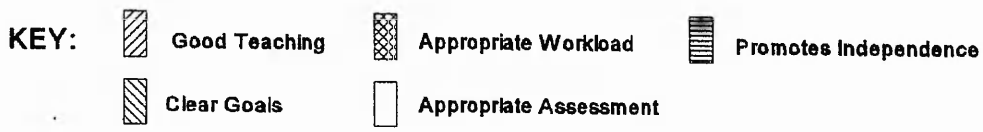


Figure 6.9 **Standardised CEQ Scale Scores by Course (Faculty of Engineering and Computing)**



No statistical evidence from this present study is available as to the level of correlation between the relative levels of CEQ perceptions shown in figure 6.9 and Approaches to Study at a course level. However some indication of the relationship between course perception, Approach and assessment outcome might be provided by the correlations shown between the Approach of students on each of these courses and assessment outcome. In table 6.6 the relative Approach to assessment outcome correlations revealed by author's current research are shown for comparison against the CEQ scores in figure 6.9. It should be noted that the course receiving the most positive CEQ feedback (Computing Studies) is the only one with anything like correlations that could be described as acceptable. In short, there is circumstantial evidence to suggest that the less well a course is perceived, the less likely it is that students will adopt a Deep Approach towards their studies and assessment. This needs to be confirmed at the local level.

Table 6.6 Correlation Between Assessment and Approaches to Study

	Pearson's r for Approach to Assessment Outcome			
COURSE	DEEP	SURF	STRA	APAT
Computing Systems	.16	-.06	.33**	-.25*
Computing Studies	.51**	-.36*	.41*	-.56**
Electrical Engineering	-.01	.04	.09	-.01
Manufacturing Eng	.12	-.09	.32*	-.54**
Industrial Management	-.06	-.11	.07	-.18
Mechanical Eng	-.03	-.08	.24*	-.10
Integrated Eng	.22	-.05	.28*	-.11

KEY: DEEP = Deep Approach, SURF = Surface Approach, STRA = Strategic Approach, APAT = Apathetic Approach *p = < 0.05, **p = < 0.01

There is evidence (Ramsden 1988, 1991, Entwistle and Tait 1990, Eley 1992, Prosser and Trigwell 1990, Meyer 1993) that the teaching context, such as assessment demands do have a significant effect on the Approach to Study adopted by students. It is argued (Prosser and Trigwell 1990, Lublin and Prosser 1994) that the prevalence of Deep Approaches at a course level, as measured by scales of the ASI, is indicative of higher quality courses. To produce statistical evidence of this relationship is beyond the scope of this present study, but there seems to be good initial evidence of this assumption being recognised within the courses at Nottingham. In this respect the findings should be viewed with some concern.

In table 6.6 the only Approach consistently correlating with assessment outcome is the Strategic Approach. Within the broader context of Engineering Education it can be argued that those students who can manage their time and who can then gear themselves towards using 'appropriate' skills for each assessment method are likely to do better. Such descriptions are of a skilled, strategic learner and academics are aware of these learners existing. One local tutor described how:

> *This kind of learning is fine for the best students, but we don't get them. Our students are learning that if they can get as much as possible out of the lecturer about what is in the exam, they can learn just enough to pass. We are turning out students who actually represent low-value for money... they simply don't understand the material.*

Students have commented (see chapter seven) on their reactions to the local assessment contexts, for example:

> *Towards the end of the year I found myself taking a more Strategic Approach to my work. This was especially true for the subjects which I had a good understanding of. An example of this was fluid dynamics. From the lectures it was easy to see what was going to be in the exam, so I concentrated only on these parts rather than trying to revise the whole subject. I feel this is a very tactical type of learning and I have managed to greatly reduce the amount of work I was doing.*
>
> (551, D=H, S=L, St=H, A=L)

Another described his learning:

> *Overall I would class myself as a Strategic / Surface Approach learner. I do believe that many people, including myself, do only the barest minimum to get through or pass; the Surface Approach. However, I do have a Deep Approach to problem solving and a Strategic Approach in my methods of tackling exams.*
>
> (207, D=H, S=L, St=H, A=L)

In this respect, passing the first year of an engineering degree at Nottingham may be associated with an ability to cope with organisational and time constraints. For example, one of the Integrated students commented that:

> *Heavy workload is a factor that applies to me, work piles up and I do it at the last minute where I don't have time for the Strategic Approach never*

mind the Deep Approach... I must change the way I manage my time as this would cut out the Surface Approach and leave time for a majority Strategic Approach with Deep being concentrated on areas of interest.

(553, D=L, S=M, St=L, A=M)

Finally the evidence emerging from the factor analysis suggests that assessment outcome loads on either the Strategic or the Apathetic factors for passing and failing students respectively. However, the Factor Analysis also reveals that 'Strategic' is primarily about being organised and skilled rather than being 'strategically or achieving motivated'. This would suggest that the assessment system and content is implicitly rewarding organised studying and those students who can effectively manage their time are those who succeed academically.

6.9 Summary

A Deep Approach to Study is not a requisite for success as measured by formal methods of assessment within the context of this research, except, it would seem on one course (Computing Studies). The context of student learning at Nottingham would appear not to be encouraging such an Approach. This context must it seems be viewed not only in terms of the way a course is taught, the way a course is assessed and of the level of workload, but also in terms of the way the discipline knowledge is constructed and student interaction with that knowledge is encouraged. Overall, it would appear that the combination of these elements is influencing at best a Strategic Approach, and at worst an Apathetic Approach.

6.10 Hypothesis Three

Students on the Integrated Engineering degree in this Faculty develop an appropriate Approach to Study as they progress through the course.

The only Approach that can be described as 'appropriate' in terms of reaching understanding of the material is the Deep Approach to Study. What is 'appropriate' in terms of '*Students on the Integrated Engineering degree in this Faculty develop an appropriate Approach to Study as they progress through the course*' is open to debate. However, in previous discussions in this thesis it has been suggested that on the whole some elements of the Strategic Approach are very important in dealing with the time and organisational demands made of students on the degree courses examined here. In this sense, students seem to be able to pass examinations at Nottingham by approaching their studies with either Deep or Surface intentions, particularly if they also adopt Strategic skills.

It is argued that the Strategic Approach to Study or an Approach that contains many of the features of the Strategic Approach may be involved in demarcating success and failure when studying engineering at Nottingham. This suggestion is incomplete though, because 'appropriateness' is so both in terms of what succeeds and in terms of achieving understanding in engineering. With respect to the discussion above, and this hypothesis therefore, it is reasonable to expect Integrated Engineering students to become more Deep and Strategic with time in order to assume that an 'appropriate' Approach is developed and in order that a null of the hypothesis might be rejected.

Appropriate in the sense described above implies that an Approach is conceptually and practically most relevant. In this respect there is only one course so far discussed which has an assessment system that seems to be promoting appropriate Approaches. This is suggested by the correlation studies earlier showing significant relationships between Deep and Strategic with assessment outcomes on the Computing Studies degree at Nottingham. Equally, this same course has significant negative correlations between assessment outcome and the Surface and Apathetic Approaches.

6.11 Hypothesis Three Results

To test this hypothesis the mean scores for each of the four Approaches reported by each successive year of the Integrated Engineering Degrees (Part-time and Full-time) were compared against each other. Initially these were plotted on a graph

to give a visual impression of any shifts in mean score over time. Comparisons were made using data obtained from three independent cohorts of students: those in the first, second and final years of the Integrated Engineering Degree in the academic year 1992-1993. There is no profiling for the industrial placement year. Graphs plotting Approach Mean Score against each of the Full-Time Course Years are shown overleaf in figure 6.10. The graphs relating to the part-time degree are shown in figure 6.11 on page 158.

In figure 6.10, those students who have been profiled for a second time (the full-time students starting in 1992 and who were subject to the learning to learn workshops) have their Approach Mean Scores plotted alongside the previously identified second year profiles. The plots referring to those students who attended the workshops are shown in red in figure 6.10. The plots for other full-time Integrated Engineering students are shown in green. On each graph the mean is indicated by the central point with the standard deviation about the mean shown by vertical bars.

To establish the significance of any inter-year differences between paired variables, one-tailed t-tests were conducted and summarised in tables 6.8 to 6.10. It is acknowledged that an Analysis of Variance (ANOVA) could be used as an alternative to t-testing to distinguish these effects of year and intervention. The summaries reported here compare the means between the four main scales. Any significant ($p = < 0.05$) differences between sub-scales are also reported. Comparisons using t-tests have already been made between the profiles obtained for the same students when initially first years undertaking the learning to learn workshops and again when second year Integrated Engineers. The discussions related to this t-testing are found in the section relating to hypothesis one.

It was found in hypothesis one, that students progressing from the first to the second year of the Integrated Engineering degree reduced their Deep Approach to Study ($p = 0.001$). They had also increased their Apathetic Approach to Study ($p = 0.030$) and their Surface Approach to Study ($p = 0.005$). Differences between the Strategic Approach means were not found to be significant ($p = 0.124$). In other words 'at their best', students passing from the first to the second year seemed to have maintained their initial Strategic Approach to Study profiles. This effect is also seen within this hypothesis (hypothesis two) when comparing the first and second year full-time Integrated Engineering profiles as shown in green in figure 6.10, and further discussed following table 6.7.

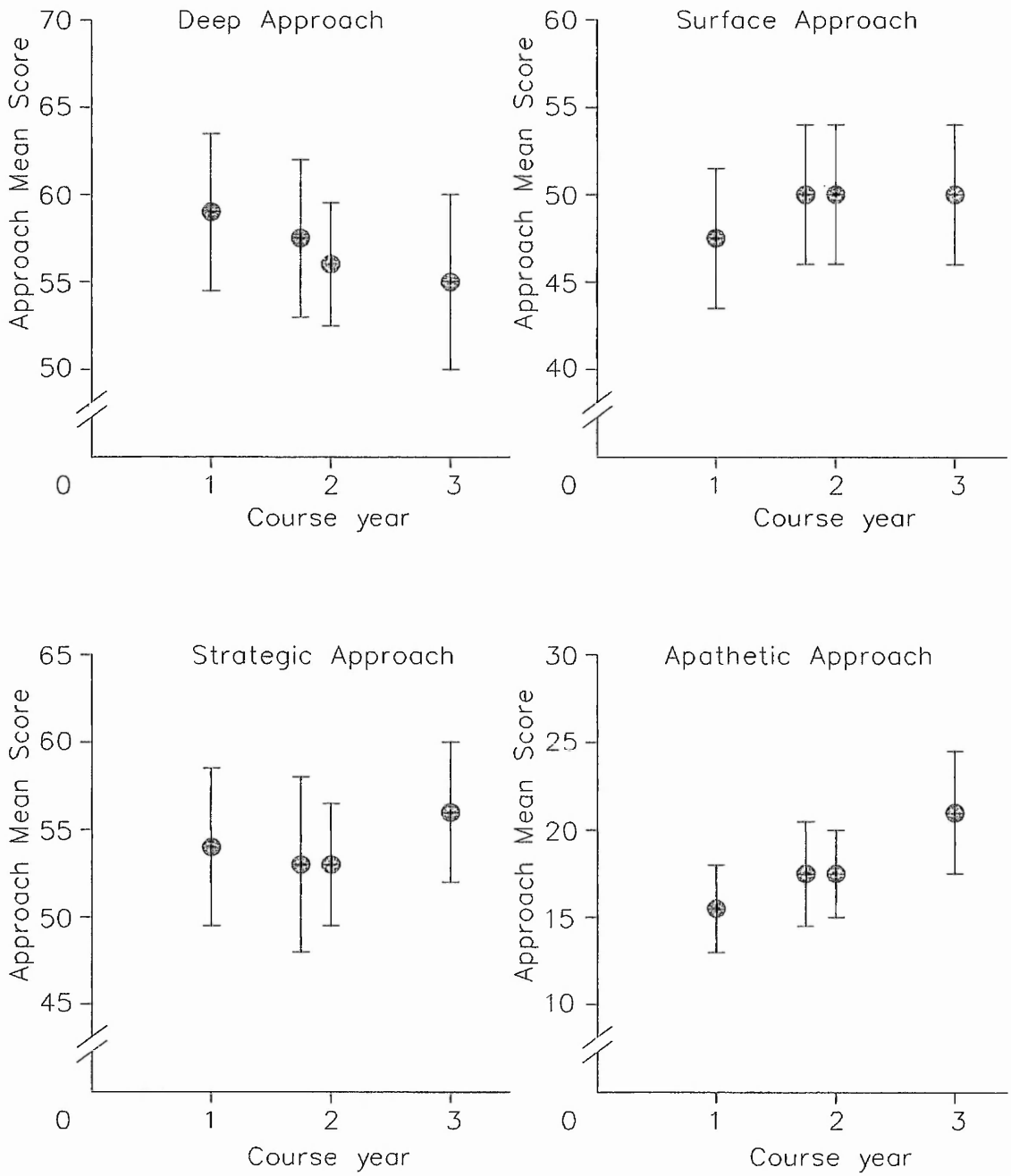


Figure 6.10 Approach Distribution by Year of Course (Full Time Integrated Engineering)

Centre spot indicates mean Approach Score. Vertical bars indicate standard deviation about the mean. Plot in green indicates those students exposed to LTL workshops.

Table 6.7 Summaries of Independent T-Tests:Full-Time Integrated Engineering Year 1 vs Year 2.

VARIABLE	MEAN	t-value	DIF	p
Deep yr 1	59.0			
Deep yr 2	56.1	1.8	-2.9	.037
Surface yr 1	47.4			
Surface yr 2	50.1	-1.4	2.7	.041
Strategic yr 1	53.6			
Strategic yr 2	52.8	0.5	-0.8	.627
Apathetic yr 1	15.6			
Apathetic yr 2	17.0	-1.0	1.4	.030

n yr 1 = 53 n yr 2 = 43

Table 6.8 Summaries of Independent T-Tests: Full-Time Integrated Engineering Year 2 vs Year 3.

VARIABLE	MEAN	t-value	DIF	p
Deep yr 2	56.1			
Deep yr 3	55.2	0.5	-0.9	.654
Surface yr 2	50.1			
Surface yr 3	49.8	0.2	-0.3	.882
Strategic yr 2	52.8			
Strategic yr 3	56.0	-1.8	3.2	.050
Apathetic yr 2	17.0			
Apathetic yr 3	21.2	-3.0	4.2	.004
Lack of Direction yr 2	8.4			
Lack of Direction yr 3	10.2	-2.0	1.8	.048
Lack of Interest yr 2	8.6			
Lack of Interest yr 3	11.0	-3.3	2.4	.002

n yr 2 = 43 n yr 3 = 32

The t-test summaries are presented and described above in table 6.7. These reveal that students in the second year of the Integrated Engineering Degree have reduced their Deep and increased their Surface and Apathetic means compared to those in

the first year of the same degree[13]. Within the first/second year differences the most stable scale is Strategic. Other scale means have shifted detrimentally. Detrimental or problematic increases are also seen between those students in the second and fourth years of the Integrated Engineering course.

In the case of the second and third years (table 6.8 above), the probability of their being a difference between the Deep and Surface Approach means are not at all significant. The Apathetic and associated sub-scales means have significantly increased by a relatively large amount. Strategic Approach means are significantly ($p = 0.05$) increased. The Approach mean differences between the first and final years are shown in the table below (table 6.9).

Table 6.9 Summaries of Independent T-Tests: Full-Time Integrated Engineering Year 1 vs Year 3.

VARIABLE	MEAN	t-value	DIF	p
Deep yr 1	59.0			
Deep yr 3	56.1	1.8	-3.8	.046
Surface yr 1	47.4			
Surface yr 3	49.8	-1.2	2.4	.230
Strategic yr 1	53.6			
Strategic yr 3	56.0	-1.3	2.4	.214
Apathetic yr 1	15.6			
Apathetic yr 3	21.2	-4.0	6.6	.000
Active Interest yr 1	13.5			
Active Interest yr 3	11.9	2.3	-1.6	.023
Uses Evidence yr 1	15.7			
Uses Evidence yr 3	14.5	2.1	-1.2	.039
Lack of Direction yr 1	8.0			
Lack of Direction yr 3	10.2	-2.9	2.2	.000
Lack of Interest yr 1	7.9			
Lack of Interest yr 3	11.0	-4.4	3.1	.882

n yr 1 = 53 n yr 3 = 32

[13] The comparisons made here are between different cohorts of students on the same course. However, the entry qualifications and background of theses cohorts is similar. Likewise the course architecture and context is also very similar.

This shows that between the first and last year of the course there is a net decrease in Deep approach at a significant ($p = 0.046$) level. There are no significant differences between the Surface and Strategic Approaches between the first and final year. There is however a very large (6.6) and highly significant ($p = 0.000$) Apathetic mean difference.

From these figures it is concluded that the full-time Integrated Engineering degree students significantly reduce their Deep Approach to study within the first year of study thereafter to maintain this reduced level of Approach. Surface Approach does not significantly alter over the three years. Likewise the Strategic Approach does not change except for a significant ($p = 0.05$) dip in the second year. Apathetic Approaches increase throughout the course years and overall by a relatively large amount. These effects are clearly shown on the graphs in figure 6.10.

The graphs also show that those students attending the learning to learn workshops closely followed the Approach means of students not undertaking the workshops. This would suggest that the workshops had little effect in being able to alter Approach to Study within the overall range of Approaches present within all the years of the Integrated Engineering degree. These results impact on the first hypothesis *Learning to learn workshops or similar material will have a positive effect on student Approach to Study* and will be further discussed in the conclusion to this thesis. In terms of the current hypothesis under discussion, *Students on the Integrated Engineering degree in this Faculty develop an appropriate Approach to Study as they progress through the course*, it is concluded that overall, the full-time students do not develop an appropriate Approach in that the Deep and Strategic Approaches do not significantly increase over the years. This is compounded by the increase in the Apathetic Approach to Study (effectively a reversed Strategic Approach). This supports the previous conclusion that the author's interventions in the form of the learning to learn workshops are seen to have had no effect in promoting an 'appropriate' Approach to Study.

The effects of time relative to Approach are parallelled in the part-time course where there is a decline in Deep Approach and rise in Apathetic Approach. The part-time students also display a rise in detrimental sub-scale means and a fall in positive sub-scale means. Surface and Strategic Approaches are not significantly different over the years of the course. This leads to the same conclusion as above, so within all modes of the Integrated degree, students do not develop a more appropriate Approach with time. Indeed, the most appropriate, the Deep Approach significantly reduces over time. This is a very important finding, on which the teaching staff at Nottingham should now reflect. The graphs and t-test summaries

for the part-time students are shown in tables 6.10 to 6.12 and figure 6.11 on the following pages.

Table 6.10 Summaries of Independent T-Tests: Part-Time Integrated Engineering Year 1/2 vs Year 3

VARIABLE	MEAN	t-value	DIF	p
Deep yr 1/2	61.1			
Deep yr 3	58.5	1.3	-1.6	.022
Surface yr 1/2	46.1			
Surface yr 3	46.7	-0.2	0.6	.848
Strategic yr 1/2	60.1			
Strategic yr 3	56.9	1.4	-3.1	.153
Apathetic yr 1/2	12.7			
Apathetic yr 3	16.9	-2.6	4.2	.013
Organised Study yr 1/2	15.2			
Organised Study yr 3	13.1	2.3	-2.1	.027
Lack of Interest yr 1/2	6.4			
Lack of Interest yr 3	9.0	-2.7	2.6	.009

n yr = 1/2 20 n yr 3 = 27

Table 6.11 Summaries of Independent T-Tests: Part-Time Integrated Engineering Year 3 vs Year 4.

VARIABLE	MEAN	t-value	DIF	p
Deep yr 3	58.5			
Deep yr 4	53.2	2.0	-5.3	.034
Surface yr 3	46.7			
Surface yr 4	46.2	0.1	-0.5	.906
Strategic yr 3	56.9			
Strategic yr 4	60.0	-1.0	3.1	.339
Apathetic yr 3	16.9			
Apathetic yr 4	17.2	-0.2	0.3	.893

n yr 3 = 27 n yr 4 = 11

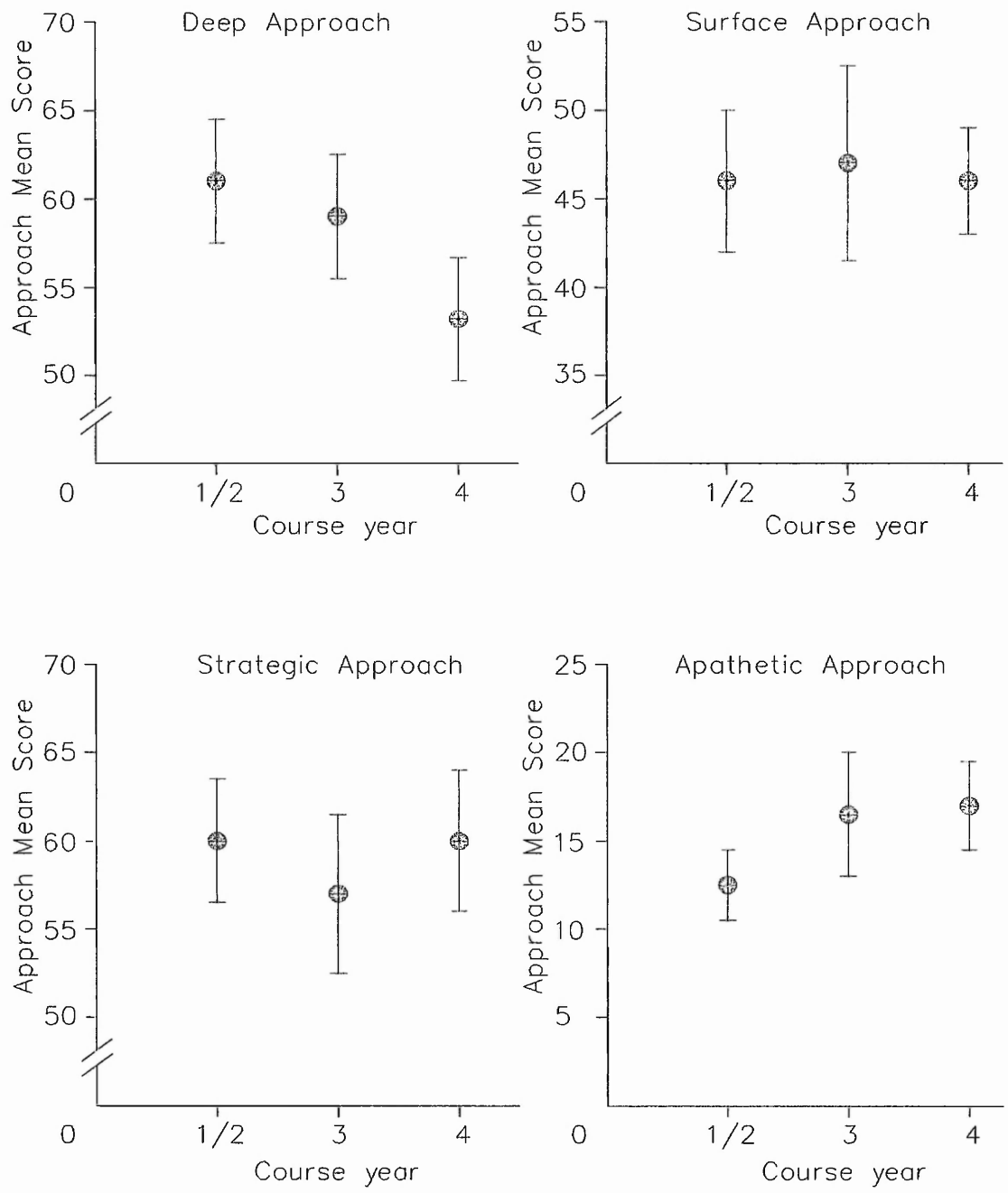


Figure 6.11 Approach Distribution by Year of Course (Part Time Integrated Engineering)

Centre spot indicates mean Approach Score. Vertical bars indicate standard deviation about the mean.

Table 6.12 Summaries of Independent T-Tests: Part-Time Integrated Engineering Year 1/2 vs Year 4.

VARIABLE	MEAN	t-value	DIF	p
Deep yr 1/2	61.1			
Deep yr 4	53.2	2.9	-7.9	.007
Surface yr 1/2	46.1			
Surface yr 4	46.2	-0.1	0.1	.976
Strategic yr 1/2	60.1			
Strategic yr 4	60.0	0.1	-0.1	.971
Apathetic yr 1/2	12.6			
Apathetic yr 4	17.2	-2.6	4.6	.017
Intent Understand yr 1/2	15.6			
Intent Understand yr 4	13.6	3.0	-2.0	.006
Relates Ideas yr 1/2	15.7			
Relates Ideas yr 4	13.2	2.4	-2.0	.024
Uses Evidence yr 1/2	16.1			
Uses Evidence yr 4	13.8	2.5	-2.3	.017
Lack of Interest yr 1/2	6.4			
Lack of Interest yr 4	9.1	2.6	2.7	.815

n yr 1/2 = 20 n yr 4 = 11

6.12 Discussion

An attempt was made at the start of this hypothesis to distinguish between what is (or what are) an 'appropriate' Approach(es) to Study. It was established that there is a difference between what is appropriate to pass a course and what is appropriate in terms of reaching understanding. The fact that these two are not the same should be of serious concern for the academics responsible for the teaching and assessment methods within these courses.

The Deep Approach to Study is considered as the most appropriate Approach to develop within a course. The results here are therefore disappointing with a drop in Deep Approach being reported with time. This phenomenon has been clearly demonstrated elsewhere (Watkins and Hattie 1985, Ramsden et al 1986, 1987,

Meyer and Sass 1993, Cliff 1995). It might therefore be concluded that there are some implications for the development of learning interventions as constructed within this thesis. It is implied from the findings that a Deep and possibly Strategic Approaches are primary factors in achieving higher quality learning outcomes. These are not being developed in the courses reported here. In order that these might be developed it is essential that interventions at Nottingham must now go beyond the simple intrusions into the system made by the author, and must take into account the demands made of students and the way in which these demands are perceived by those students. This can only really be done by examining and changing where appropriate the methods of teaching and of assessment. These effects have been shown to have significant impact on the quality of student learning elsewhere (cf. Clarke 1986, Newble and Clarke 1987, Gibbs 1992). Mechanisms by which this might be achieved and monitored could form the basis of future research.

6.13 Summary

The evidence in respect of this hypothesis is quite conclusive. If the most 'appropriate' Approach is Deep then this significantly decreases during their Integrated Engineering course of study. If the Strategic Approach to Study is the most 'appropriate' Approach then students do not significantly develop this over the course of study. This conclusion is reinforced by the increase in Apathetic Approaches to Study, an Approach that is conceptually similar to a reversed Strategic Approach. In both cases therefore, for Deep and Strategic Approaches, an 'appropriate' Approach is not being developed. The hypothesis is therefore not maintained and it must be assumed at this level of analysis that students on the Integrated Engineering degree do not develop an appropriate or preferential Approach to Study as they progress through the course.

6.14 Hypothesis Four

Students on the Integrated Engineering full and part-time degrees display a more appropriate Approach to study than those on other degrees in the Faculty.

This hypothesis, just as the previous, requires some judgement as to what 'appropriate' means. As discussed earlier, this centres around the concepts of Deep and Strategic Approaches to Study. This hypothesis is assuming that because of some unique characteristic(s) of the course, perhaps reflected by Jeffery (1993) or the students on the course, students taking Integrated Engineering are likely to be adopting 'more appropriate', 'better' Approaches than students on other courses in the Faculty of Engineering and Computing. In respect of this hypothesis therefore, it is expected that students on the Integrated Engineering degree produce higher RASI profiles for Deep and Strategic Approaches, and lower RASI profiles for Surface and Apathetic Approaches than their peers on other courses.

6.15 Hypothesis Four Results

To test this hypothesis one-tailed t-tests were conducted so as to establish the difference in Approach means and the significance of any differences between all first year students from the data base and the first year full-time and part-time Integrated Engineers. The summaries from this t-testing are presented below and overleaf and are summarised as before. Each set of Approach means were tested independently of each other so that any course producing significantly different Approach means could be identified. In order to reduce the amount of data presented here, only significant results are listed. If some courses are not mentioned, there simply was no significant difference between the Approach mean of students on those courses and either the Approach means of the full-time or the part-time first year Integrated Engineers.

In the case of full-time courses, the only significant Approach mean difference observed was as shown in the table below:

Table 6.13 Summaries of Approach Differences: FULL TIME Integrated Engineering Yr 1 vs all other FULL TIME Yr 1 courses

VARIABLE	MEAN	t-value	DIF	p
Deep INTENG FT	59.0			
Deep INDUMAN FT	51.9	3.7	-7.1	.000

n INTENG FT = 53 n INDUMAN FT = 54

Table 6.14 Summaries of Approach Differences: PART TIME Integrated Engineering Yr 1 vs all other Yr 1 courses

VARIABLE	MEAN	t-value	DIF	p
Deep INTENG PT	61.1			
Deep COMPSYS FT	56.8	2.4	-4.3	.019
Strategic INTENG PT	60.1			
Strategic COMPSYS FT	54.8	2.8	-5.3	.025
Apathetic INTENG PT	12.7			
Apathetic COMPSYS FT	17.1	-4.1	4.4	.000
Deep INTENG PT	61.1			
Deep MECHENG FT	56.5	2.5	-4.6	.016
Strategic INTENG PT	60.1			
Strategic MECHENG FT	54.8	2.6	-5.3	.011
Apathetic INTENG PT	12.7			
Apathetic MECHENG FT	16.0	-3.0	3.3	.004
Strategic INTENG PT	60.1			
Strategic INTENG FT	53.6	2.9	-6.5	.002
Apathetic INTENG PT	12.7			
Apathetic INTENG FT	15.6	-2.5	3.2	.008
Deep INTENG PT	61.1			
Deep ELECENG FT	56.4	2.6	-4.7	.013
Strategic INTENG PT	60.1			
Strategic ELECENG FT	56.2	2.0	-3.9	.050
Apathetic INTENG PT	12.7			
Apathetic ELECENG FT	15.0	-2.2	2.3	.035
Deep INTENG PT	61.1			
Deep MANUENG FT	56.0	2.5	-5.1	.030
Apathetic INTENG PT	12.7			
Apathetic MANUENG FT	15.4	-2.1	2.7	.037
Strategic INTENG PT	60.1			
Strategic COMPSTU FT	52.5	3.0	-7.6	.004
Apathetic INTENG PT	12.7			
Apathetic COMPSTU FT	15.6	-2.6	2.1	.012
Deep INTENG PT	61.1			
Deep INDUMAN FT	51.9	4.5	-9.2	.000
Strategic INTENG PT	60.1			
Strategic INDUMAN FT	54.4	2.5	-5.7	.016
Apathetic INTENG PT	12.7			
Apathetic INDUMAN FT	17.2	-3.7	4.5	.000

n INTENG PT = 20 n INTENG FT = 53 n COMPSYS FT = 96 n MECHENG FT = 74
n ELECENG FT = 78 n MANUENG FT = 40 n COMPSTU FT = 39 n INDUMAN = 54

When part-time students are compared with their full-time counterparts, several significant and very significant differences between Approach means are observed (table 6.14). In the Deep and Strategic scales reported it can be seen that the part-time students have Approach means which are significantly higher than the full time students. Part-time students also have Apathetic scale means which are significantly lower than the full-time students.

The only evidence of any difference between cohorts of exclusively full-time students is between the full-time first year Integrated Engineers and the full-time first year Industrial Managers, where there is a significant difference between the Deep Approach means shown in table 6.13. This suggests the Industrial Management degree is promoting a much lower Deep Approach to Study. This phenomenon has already been identified in chapter 5 and is thought to be linked to the negative expectations of students on the Industrial Management course. Many of these students would prefer to be on a Business Studies course and only take Industrial Management as a second choice. They may then adopt inappropriate Approaches as they begin to engage with more engineering learning than they had anticipated. Locally based interviews in future might help confirm or disprove this suggestion.

6.16 Discussion

There are variations in Approach means as exemplified in chapter 5 from which some conclusions were proposed regarding individual courses and the quality of student engagement. Within this hypothesis, it is concluded that these differences are not statistically significant except for that already reported for Industrial Management. The implications that can be drawn out are somewhat limited except that there would seem to be little variation in Approach means between all the cohorts of full-time students.

It is interesting to note that none of the part-time summaries include reference to the Surface Approach to Study. According to the statistic outcomes there is no difference between the Surface Approach mean for part-time students and the Surface mean for all other full-time students. In this respect the Surface Approach seems to be somewhat consistent and universal regardless of mode or subject of study.

6.17 Summary

There is no statistical evidence that students on the full-time Integrated Engineering course display 'more appropriate' Approaches to Study than students on other full-time engineering degrees except for the Deep Approach scale with respect to Industrial Management. This rejects the claims for development made by Jeffery (1993)(see literature review) and the assumption that the learning to learn workshops have had any effect on the Approach to Study of the Integrated Engineering students attending them.

There are differences to be seen between the Deep, Strategic and Apathetic Approaches of Integrated Engineering students on the part-time course and those on the full-time course, the part-time course generally having significantly higher means for these Approaches. There is however no difference between the Surface Approach means for the same part-time and full-time students. The reasons why such differences and similarities are reported is partly examined in the following section.

6.18 Hypothesis Five

There are relative differences in Approach to study between differentiated groups of students, for example, male and female.

By using the term 'differentiated groups' it is implied that there are a series of differing cohorts of students that may be categorised by some defining feature, for example male and female. This hypothesis is designed to compare Approach to Study means provided by these differentiated groups. As Richardson (1993a) says:

> *A basic research issue is whether there are differences in terms of patterns of responses given to the Approach to Study Inventory on the part of male and female students... The idea that male and female students in higher education differ in their Approaches to Studying is intrinsically a very plausible one. Despite the increase during recent years in women's participation in higher education, there has been very little change in the underlying distribution between men and women in institutions of higher education. In particular, it remains the case that female students are expected to study what are in most cases codified versions of men's experience.*

This last point may be relative to the local context, where for example, there is one female (single subject) lecturer in a population of twenty-seven academics and the student population has a male to female ratio of less than 10:1.

Limited (localised, small scale, single subject) research into the Approach to Study of differentiated student groups has taken place. Richardson (1991, 1993a, 1994, 1995a), Richardson and King (1991), Hayes and Richardson (1995), Trueman and Hartley (1994), and Severiens (1995) have undertaken some research specifically in respect of gender and age differences using scales identical or conceptually similar to those in the RASI. Richardson (1993a) found no significant differences in respect of gender, and that:

> *...there was no main effect of gender in the case of either meaning orientation or reproducing orientation, nor was their any interaction between the effects of gender and of sub-scales... the effects of gender upon approaches to studying can again be dismissed as small...*

This backed previous findings by Richardson and King (1991) and were similar to later findings by Hayes and Richardson (1995). Severiens (1995) has performed a meta-analysis on RASI data obtained form Edinburgh and from the research reported here. Severiens (ibid) found several small gender differences associated with some scales of the RASI, but most of these were reporting an effect size of no more than 30 percent. Richardson (1993a) also reports similar effect sizes when using the 18 item ASI set out by Gibbs et al (1988) as well as the 32 item ASI (Richardson 1990, Hayes and Richardson 1995).

If conducting research into intra-cohort gender differences, Richardson (1993a) makes some suggestions as to three consequences of 'gender insensitivity', being: *Methological:* the potential to inappropriately apply a description of learning to one gender when the description was derived from a study of the opposite gender; *Theoretical:* failing to realise that gender is a 'significant differentiating variable in many social phenomenon'; and, *Political:*

> *...in so far as the research findings may lead to proposals or interventions that affect men or women in a differential manner... Further research is obviously needed to determine whether any gender differences exist among students in the same disciplines...*

In addition to contributing to the general debate over gender differences and Approach to Study, this hypothesis within the context of the thesis, enables the three consequences referred to by Richardson (ibid) to be addressed. Does the methodology produce a mismatch between descriptions of male and female students? Is the application of the theory equally applicable to both sexes? Are there any significant differences that will alter policy on say, developing learning to learn interventions? Likewise similar questions can be applied to other differentiated groups such as students over and under the age of 21 years, or part-time and full-time students.

For this hypothesis, differences considered were those that are identifiable through responses to the RASI. It was possible to identify several significant groups: male/female, over 21 years/21 years and under (representing mature/standard age groups), part-time/full-time, Non-Standard Entry (NSE) students/all other students. Two tailed t-tests were used to establish any significant differences in means of RASI scales and sub-scales between the above pairings.

6.19 Hypothesis Five Results

Male and Female

The first pairing, male versus female, revealed the summaries described below. In the summaries in this section the four RASI scales are reported and then only sub-scales where any significant ($p = < 0.05$) differences were evident.

Table 6.15 Summaries of Independent T-Tests: Male/Female

VARIABLE	MEAN	t-value	DIF	p
Deep ♂	56.7			
Deep ♀	54.8	1.5	-1.9	.143
Surface ♂	48.1			
Surface ♀	49.4	-1.0	1.3	.341
Strategic ♂	55.2			
Strategic ♀	52.7	2.2	-3.2	.031
Apathetic ♂	16.4			
Apathetic ♀	15.2	1.7	-1.2	.095
Fear of Failure ♂	11.7			
Fear of Failure ♀	13.0	-2.2	1.3	.030
Intention to Excel ♂	13.6			
Intention to Excel ♀	12.4	2.9	-1.2	.005

n ♂ = 455 n♀ = 54

As can be seen in table 6.15, a statistically significant difference was found in Strategic Approach means with females producing a lower Strategic mean than males. Females also had a significantly lower Intention to Excel mean and a higher Fear of Failure mean than males. In all other scales and sub-scales there were no significant differences.

In respect of this, differences found in the Strategic Approach means would appear to be largely accounted for by differences in the Intention to Excel sub-scale. This is not to say that men are more Strategic than women in the Faculty of Engineering and Computing, but rather, it is the effect of one sub-scale that is producing an apparent differentiation in Strategic behaviour[14]. However, as

[14] A meta-analysis by Sabrine Severiens has recently conformed that whilst there are differences on between men and women on the Strategic score using the same data set used in the author's research, but at d = -0.30, the effect size is comparable with those found by Richardson, which cannot be described as a significantly large enough effect to support the hypothesis.

already seen in the factor analysis, this interpretation is confused with Intention to Excel loading on the Deep rather than the Strategic factor. There is no statistical evidence to suggest that in assessment men do significantly better than women on our courses. In that respect it is suggested that the differences reported here do not have corresponding observed effects.

Mature and Non-Mature Students

Students over the age of 21 represent 30% of the full-time students profiled in this research. Approach summaries of over and under 21 year old students are described in table 6.16.

Table 6.16 Summaries of Independent T-Tests: Young/Mature

VARIABLE	MEAN	t-value	DIF	p
Deep <21	55.6			
Deep >21	58.7	-3.2	3.1	.002
Surface <21	48.9			
Surface >21	46.5	2.1	-2.4	.044
Strategic <21	54.5			
Strategic >21	57.5	-2.8	3.0	.005
Apathetic <21	16.8			
Apathetic >21	15.0	3.1	-1.8	.002
Intent to Understand <21	14.1			
Intent to Understand >21	15.0	-3.2	0.9	.001
Active Interest <21	12.7			
Active Interest >21	13.8	-3.0	1.1	.002
Relating Ideas <21	14.2			
Relating Ideas >21	14.8	-2.3	0.6	.022
Passive Learning <21	11.8			
Passive learning >21	10.8	3.3	-1.8	.001
Study Organisation <21	12.8			
Study Organisation >21	13.5	-2.1	0.7	.035
Time Management <21	12.3			
Time Management >21	13.7	-3.4	1.4	.001
Lack of Direction <21	8.4			
Lack of direction >21	7.4	3.6	-1.0	.000
Lack of Interest <21	8.3			
Lack of Interest >21	7.6	2.1	-0.7	.033

n <21 years old = 391 n >21 years old = 118

This pairing of over and under 21 year old students produced significant differences within all the main scales; those students over 21 years of age producing higher Deep and Strategic Approaches and lower Surface and Apathetic Approaches. These differences are paralleled by the sub-scale profiles. There is a broader range of differences than those revealed in the male/female pairings and several related sub-scales can be seen to be contributing to the significant difference found in their respective main scales. For example, the significantly higher Deep Approach to Study mean produced from the over 21 years profile is supported by significant differences on the contributing Intention to Understand, Active Interest and Relating Ideas sub-scales. Strategic and Apathetic scales are similarly supported and only the Surface scale has limited, that is, one supporting significant sub-scale. In this respect, the Surface score would seem to be 'swamped' by the very significant Passive Learning sub-scale.

The results for the Apathetic Approach to Study make sense in that it would be expected for older (mature?) students to have a greater sense of direction and a keener interest than their younger counterparts. This is mirrored by the Strategic Approach summary which may indicate greater organisational and time-management abilities on the part of the mature students. Likewise the Deep Approach to Study differences can be explained by age, especially the idea that older students will tend to be more active in their thinking and are likely to be more reflective and to be seeking personal understanding (Richardson 1995a). It is therefore, concluded that the differences found on the Strategic, Apathetic and Deep scales are realistic. Less confidence should be attached regarding the nature of the Surface Approach to Study as being a significant differential variable between age groups.

Part-time and Full-time students

Table 6.17 overleaf summarises the significant differences found between the RASI Approach profiles produced by full and part-time students. Part-time students had significantly higher means on the Deep and Strategic main scales, and significantly higher Intention to Understand, Study Organisation, Time Management and Academic Self-Confidence sub-scale means. It could be argued that part-time students may be more skilled than full-time students; part-time students have a need for, and may be influenced by the context of their study so as to have developed organisational and time-management abilities. This follows the suggestions made by Richardson (1994) and Trueman and Hartley (1994). The Deep Approach to Study profile for part-time students can also be argued to make conceptual sense in that many part-time students tend to have a vocational

interest and may have more experience of the application of theories revealed in class than their full-time counterparts.

Table 6.17 Summaries of Independent T-Tests: Part/Full-Time

VARIABLE	MEAN	t-value	DIF	p
Deep FT	56.3			
Deep PT	58.5	-2.1	2.2	.040
Surface FT	44.4			
Surface PT	46.4	1.5	-2.0	.142
Strategic FT	54.6			
Strategic PT	58.5	-3.0	3.9	.003
Apathetic FT	16.4			
Apathetic PT	15.5	1.0	-1.1	.313
Intent to Understand FT	14.3			
Intent to Understand PT	15.1	-2.6	0.8	.011
Study Organisation FT	13.0			
Study Organisation PT	14.1	-2.6	1.1	.010
Time Management FT	12.4			
Time Management PT	13.9	-2.9	1.5	.004
Academic Self-Conf FT	13.9			
Academic Self-Conf PT	13.0	2.6	-0.9	.011

n Part Time = 58 n Full Time = 509

As indicated previously, there is little variation in the Surface Approaches to Study regardless of gender or age and this effect is also seen in the results for part and full-time students. It could be argued that this may be because of workload, assessment and time constraints placed on part-time students who respond by taking a Surface Approach to Study of a similar magnitude to full-time students. This would imply that part-time students produce comparable Surface Approach to Study means to the full-time students because the part-time course prompts Surface Approaches in a similar way to the full-time course. Alternatively, the full/part-time Surface Approach means are comparable because the Approach itself is less of a key differential variable than the Deep or Strategic (and by association the Apathetic) Approaches. The research is inconclusive and further evidence, perhaps in the form of data about student orientation and conceptions would be needed before reaching such a conclusion.

Non-standard and Standard Entry Students

RASI profiles for Non-Standard Entry (NSE) students were compared with the profiles from standard entry students. The results are shown below in table 6.18.

Table 6.18 Summaries of Independent T-Tests: Standard/NSE

VARIABLE	MEAN	t-value	DIF	p
Deep	55.8			
Deep NSE	60.6	-3.6	4.8	.000
Surface	48.5			
Surface NSE	47.4	0.7	-1.1	.484
Strategic	54.4			
Strategic NSE	57.1	-2.0	2.7	.042
Apathetic	16.6			
Apathetic NSE	14.6	2.3	-2.0	.022
Intent to Understand	14.2			
Intent to Understand NSE	15.3	-2.8	1.1	.005
Active Interest	12.7			
Active Interest NSE	14.7	-4.4	2.0	.000
Use of Evidence	14.6			
Use of Evidence NSE	15.6	-2.2	1.0	.032
Passive Learning	11.7			
Passive learning NSE	10.8	2.2	-0.9	.025
Intent to Excel	13.3			
Intent to Excel NSE	14.2	-2.0	0.9	.044
Lack of Interest	8.3			
Lack of Interest NSE	7.0	3.0	-1.3	.004

n Standard Entry = 426 n NSE = 83

For this purpose and as demarcated on the RASI, 'standard entry' is considered as the student having gained entry qualifications in either school or Further Education college. 'NSE' students are those gaining qualifications via Access, from overseas or elsewhere apart from school and FE college. These students represent about 12 percent of intake to local engineering degrees. As can be seen the NSE students produced significantly higher Deep and Strategic Approach to Study profiles. They also produced a lower Apathetic Approach to Study profile. There was no significant difference in Surface profile between Standard and NSE students.

So again there is little variation of the Surface scale means even though there are significant differences on the other three main scales. The Deep Approach differences are particularly strong and are well supported by the differences found on the associated Deep sub-scales. The higher Deep and Strategic means (and complementary lower Apathetic mean) might be explained in this case by the common individual characteristics of Non Standard Entry students. Many are over 21 years old and will thereby have characteristics of mature students in respect of Approach to Study as already discussed.

For the majority of these students, the decision to pursue a degree in engineering has implications for their learning prior to arriving into university. They are required to have shown through study or through the accreditation of prior learning that they are competent to study at degree level. For many this will have involved periods of study involving similar strategic needs to the mature students described above. For others with conceptual understanding gained through work or elsewhere, it is certain that the tutors responsible for admission will have also looked for an active interest in engineering matters as well as an intention to build personal understanding. It is likely that NSE students will report this interest. One NSE student, male, 34 years old, married with two children, reported a tension between intention and demands:

> *I came to university via an engineering access course... my decision to take this course was based upon a liking for problem solving... I know from my employment background that I enjoy learning, above all other considerations it is the fact that I enjoy learning that I see as my greatest asset. When I started my degree I felt I was ready to tackle it... what I was not prepared for was the degree to which students are left on their own devices... once I realised that organising my own schedule was entirely my responsibility I decided that I had to be very strict with myself in organising my time, maybe more than most due to family and financial commitments. I feel that it of utmost importance to keep my workload under control.*
>
> (563, D=H, S=L, St=M, A=H)

It is concluded that the differences found between NSE Approach scale means and standard entry Approach scale means are likely to be partly a function of the composition of the cohort in that many students will be classed 'mature'. The differences may also be a function of the intentions NSE students have towards engineering study, it being likely that these students have an intrinsic personal interest in engineering. Such students are likely to intend to actively interact with material and arguments presented to them as a route to personal understanding.

6.20 Discussion

With respect to this hypothesis, *there are relative differences in Approach to study between differentiated groups of students*, it can be argued that there are some statistically significant differences between all the pairings within the groups studied. Women are less Strategic than men in the context of this study but the effect size is very small. Mature students take Deeper and the more organised elements of Strategic Approaches to Study than students under 21 years of age. Part-time students also take Deeper and more Strategic Approaches to Study than full-time students as do NSE students over standard entry students. Mature and NSE students take less Apathetic Approaches over their respective counterparts.

The identification of these differences are relatively clear in respect of all the pairings except the male/female comparisons as previously suggested by Richardson (1993a). In this case the differentiation on the Strategic scale is based on the Intention to Excel sub-scale and this has already been shown to be unreliably associated with the Strategic factor. However, this sub-scale did account for 40 percent of the variance within meta-analysis based on the same data set (Severiens 1995). It could be possible that men produce higher means on this scale than women in this study because females maybe less competitive within the local context. Despite the emancipation of women, female students are still a minority in Engineering Education and as such may tend to succumb, that is, to 'fit in' to the male dominated environment. They may naturally not want to be seen to be in competition with the majority nor the culture. The reverse of this argument might explain the higher female Fear of Failure. Failing to complete the course of study within this male culture would be seen as a weakness by the culture, thereby further diminishing the (already) minority status of women engineering students. Also, for some females there may be greater parental or significant other pressure to succeed, as one female, 20 years of age describes:

> *I suppose I do have a great fear of failing examinations, firstly because I have never failed an examination before. Secondly I am scared of letting my family down, because when I first mentioned it they were very down on the idea of going to university. I would love to prove to them I made the right decision.*
>
> (195, D=L, S=M, St=M, A=M)

In this respect engineering is not seen as a subject for females and as a result the female student may as indicated, feel pressured to succeed and therefore report a greater Fear of Failure. Notably, Fear of Failure was not found to be a significant

differential variable in any of the other pairings studied. Again this reflects the previous work (Richardson 1993a, Hayes and Richardson 1995), with significant variation being found at the sub-scale level for Fear of Failure. However, the effect size calculated by meta-analysis is only 16 percent (Severiens op cit). In this respect and with respect to the rest of this discussion, the author must draw a similar conclusion to that stated by Richardson (1993a) that there is no clear evidence of differences between men and women in their Approaches to Study.

Overall though it should be noted that these findings are based on quantitative analysis of attitudinal questionnaires, and these may not be sensitive enough to pick up any differences in underlying issues inherent in the author's model of student learning. Any suggestions here have been based on extrapolation from data. Further work could involve some examination of the orientation to study and conceptions of learning held by these differing groups of students so that some of the minor findings here might be interpreted more accurately.

6.21 Summary

In each of the groups studied except the male/female pairings, very small variations were found in Approaches to Study. With respect to Richardson's (1993a) three consequences it may be concluded that from the male/female study that firstly, there is no evidence suggesting that political implications should be taken from these findings. Secondly, that there are no significant theoretical consequences may be open to question, in that it may be more appropriate to apply the concept of orientation to study in attempting to understand the small differences reported here. Thirdly, the methodology appears to be acceptable in that the arguments supporting the statistical findings make conceptual sense and the RASI has identified differences in gender, albeit not at a sufficiently high level to accept the hypothesis. However, in respect of this last point it is also suggested that an alternative methodology such as interviews may be more gender sensitive, whilst at the same time bringing the danger of bias though differential behaviour toward male and female subjects by the interviewer. In attempting to deal the potentials for bias and for by inventory insensitivity, Richardson (ibid) used two different forms of the ASI, but still found results consistent with those reported here. These, it is argued, support the author's suggestion that there is no interpretable variations in the Approaches to Study of the males and females reported here.

Carried forward to the other pairings studied, there do seem to be at least a few consequences that might be noted. Again in each case it has been possible to make conceptual sense of the outcomes, broadly based on the suggestion that the other groups (NSE, and part-time) have differences largely accounted for by the presence of a high proportion of mature students. It would seem therefore, that there are theoretical consequences, and for example, it is important to realise that age is a 'significant differentiating variable', probably because experience is related to age and older students may take superior Approaches to Study. The commonly held belief that mature students have inferior skills for learning is thereby questioned and the previous research (Trueman and Hartley 1994, Richardson 1994, 1995a) is supported. Politically this may mean that courses should be encouraged to accept mature students and that these should be dispersed evenly through seminar groups so that their superior Approaches might be seen and emulated by non-mature students (Richardson 1994, 1995a).

The methodology is broadly acceptable in that the RASI and the analysis does differentiate between these groups examined, however it is noted that validity of all these analyses may be questionable given the unequal size of the paired groups. As has already been suggested, an alternative methodology (and theoretical consideration) might be applied to such studies in future. This is most likely to be qualitatively based, possibly along the lines of the qualitative study reported within this research which is discussed in the next chapter.

7.0 Qualitative Analysis

7.1 Introduction

This chapter aims to describe and explain an additional and supporting research activity to the main quantitative study. As will be described, the students exposed to the learning to learn workshops completed a summative assignment in which they reflected on the quality of the interaction between their learning and their course of study (Integrated Engineering). This produced some informed and insightful comments which were used to illustrate and enhance the statistically based work reported earlier. Even though qualitative research forms a relatively small part of the overall research, in gathering this qualitative data it was important to establish and to uphold appropriate research rigour. This chapter reviews the paradigms that support the type of qualitative research adopted, describes the methods used and presents the results obtained.

7.2 Background

Qualitative research is not without its critics and Richardson (1993) has described qualitative methods used by some researchers as 'poorly structured' and that the 'validity of most phenomenographic research that is carried out must be open to question'. His central criticisms seem to be concerned with the emotive nature of enquiring into the dispositions of students, the potential to bias the answer elicited, to uncover problems that the researcher is not equipped to handle, and earlier (1990) the way in which researching into student behaviour may affect the students' future academic decisions, especially if the student's tutor is also the researcher. Taking these warnings seriously means that an alternative to direct questioning and interviewing might be sought and applied. Further, the methodology must be presented and reported clearly, paying attention to, and reporting clearly any local characteristics and contexts in which the study took place.

7.3 Qualitative Methodology

Hitchcock and Hughes (1989) describe how it is necessary 'for the social researcher to qualify through the eyes of the observer' - meaning that at some point in social research the desire to establish generalisations from the data needs to be replaced

with a willingness to look at the data from a small-scale, local level perspective using the participants' own descriptions. In short the methodology is generally *interpretative ethnographic*[15] broadly meaning that the researcher attempts to capture and describe the subject's interpretation of his or her social context by accessing personalised information regarding the subject's behaviour.

Interpretative ethnographic research would seem to cross two boundaries of qualitative research approaches: that of *Interpretivism* and of *Social Anthropology* (Miles and Huberman 1994). Social anthropology involves the 'description of local particularities' (ibid), and the way in which individuals relate to their world. The research outcome is a description of the way in which these individuals are seen to be regularly behaving within their social context. Interpretivism involves the identification of the meaning behind what people do. In this sense, human activity is seen as 'a collection of symbols expressing layers of meaning' (ibid) and some interpretation is to be made of this symbolic activity by the researcher.

Taking the problems and potential pitfalls described by Richardson (1993) seriously, it was decided not to conduct direct observation and research such as face-to-face interviews and rather, to present the opportunity for students to report any meanings they may have associated with their study orientation remote from the researcher.

The main activity involved a written assignment towards the end of the learning to learn workshops that asked students to reflect on and report their perceptions and reactions to their learning environment. This was supported by an exercise using the SWAIN technique (O'Neil and Pennington 1992). Here students are asked to identify their own Strengths, Weaknesses, Aspirations, Interests and Needs in relation to a particular item. In this case the item was their own learning as implicit in the assignment question:

> *Describe the Approach(es) to Study you are taking to your engineering learning. Justify your description and evaluate the implications of taking the approach(es) you do.*

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[15] There is no specific set of research procedures in ethnography although there are distinctions between different types of ethnographic research. However, they all have in common the desire to explore, discover and understand people's views of their world (McMillan and Schumacher 1989). The term *interpretative ethnographic* is used simply to imply that this research must attempt to relate the interpretations made by a student to the environment in which the student operates (Hitchcock and Hughes 1989).

In posing such an assignment it was hoped that it would allow students to report their own understanding of meaning associated with Approach to Study, and to be able to discuss their feelings without being biased or unduly prompted by the author. All the students had attended at least six of the eight learning to learn workshops prior to the issue of the essay title. Each student was issued with the a marking scheme indicating the qualities of discourse that would be expected. This scheme was based on the SOLO Taxonomy (Biggs and Collis 1982). In tutorial, explicit instructions were given to report personal and true reactions to the course of teaching and any consequent response. It was made quite clear that there would be no 'correct' or expected answer and that reward would be given to open and honest discussion. Each student was assured that their names or any other identifying information would not be revealed to anyone other than the researcher.

Richardson (1995) supports this methodology as being 'essentially qualitative in character' in that the data collected and the interpretation of the data follows qualitative methods and, though this technique lacks the rigour of a 'full-blown' qualitative research project, it avoids many ethical problems. From the discussions above it might be summarised that this research is qualitative in nature, following a humanistic, ethnographic tradition, and relying on the collection of the student's interpretation of the task in hand as described by the content of his or her essay writing.

The process described above fits a research paradigm known as *hermeneutics* (Odman 1988) which literally means the 'science of interpretation'. This is very similar to, and would seem to provide the logical background to *phenomenography* (Marton 1981) as previously discussed. Within the hermeneutic research paradigm and the phenomenographic the researcher is involved in the study of and explanation of meaning as comprised by 'the theory and practice of interpretation and understanding in different social contexts' (Keeves 1988) so that in, for example this study, an understanding is established of how students see themselves operating within a specific culture and environment and of what they understand the learning process to be.

7.4 Qualitative Data

An essay title was presented to the students towards the end of the learning to learn workshops. It was an open question and students were encouraged to interpret the question and to comment subjectively on their relationship with their

course of study. Measures were taken to assure the students' confidentiality and to make it explicit that in the absence of a single correct answer, the students would not gain marks by attempting to guess what the lecturer wanted. The full question and the marking scheme are to be found in Appendix Two as part of the learning to learn scheme of work. The essays varied between 1500 and 3000 words in length and were written in the first person. This produced 31 essays, comprised of 22 from students still on the course at the end of the first year, 6 from students who had withdrawn by the end of the first year and 3 that proved unusable.

Student essays were subjected to a sequential analytical process common in much qualitative research and outlined by Miles and Huberman (1994), subsumed under a more general process of data reduction, data display and conclusion drawing and verification. The first of these, data reduction involved selecting and paraphrasing in order to reduce the data (some 200 pages of text) to a manageable collection of salient information. The second stage involved displaying the data in some organised way so as to facilitate the recognition of themes and structures within the data. Conclusions were drawn from the patterns emerging and considered against the author's understanding of the Approach to Study epistemology. It is most likely that a series of techniques drawn from different qualitative stances will have been used so it is essential at this point to describe the methodology, the context in which it was used and the subsequent outcomes.

7.5 Data Reduction and Display

In order to handle the data in an efficient manner and to enhance the sensitivity with which it is viewed, it is suggested (Miles and Huberman 1994, Strauss and Corbin 1990) that data is *coded*[16] allowing the systematic labelling of phrases and sentences used in the construct of the essays. For the student essays these codes were designed so as to make explicit the meaning or concept described by chunks of text. A set of criteria was established by which the text could be fractured and sorted into categories. These criteria are listed overleaf. Categories are conveniently available for this data in that the conceptual constructs of Approaches to Study are widely established and in this instance, described within the scales of the RASI (see figure 4.1). The notion of identifiable Approaches to Study is discussed in the literature section as is the motivational base on which some of

[16] 'Grounded Theory' was developed by Glasser and Strauss (1967) and refers to a sophisticated method of qualitative analysis whereby a new concept or theory emerges from the data obtained. In other words the new theory or concept is 'grounded' in the data obtained rather than in the research literature.

these theories are established. The application of the categories and their sub-categories was enhanced by constructing new categories based around the motivations students seemed to have in their attitude to learning as described in their essays.

Deep Strategy	**DEEP**
Intend to Understand	INT-UND
Active Interest	ACT
Relating Ideas	REL
Using Evidence	USE
Surface Strategy	**SURF**
Memorising	MEM
Making Sense	SENS
Passive Attitude	PAS
Coping Strategy	CONC
Minimalist Strategy	MIN
Strategic Strategy	**STRA**
Organisation of Time	TIME
Organisation of Study	ORG
Intention to Excel	INTEX
Alert to Assessment	ASS
Apathetic Strategy	**APAT**
Lack of Direction	LACK-DIR
Lack of Interest	LACK-INT
Self Belief	**SELF**
Academic Self Confidence	ASC
Institutional Context	**IC**
Tutor Attitude (to Student)	TEACH
Workload	WORK
External Context	**EC**
Predisposed	PRE
Family/Home	HOME
Motivation	**MOT**
Intrinsic	I-MOT
Extrinsic	E-MOT
Decline	DE-MOT
Increase	INC-MOT
Dependent	DEP-MOT
Independent	IND-MOT

Figure 7.1 Initial Codes for Essay Analysis

The final list of categories was established after several readings of the essays and attempts to ascribe codes. During this process codes were renamed, and redefined until a set that fitted the data was established. This set of codes is shown in figure 7.1 and further explained in figure 7.2. Those categories described in bold

type-face refer to the main group headings with the subsidiary components listed below these headings. The abbreviated forms of the codes are shown and it is these abbreviations that was used to note categories within the student essays.

In figure 7.2 there are four columns headed CODE, TENDENCY, *f.*, and EXAMPLES. CODE refers to the above code applied to categories within the student essays. TENDENCY describes the meaning of the category. For example, a phrase coded CONC would assume the student appears to be concerned with his or her ability to cope with the intellectual demands of the course. Column *f.* shows the frequency at which each code was recorded, for example, identifiable phrases relating to Motivation (MOT) were recorded a total of 76 times to include Dependent Motivation (DEP-MOT) which was recorded 41 times within the collection of essays. The main headings also include counts of phrases that could not be specifically described by sub-categories but could be described as being generally within the main category.

EXAMPLES paraphrases or directly quotes an appropriate example of the code as identified within the data. Those examples with 'Pre' at the start indicate that the comment had been made as to indicate a predisposition, something from past experience that affects action now. The number of times a particular comment was made to indicate a predisposition is indicated, for example, (Pre 4).

In order to profile the range of meaning and to facilitate the search for more specific patterns than those discernable in figure 7.2 it was necessary to compare the coding for each essay against the rest of the coding frequencies. A spreadsheet was utilised to offer an initial visual analysis and this is shown as table 7.1. Table 7.1 displays the code frequencies relative to individual students. The student identification number is shown in the first column. Aggregated assessment scores (in percent) over the first and second years of the degree are displayed in the second column. Those students who have withdrawn from the course are labelled 'W/drawn'. The category codes are listed as in figure 7.1 and the frequency at which each is present in individual essays is noted. Towards the right hand side of table 7.1 the RASI profiles for each of the students is indicated under the headings Deep, Surface, Strategic and Apathetic. Headings with the suffix 'B' refer to profiles taken before the learning to learn workshops and before the essays were written. Those without the suffix were taken after the workshops and after the essays were written and submitted. The RASI profiles are presented using the High, Moderate and Low categories described in more detail in table 5.5, chapter five.

CODE	TENDENCY	f.	EXAMPLES
Deep Strategy (DEEP)	**Meaning Orientation to Study**	55	'I endeavour to understand why a particular equation or method is being used at a particular time'
Intend to Understand (INT-UND)	A desire to interact with the learning material at a deep level	14	'.. if I do not know why I will not be able to apply information' '.. in order to learn effectively the subject matter needs to be understood'
Active Interest (ACT)	Descriptions of further thinking promoted by the learning material	10	'I try to bring the material to life in my mind... by applying it to real situations' 'I learn considerably well.. when I apply information'
Relating Ideas (REL)	Thinking about information in order to check personal understanding	17	'I have to be able to see a relationship between what I have been told, what I thought and how to use the information in practice'
Using Evidence (USE)	Examination of personal and received information for justification	7	'I get a greater understanding of the subject when I read about it.. if I can read a chapter and then visualise it I know I've understood it'
Surface Strategy (SURF)	**Reproducing Orientation to Study**	85	(Pre 2) 'When facts are taught by repetition and reinforcement I find it very useful because it sinks into the memory and I can remember them'
Memorising (MEM)	Using unrelated memorising as a strategy for holding information (rote)	30	(Pre 7) 'If I don't understand it then I memorise it... it's best not to bother and ignore it completely instead of wasting time on something I'll never learn'
Making Sense (SENS)	Unwilling to try to understand or difficulty in reaching understanding	11	'I have problems grasping the concept.. I do just enough.. I struggle relating a theory to non run-of-the-mill problems which may lead to downfall'
Passive Attitude (PAS)	Lacklustre and passive audience approach to the learning environment	14	(Pre 1) 'I take a passive role... depending on the subject... there isn't any interaction with the material' 'I do not ask if a point comes up I don't understand'
Coping Strategy (CONC)	A perceived inability to cope with the intellectual demands of the course	15	'.. so frustrated/scared by all the unrecognisable knowledge thrown at you... I can't face going to the tutorial because you're not going to have a clue'
Minimalist Strategy (MIN)	Strategy of doing the least amount of work possible	9	(Pre 1) 'I do minimal preparation... the barest minimum to get by... just the facts in a structured layout' 'I do only the minimum to pass.. it's surface'
Strategic Strategy (STRA)	**Achieving Orientation to Study**	64	'My intention is to succeed and therefore I'll use any method that will get me a reasonable degree in the course'
Organisation of Time (TIME)	Good organisation of time	18	'I can very quickly plan my work and prioritise each piece in terms of urgency... I also allocate the time to be spent on each assignment'
Organisation of Study (ORG)	Systematic and determined attitude to getting work done	18	'I have always tried not to leave problems aside as if they did not exist, but instead I tackle them head on'
Intention to Excel (INTEX)	Driven by a determination to achieve personal goals	8	'I can congratulate myself if I am ahead.. or chastise myself if I am not performing.. either way I can tick off another section which is an ego boost'
Alert to Assessment (ASS)	Aware of lecturer clues regarding assessment type and content	8	'From the lectures it was easy to see what was in the exam.. I concentrated on these parts.. I managed to greatly reduce the amount of work'
Apathetic Strategy (APAT)	**Apathetic or Ambivalent Orientation to Study**	26	(Pre 1) 'I still can't get motivated to want to do the work which reflects on my general attitude'
Lack of Direction (LACK-DIR)	Not really sure about the reasons for being on the degree course	7	'I think I have the ability to complete this course but I really need to sort myself out and decide whether I really want a degree in engineering'
Lack of Interest (LACK-INT)	Not really interested in the course materials	14	(Pre 1) 'I am neither interested in, nor do I enjoy that which I am pursuing' 'I don't believe it is possible to decide to be interested in engineering'
Self Belief (SELF)	**Self Belief in Learning Abilities**	9	'I will gain the confidence and motivation necessary to complete the course and I hope I shall emerge with the qualities required to be successful'
Academic Self Confidence (ASC)	Confidence in the ability to interact with the material	2	'The major necessity is for me to have confidence in my own ability'
Institutional Context (IC)	**The Effects of the Learning Context on Student Learning**	50	'A lot of the course is taught conventionally... I would say you can quite easily pass if you had a good memory but don't really understand'
Tutor Attitude (TEACH)	Tutor attitudes and skills as perceived by the student	18	'Who uses real life examples to the theories.. helps student's appreciate their work and.. better understanding all round'
Workload (WORK)	The nature of the work and its effect on student orientation	8	'The situation I'm now in is there appears to be too much to deep learn and I'm panicking'
External Context (EC)	**Effects of Previous Learning Contexts on Learning**	30	'In terms of the skills I gained at my previous college and from time in industry I was ready to tackle the degree course'
Predisposed (PRE) (may be suffix)	Archaic attitudes developed in previous schooling and continued now	18	'It was no longer a case of information being given to you on a plate... I got very tired of trying to keep up'
Family/Home (HOME)	Pressures/Influences affecting attitudes to study now	4	'Because they eventually let me go to university I feel very scared of failing these exams and letting them down'
Motivation (MOT)	**Motivations for Study**	76	'A compelling reason for doing my degree is that it is a means to an end.. as I wish to be in the armed forces'
Intrinsic (I-MOT)	Interest internal to the course and the course material	5	(Pre 1) 'The main driving force.. is the fact that I want to be here because of the stimulation and enjoyment I gain from learning'
Extrinsic (E-MOT)	Interest external to the course and the course material	12	(Pre 1) 'My assumption for studying.. is to be injected into the management ladder instead of working your way up'
Decline (DE-MOT)	Reported decrease in motivation/interest since starting the course	7	'After trying to master studying as well as being bombarded with new material... some of my inner-drive started to disappear'
Increase (INC-MOT)	Reported increase in motivation/interest since starting the course	2	'A good case study is this subject. I started off thinking what a waste of time, now I see the relevance and it may help'
Dependent (DEP-MOT)	Reliant on the learning environment maintaining interest	41	(Pre 4) 'I generally become a surface learner when I am not stimulated.. those around me also influence me.. I don't want to appear a creep'
Independent (IND-MOT)	Reliant on self maintaining interest	6	'Now I am aware of different approaches... the work I have to do is no longer a chore.. now find it interesting'

Figure 7.2 Essay Analysis: Code Frequencies and Examples

Student Code Number	Mean Score Percent / Code Category	Deep	Int −und	Act	Rel	Use	Surf	Mem	Sens	Pas	Conc	Min	Stra	Time	Org	−ve Org	Intex	Ass	Apat	Lack−Dir	Lack−Int	Self	−ve Self	Asc	−ve Asc	IC	Teach	−ve Teach	Work	−ve Work	EC	Pre	Hom	−ve Hom	Mot	−ve Mot	I−Mot	E−Mot	De−Mot	Inc−Mot	Dep−Mot	Ind−Mot		Deep B	Surface B	Strategic B	Apathetic B		Deep	Surface	Strategic	Apathetic
549	69	7	1		2	3	0		1				2				2		0			3		1	2	3	3			0				4				1		3			H	H	M	M		H	M	M	L
556	69	3	1				1	1					2		1			1	0			0				0					3		1	2	3				1	1	1		M	M	L	M		L	M	M	L
548	68	1			1		5	2		1	1		1				1		2		1	0				1	1			3	3			6				1		4	1		M	M	L	M		M	H	L	H
550	68	2	1		1		2	2					2					1	0			0				0					0				4				1		1	2		L	M	L	M		L	M	M	H
532	65	3	2	1			11	1	4		5		7	3	3	1			0			0				1	1				0				4						4			H	H	M	M		H	M	H	M
544	63	2			2		2	2					1						0			0				0					0				2						2			M	M	M	M		M	L	H	L
568	62	1	1				8	4		1	1		1		1				1		1	0				0					3	3			1						1			L	M	L	H		L	M	L	H
534	62	2	2				0						7	5	1				0			2	1			4	1	1	1	1	0				1			1					H	H	M	M		M	H	M	H
563	62	8	2	3	1	1	1	1					1	1					0			0				0					3				3		2							H	L	H	L		H	L	M	H
569	61	1			1		7	2	1	2			3	1	1				0			0				4	1	1	1	1	2	2			2						2			L	H	L	H		L	H	M	M
546	60	9	2	1	4	1	3		1	1	1		2				2		0			0				5	1	3			0				4		1				2	1		M	M	L	M		L	M	L	H
537	60	0					4	1	1	1		1	2	1				1	5	4		0				5	1	2	1	1	3	2	1		4			2			2			M	M	M	H		M	L	M	H
533	57	1			1		1					1	4		1	2			4		4	0				1	1				1	1			6			4			2			L	M	L	H		L	M	L	H
551	57	3	1	1	1		0						5	2	2		1		0			0				1	1				0				0									H	M	H	L		H	L	H	L
540	56	0					1					1	4	1	2		1		0			0				0					0				1						1			H	M	M	H		H	H	M	H
554	56	1		1			2	2					4	1	2	1			0			0				0					1	1			4			1		1	2			H	M	L	L		H	M	L	L
567	56	0					2			1			0						1		1	0				3	1		1	1	1	1			3			1	1		1			M	L	L	M		L	H	L	H
541	55	0					1				1		2	1	1				0			2		1		0		1			2	2			2						2			H	M	M	H		H	H	M	H
557	53	0					0						4		2	1	1		0			0				0					0				0									H	M	M	M		H	L	M	M
559	51	8	1	3	1	1	0						3		1				0			0				4	1		1	2	0				0									H	L	M	L		H	L	M	M
542	49	1				1	5			2	3		1	1					1	1		1				8	3	2	1	2	0				6	1	1	2			1			M	M	L	H		M	M	M	H
553	46	0					2			1	1		5	1				4	1		1	0				0					0				2		1				1			M	L	L	L		L	M	L	M
207	W/drawn	1			1		11	4	1	1	1	3	0						1		1	0				0					1		1		0									H	L	H	L		−	−	−	−
195	W/drawn	0					7	3	1	1		2	0						2	1		0				3			1	2	5	1	1	3	3				2		1			L	M	M	M		−	−	−	−
209	W/drawn	0					2	2					0						2		2	0				0					0				3				2		1			M	M	L	L		−	−	−	−
189	W/drawn	1			1		2		1			1	0						4		2	1				5	1	1	1	1	2	2			5						4	1		M	H	L	M		−	−	−	−
173	W/drawn	0					3	1		1	1		0						1	1		0				0					0				0									M	M	L	M		−	−	−	−
172	W/drawn	0					3	2		1			1					1	1		1	0				2	1	1			0				3						3			M	M	L	M		−	−	−	−
	Total	55	14	10	17	7	85	30	11	14	15	9	64	18	18	5	8	8	26	7	14	9	1	2	2	50	18	12	8	11	30	18	4	5	76	1	5	12	7	2	41	6										

Table 7.1 Essay Codes Distribution by Student

Categorisation inevitably involves a primitive quantification of data (Anderson and Burns 1989) as categories are plotted and the frequency of response noted. This quantification can be interpreted using statistical methods. Initially some examination of the difference between those essays from passing and failing is in order. However, some qualification must be made in that the sample is small and comparison between those who withdrew from the course and those that did not involves even smaller sub-groups. Emerging evidence must therefore be viewed carefully and described as indicative and not conclusive.

Viewing table 7.1 gives some indication of the patterns that may be inherent in the data set. It is noted that there is a lower incidence of Deep and Strategic categories being reported by those students who withdrew from the course compared to those who did not. While this phenomenon is not obviously directly reflected in the RASI profiles, it does seem that those students who withdrew have RASI profiles that are somewhat similar, with four of the six students displaying moderate Deep scores and low Strategic scores.

To try and establish if there was a difference between the groups of students commented on above, the data in table 7.1 was tested for statistical significance. Initially it was important to see how the code categories correlated. This revealed the correlations in table 7.2.

Table 7.2 Inter-correlation Matrix for Essay Code Categories

	DEEP	SURF	STRA	APAT	SELF	IC	EC	MOT
DEEP	1.0							
SURF	-0.2	1.0						
STRA	0.1	-0.2	1.0					
APAT	-0.2	0.1	-0.0	1.0				
SELF	0.1	-0.3	0.1	-0.1	1.0			
IC	0.2	0.1	-0.1	0.3	0.3	1.0		
EC	-0.1	0.3	-0.4	0.1	-0.1	0.0	1.0	
MOT	0.0	0.3	-0.2	-0.0	0.1	0.1	0.2	1.0

n = 28

KEY: DEEP = Deep Approach SURF = Surface Approach STRA = Strategic Approach APAT = Apathetic Approach SELF = Self Belief IC = Institutional Context EC = External Context MOT = Motivation.

Table 7.2 above shows the inter-correlation matrix for the essay codes. As can be seen the correlations are quite low which may be indicative of their relative independence, however, the cohort number is only 28 so these figures are difficult to interpret accurately.

Taking the main category headings in turn, two-tailed t-tests were conducted to establish the size and significance of difference between the groups categorised as passing or failing students. This effectively means that a null-hypothesis was tested that suggested there is no difference in the frequency of Approach related comments made by students either completing or withdrawing from the first year. Table 7.3 shows the difference (DIF) between the mean variable scores of the students who are still on the course (PASS) and those who have withdrawn (FAIL). The significance these differences represent is also shown as a level of probability (p), significance being set at $p = < 0.05$ and very significant at $p = < 0.01$.

Table 7.3 Essay Category T-Test Results

VARIABLE	PASS	FAIL	DIF	p
Deep Approach	2.4	0.3	2.1	0.05
Surface Approach	2.6	4.7	-2.1	0.08
Strategic Approach	2.8	0.2	2.6	0.00
Apathetic Approach	0.7	1.8	-1.1	0.03
Self Belief	0.4	0.2	0.2	0.30
Institutional Context	1.8	1.6	0.2	0.44
External Context	1.0	1.3	-0.3	0.39
Motivation	2.8	2.3	0.5	0.29

Table 7.3 reveals some significant differences between the two groups. Students dropping out of the course are less likely to report either Deep or Strategic categories within their essays ($p = < 0.05$ and $p = < 0.01$) and are more likely to report Apathetic categories ($p = < 0.05$)

In table 7.4 overleaf, Assessment Outcome refers to the students' end of year aggregated assessment score, and the essay codes as already established in this chapter are listed. The trend emerging is that the presence of comments within students' essays relating to Deep and Strategic code categories are correlated with academic success, whereas the presence of Surface and Apathetic comments may indicate a lower academic outcome. Again it should be noted that the population studied here is small and any results can only be indicative.

Table 7.4 Pearson's r for Code Category Against Assessment Outcome

	ASSESSMENT OUTCOME		
CODE CATEGORY	r	r^2	p
Deep Approach	0.4	0.16	0.03
Surface Approach	-0.1	0.02	0.42
Strategic Approach	0.5	0.25	0.00
Apathetic Approach	-0.3	0.09	0.01
Self Belief	0.2	0.04	0.50
Institutional Context	-0.1	0.09	0.75
External Context	0.2	0.04	0.25
Motivation	0.2	0.04	0.49

The correlation between assessment outcome and Surface Approach is not significant ($r = -0.1$, $r^2 = 0.02$, $p = > 0.05$). When the t-test results from table 7.3 are also taken into account, the presence of comments most likely to correlate with success or with simply remaining on the course are those in the Deep category ($r = 0.4$, $r^2 = 0.16$, $p = < 0.05$) and especially the Strategic category ($r = 0.5$, $r^2 = 0.25$, $p = < 0.01$). However, these categories only explain between 4 and 25 percent of the variance, and the statistical power of these results is open to question given the small cohort ($n = 28$).

7.6 Discussion

The findings support those emerging from the questionnaire based analysis and make some conceptual sense. There are identifiable patterns and indications emerging from this part of the research and although the sample size is small, the results may indicate that there may be potential for some further, probably substantiating and very powerful research.

It could be, that asking students the appropriate questions can elicit responses that allow an insight to their learning disposition and their attitudes and beliefs that are associated with academic success or failure. Such a research method is well established in the literature and has formed the basis of many interview

studies (cf. Laurillard 1979, Entwistle and Ramsden 1983, Marton and Saljö 1984, Gibbs et al 1984, Marton et al 1993) from which the main concepts supporting the work in this thesis were established. With respect to these researchers and their work, it can be argued that the most insightful method of eliciting understanding from students regarding what learning means to them, is via in-depth interviews. However, following Richardson's (1993) 'health warnings' about conducting research into student learning, it may be that the method used by the author and reported here has been useful in avoiding some of the potential dangers which threaten the emerging researcher.

It is not clear whether the students who produced the essays were fully aware of the concepts and behind the Approach to Study terminology they used in their writing and descriptions of their working. It was the intention of the author that the learning to learn workshops should enable some of this awareness. The scheme of work provided explicit and implicit opportunities to examine and reflect on the concepts of orientation to study, conception of learning and Approaches to Study. This it could be argued, means that the essays are simply interesting anecdotes describing the level of understanding students have about Approach to Study and other information gleaned in the learning to learn workshops, and that these are entirely removed from the reality of the students experience at Nottingham. This however, is believed by the author to be unlikely, many of the essays are informed and insightful and substantiate claims made by the students in respect of the concepts used. All the students attempt to write to the essay question posed and it is felt that the data can be viewed as reliable.

The author acknowledges the complexity of meanings behind what students say and do. He also acknowledges the crucial constraint of context over what students do. Essays such as reported here, cannot alone, enable students to describe and criticise their cognitive strategies as suggested by Abouserie (1994), whose work echoes that of Laurillard (1979), Gibbs (1981), Svensson (1984) and Martin and Ramsden (1987). Even so, asking students attitudinal questions, perhaps in the form of questionnaires like the RASI may not reveal the depth of descriptions available in these type of essays. The statistical research presented in chapters five and six also help illuminate these concerns. The RASI identifies some rather broad attitudes to studying engineering and now perhaps needs to be more sharply focused to elicit the kind of information and depth of insight more indicative of qualitative research projects. This depth is essential if the way in which students study within a particular context is to be fully understood and explained. Further, the analysis of meaning as espoused by students reveals insights to their learning that cannot be derived from the analysis of statistical data alone.

This level of insight is demonstrated by the student quotes that support the statistical analysis in chapter six. In this respect the meaning that might be attached to a particular statistical outcome is illuminated. This has resulted in the author suggesting that his interventions were largely ineffective in changing students' Approaches to Study. However, there is evidence in the students' essays which offer some (albeit weak) support for the learning to learn workshops. This effect has already been alluded to in chapter five and described previously by Meyer et al (1994) and Norton, Scantlebury et al (1995) who show how some students report interventions having a positive effect on their perception and conception without the expected and corresponding shift in Approach to Study at the group level. For example, these quotes are from the essays already described in this chapter:

> *I know I have certainly changed from the first term in my approach... the work no longer seems to be so much of a chore; I now find it interesting. The learning strategies part of the syllabus has made me aware of improving my learning and I am sure it has helped changed me in my approach. I am grateful this subject was on the course... what you put in is what you get out.*
>
> (556, D=L, S=M, St=M, A=L)

> *I started off thinking what a total waste of time, but now I see the relevance and it may even help me a little.*
>
> (550 D=L, S=M, St=M, A=H)

> *The learning strategies course has certainly helped me to recognise my strengths and weaknesses but it cannot be expected to answer the questions I have mentioned.* (concerning the workload and lack of direction regarding quality of work expected by tutors).
>
> (537 D=M, S=L, St=M, A=H)

> *Having been on the* (learning strategies) *course for two terms, I can see there is plenty of room for improvement in my learning. Relying on myself has a lot to do with it. Having an open mind is extremely helpful. This course has shown me that there are many aspects to learning engineering and being flexible is a great strength to have. Being able to see things from different views and to have enough confidence to accept criticism when necessary is all part of becoming a good engineer.*
>
> (541 D=H, S=H, St=M, A=H)

7.8 Summary

Looking at the essay code distribution frequencies (table 7.1) by individual student reveals some interesting patterns of distribution. Students who eventually withdrew from the course referred to Deep and Strategic Approaches to Study at a lower frequency than those students who passed their first year of study. This conclusion was broadly supported (given the small cohort) by the t-tests and correlation matrices. Taking these two results together suggest that students who refer to Deep and Strategic categories within their essays are likely to do better than those who do not. The percentage of variance thereby explained is of a slightly higher level than reported for the RASI earlier. The non significant relationship between Surface Approach categories and academic success does not suggest that this category is highly decisive in indicating pass or fail. It is still at this point more accurate to suggest that it is the prevalence or otherwise of some elements of the Strategic Approach that are likely to correlate with academic success or failure. However, the debate started earlier in this thesis concerning the true nature of the Strategic Approach is still maintained, as the majority of comments associated with this dimension in students' essays were about Strategic skills rather than motivations.

There is qualitative evidence to suggest that some of the students found the intervention of help in raising their awareness of their relationships with the course of study. However, the reasons why this evidence is not supported by the results in chapter five is not clear and will require further research. It has already been suggested that this is likely to involve qualitative research into the ways in which students perceive and respond to the overall course demands.

8.0 Conclusions and Implications

8.1 Introduction

This concluding chapter is divided into five sections. The first section summarises the findings from the Factor Analysis study of the research instrument. The second section considers the main findings of the study, which in turn are supported by the qualitative study summarised in the third section. The fourth section summarises the more general conclusions from the research, for example concerning the future of learning to learn interventions. The final section considers some of the potential areas for further work and the directions that future research might pursue based on the findings of the author's research programme. The design of the research and the interpretation of its findings rest on the concepts and constructs explored in the literature review. Relationships between these constructs and the conclusions is commented upon within this chapter.

The research reported in this thesis was conducted with the aim of determining the effects that learning to learn workshops had on the Approach to Study of engineering students. This follows previous work in teaching students to learn (cf. Gibbs 1981, Ramsden et al 1986, Martin and Ramsden 1987, Norton et al 1995) the outcomes of which have shown various levels of success and failure. There is some consensus in the literature about what the intervention should comprise of if it is to have any chance of having a positive effect on the Approach to Study of students. Previous research has not been concerned with the effects of such interventions within an engineering context similar to that at Nottingham.

In terms of exploring the effects of interventions, very few studies have used consistently similar methods of acquiring data and analysing results. In the author's study, the principle instrument for profiling change was the Revised Approach to Study Inventory. In adopting this inventory some work was needed in examining its structure and reliability. This research therefore aimed to acquire data, analyse results and present the findings in a way that would be accessible and relevant to the department in which it took place, whilst also paying attention to (in particular) the critical findings of several authors who have reviewed and developed similar work. Whilst comment has been made regarding the effects of time and context on student Approaches to Study, it is recognised that clear identification would require a longitudinal study and the use of control groups.

With respect to this comment, this study was cross-sectional rather than longitudinal, from which certain assumptions about changes over time were made. Extrapolation has been made by comparing similar groups of students from within the same discipline, for example first year students with second year students. Local RASI norms were calculated retrospectively using the data obtained so that relative levels of Approach might be judged. It was concluded from the data analysis that the students who supplied RASI profiles were relatively homogenous in their Approaches which meant that comparisons for identifying change could be made between the group exposed to the workshops and the rest of the sampled population. This however, is still not a controlled comparison in its strictest sense.

The study has exposed a series of conclusive findings about the deterioration of Approach during the first year of study, despite the interventions of the author. Some indication as to why students reacted to the local context in peculiar ways was obtained from additional data in the form of students' essays in which they reflected on reactions to the context of study. In future therefore, if questionnaire based measures of student Approaches are to be conducted, a parallel programme of either questionnaire or interview identification of students' perceptions of the context should be ensured. Even so, as already stated, the data collected in this research has provided some powerful indicators of student engagement with engineering courses at Nottingham which can now be publicised and discussed internally so that some action for improvement might be initiated.

8.2 Factor Analysis

The factor analysis revealed three main conclusions regarding the utility of the RASI. Firstly, it alerted the author to potential problems associated with further interpretation of the data, particularly in respect of the Strategic Approach to Study and its constituent sub-scales. Secondly, it provided a broad pattern of the Approaches associated with passing and failing engineering courses at Nottingham; this implicitly criticised the assessment system at Nottingham for not promoting a Deep Approach. Finally, considering the factor analysis findings against the literature review suggests that there may be some need to explore Approaches to Study within specific contexts, and at a level of finer detail than is reported here and more generally in the literature associated with inventory based research.

The RASI was designed with the intention of 'collecting information' about students' Approaches to Study as a prelude to identifying 'students with potential weaknesses' (Entwistle and Tait 1993). It is based on the factor constructs of four

main scales as previously described. Those factors associated with Deep and Surface Approaches to Study within the ASI, have been replicated elsewhere and were retained in the RASI, with their motivational elements clearly defined as Intention to Understand and Intention to Reproduce respectively. Concerns regarding factors being consistently replicated in other studies using the RASI's predecessor have been largely concerned with the factor associated with the Strategic Approach to Study. The Strategic scale constructs were modified and expanded in the development of the RASI. The expansion in the Strategic Approach items of the RASI was partly intended to aid the prediction of study weaknesses. It was found in the author's research that it was this scale that was intercorrelated with measures of academic success, but not of academic failure, with which the Apathetic Approach was most associated.

The author's research has revealed and maintained suggestions that the Strategic Approach scale does have utility problems, in particular the motivational element of Intention to Excel. This sub-scale was found to load consistently on the Deep Approach factor, and whilst another Strategic sub-scale, Alert to Assessment Demands did load on the Strategic factor, it was also found to split between the Deep factor and the Strategic factor. The factor analysis in this research has suggested that a reason why the Strategic scale is harder to replicate may be associated with its construct and the broadening of the RASI sub-scales that has been reported by Entwistle and Tait (1993).

With respect to the findings above it is suggested by the author that the Strategic scale needs to be redefined. It would seem that, following the pioneering work of Ramsden (1979) in describing this Approach as defined by an intention to achieve the highest possible grades, and effectively thereby a Strategic Approach to assessment, some questions have been raised about what the Strategic Approach is focused toward. The results described in chapter four suggest that the focus of this Approach is less about assessment and more about effective study organisation; the assumption being that students who succeed academically at Nottingham have effective time-management and organisation skills. Further, the Strategic Approach, as defined within the Nottingham data-set, is so defined mainly through these time-management and organisational skills. Support for this conclusion is found elsewhere (cf. Britton and Tessler 1991, Trueman and Hartley 1994, 1994a). The author's suggestion that scale constructs of the Strategic Approach might now be narrowed rather than widened have also been supported elsewhere (Entwistle and Tait in preparation), noticeably in the redesign and renaming of this RASI scale to 'Organised Studying'. The question regarding whether or not this still represents what might be called a Strategic Approach to

Study is left open. Further research might explore the background variables to this construct against interviews with local students about more general constructs such as orientation and conception of learning, so that this question might be resolved. This is particularly important in respect of the comments made by Entwistle and Tait 1993 (and others) about the context dependence of students' perceptions and the potentially variable ways in which different discipline and institutional contexts influence the way in which students themselves construct their conceptions of learning and Approaches to Study (Laurillard 1987, Ramsden 1992). In this respect the assumptions made about how scale items cluster together may not be valid for different student populations (Tait 1992). This supports the need to analyse data relative to the context in which it was obtained, and to develop a 'map' or model of the local context in a similar way to that suggested in the literature review.

Ultimately therefore, the identification of students with 'potential weaknesses', especially within a cross-sectional or snap-shot study like the author's, cannot reliably be judged against external criteria. The analysis needs to be introspective so that the students' success or failure can be judged against prevailing conditions. Whether the prevailing conditions are supportive or not of learning for understanding, and whether or not the local students were taking 'appropriate' Approaches is a wider issue that the author has questioned and then found largely disappointing answers. Broadly speaking these have revealed a spiralling deterioration of Approach within the Faculty of Engineering and Computing at Nottingham.

It can be further argued that this research also supports the need to find out just what are Approaches to Study, or more probably the mixture of Approach variables that are necessary, not just to pass a local engineering degree course, but desirable in understanding the range of engineering concepts and engineering problem solving. This last point is of course tempered by the need to develop meaningful learning experiences which might now be sought in respect to the findings reported here, and the received wisdom reported in the literature review.

If identifying 'at risk' students through using inventories is a worthwhile objective, then a mechanism for doing this must be sought. Previous work (Meyer and Parsons 1989, Entwistle, Meyer and Tait 1991) has identified that at risk students typically responded to the ASI in ways that produced incoherent factor structures. However, it is argued by the author that this effect may have been a result of inadequacies in the ASI, rather than showing genuine patterns of failure. The factor matrix for failing students at Nottingham shows a remarkable degree of

demarcation, and a structure at least as clear as that for the passing students. This may suggest that the RASI is a conceptually more coherent instrument than the ASI and that some phenomenon, other than a disintegrated factor structure, will correlate with academic failure. Initial findings from the factor analysis suggested that both of these conclusions are supported, or are, at least to some extent, considering that the RASI scale (Strategic) associated with academic success at Nottingham is still somewhat broad.

As discussed in the literature review, the RASI is an attempt to move away from the broad level of profiling, that typified the ASI, toward the kind of diagnostic instrument that Meyer and Muller's (1990) QCI represents. The QCI has associated with its interpretation a complex level of analysis that can reveal disintegrated patterns of Approach variables, and contextual perceptions at an individual level. There is not sufficient evidence available from the research reported here about the ability of the RASI to identify at risk profiles at the individual level. Again, further work could be pursued in this area, possibly by applying different methods of analysis. Richardson (in preparation) suggests that cluster analysis of data form the 32 item ASI (Richardson 1990) may help to reveal two broad meaning and reproducing orientations at the individual level. The author considers later in this chapter the possibility of training a neural network to analyse the relationship between, for example, individual variables of the RASI and academic performance. However, within the factor matrices in chapter four, it can be seen that students passing the course have assessment outcomes intercorrelated with some Strategic sub-scales. It is anticipated that following further modifications to the RASI already discussed, academic success at Nottingham would be intercorrelated with the new scale construct of 'Organised Studying'. Further research using the latest RASI (Entwistle and Tait in preparation) could explore this assumption.

8.3 The Main Study

Having explored the utility of the research instrument, the analysis proceeded in exploring the five hypotheses. Chapter five established the pattern of Approaches to Study across the degree courses from where the RASI data was gathered. It was indicative within the data that many of the engineering degree courses at Nottingham had student populations with similar distributions of Approaches to Study. It was suggested that both full and part-time modes of the Integrated Engineering degree progressively fostered a Surface Approach from year one to the

final year of the course. Considering the factor analysis which found the assessment outcomes to be unrelated to the Deep Approach to Study, this was considered to be a finding of some concern for the quality of learning at Nottingham.

In order that the author's intervention be considered successful, the intervention would have to be seen to have influenced a reversal of the trend described above; in retrospect a very optimistic aim. This was examined in chapter six, where the analysis of the five hypotheses revealed five corresponding findings.

The First Finding

The first and most important finding is that the author's intervention did not change Approaches to Study in the desired direction. This is obviously disappointing, but can be rationalised within the literature reviewed and the model proposed, which at least helps support the constructs applied within the author's research. It is concluded that within the context of this research and the methods of data collection and analysis, the learning to learn workshops did not have a positive effect on student Approach to Study. It is assumed that this indicates the greater influence (in part at least) of teaching, assessment or student conception of learning over Approaches to Study. This is consistent with previous findings (Ramsden et al 1986, 1987, Meyer et al 1993, 1994) and thereby contributes to the evidence that militates against the use of learning to learn interventions in attempts to compensate for broader course inadequacies. In such a relationship between intervention and course, and in the framework of the systems model presented in this thesis, it can be argued that the interventions referred to here have not been 'congruent with the prevailing system' (Biggs 1993a). Where interventions have been congruent with the prevailing system, some beneficial results have been reported (Biggs and Rihn 1984, Meyer et al 1994, Norton et al 1995). Most success has been associated with intervention at the individual level (Gibbs 1981, Biggs and Rihn 1984, Meyer et al 1994). These findings suggest that an intervention may be appropriately applied at some time in the future only if the teaching and learning system broadly supports it and rewards high quality outcomes. The fact that the interventions did not effect change suggests that the prevailing system promotes a deterioration in Approaches to Study. This finding should be carefully considered by the author's department.

The Second Finding

The next finding relates to the first in that it supports the suggestion that the assessment system at Nottingham does not generally encourage a Deep Approach to Study. Indeed, within the complete data-set, all four Approaches were generally poor in accounting for variance in assessment scores. One course population could be seen to have correlations explaining a reasonable percentage of the variance between Approach and assessment outcome. This course is Computing Studies and future research work might explore the system conditions associated with this course and the correlations found between Deep/Strategic Approaches and assessment outcome. At a course level it is suggested that the reported poor relationships between Deep Approach and assessment outcome are indicative of the effects of negative course perceptions held by students. Whilst there is no direct evidence reported in this thesis of the link between course perception and Approach at Nottingham, there is sufficient circumstantial evidence to suggest that future research might provide evidence of perceptions of heavy workload and poor teaching being associated with the generally poor Approaches to Study identified.

The Third Finding

The third finding suggested that all years of the Integrated Engineering degree at Nottingham had a student population with progressively declining Deep Approaches to Study and progressively increasing Surface Approaches. Apathetic Approach was also seen to increase with the duration of the course while Strategic Approach did not change. In respect of these findings it was suggested that the Integrated Engineering students do not develop appropriate Approaches to Study as they progress through the course, even if 'appropriate' is construed as more Strategic than Deep. Comparisons between these overall shifts in Approach and those reported by the students attending the learning to learn workshops revealed a very similar pattern suggesting that the author's intervention had no observable effect on Approaches to Study. These outcomes may suggest that there are greater influences on student learning than the intervention can compensate for, notably the course demands as suggested previously (Watkins and Hattie 1985, Clarke 1986, Ramsden et al 1986, 1987, Newble and Clarke, 1987, Trigwell and Prosser 1991, Eley 1992, Gibbs 1992, Cliff 1995), and the students' perception of these course demands (Svensson 1977, Laurillard 1979, Ramsden 1979, 1988, Gibbs 1981, Biggs 1993, 1993a, Meyer et al 1989, 1990, 1993, 1994, Tang 1994, Richardson 1995b). These conclusions suggest that the Integrated Engineering degree at Nottingham has some serious problems in terms of developing students' Approaches to Study which cannot be overcome by simple intervention.

The Fourth Finding

The fourth finding suggested that when students were compared for Approach between courses of study, a remarkable similarity in Approach at the full-time first year level was found. It was therefore concluded that there is no evidence that students on the full-time Integrated Degree display more appropriate Approaches to Study than other full-time first year students, with the exception of Industrial Management for reasons already discussed. This contradicts the implied qualitative benefits of taking the Integrated Engineering degree suggested earlier in the literature review (Jeffery 1993), and when taking into account with the other local findings, this may be indicative of generally poor Approaches to Study across all first year courses in the Faculty of Engineering and Computing.

The Fifth Finding

The fifth finding was concerned with the comparison of Approaches between differentiated groups of students. It was suggested that there were generally very small differences in Approach means between male and female students. These were not sufficiently large to make any interpretations about future interventions or other proposals for changes in the teaching and learning context. This finding is supported elsewhere (Richardson et al 1991, Richardson 1993a, Severiens, 1995). Other comparisons involving mature and non-mature students, part-time and full-time students, standard and non-standard entry students all revealed significant Approach differences, particularly in respect of the scores for Deep and Strategic Approaches. It is assumed that the higher levels of these Approaches and their sub-scales for mature, part-time and non-standard entry students is a function associated with the higher age profile of all these students over 'standard' students. This finding is supported elsewhere (Richardson 1994, 1995a, Trueman and Hartley 1994). No conclusions are drawn here regarding the consequences of age being a differentiating variable in adoption of Approaches to Study when designing interventions such as the author's. However, comment is made about the potential benefits mature students may bring to general student populations in that their generally superior Approaches might be seen and emulated by the rest of the population. Clearly more research would need to be conducted before any such effects could be demonstrated.

8.4 The Qualitative Study

Additional data to that provided by the RASI was collected by the author in the form of essays written by the students participating in the learning to learn workshops. Qualitative analysis of student essays provided the author with a series of statements and quotes made by full-time first year Integrated Engineering students in respect to the quality of learning they felt they were engaged with, and the reasons why this should be. The essays broadly supported the findings of the quantitative study, with students generally describing a deteriorating pattern of study with time, even though many were aware that there were superior Approaches to Study that they could be adopting. This type of finding is supported elsewhere as course demands overwhelm idealised Approaches to Study (described as 'strategic variability' Ramsden et al 1986, 1987). This variability would seem to be successful for some students as they perceive correctly what will be rewarded by assessment, and then modify their Approach accordingly. Comments from student essays were used to annotate the discussions regarding the five research hypotheses. Coding and quantifying the type of comments made by students revealed that at the $p = < 0.05$ level:

- students passing their first year of study reported the Deep Approach to Study in their discussions more frequently than those students who failed their first year of study.

- students passing their first year of study refer to the Strategic Approach to Study in their discussions more frequently than those students who failed their first year of study.

- students failing their first year of study refer to the Apathetic Approach in their discussions more than those students who passed their first year of study.

Following these outcomes, a correlation matrix revealed the relationship between the frequency of comments made by students and end of year assessment outcome scores for the same students. It was found that at the $p = < 0.5$ level:

- there is a moderate (0.4) positive correlation between frequency of Deep Approach comments and assessment outcome,

- there is a moderate (0.5) positive correlation between frequency of Strategic Approach comments and assessment outcome and,

- there is a small (-0.3) negative correlation between frequency of apathetic Approach comments and assessment outcomes.

It is concluded that in respect of these findings, students who are aware of and reflected on their adoption of the Deep and Strategic Approaches to Study within their essays, are more likely to pass their course of study than those students who do not refer to the Deep and Strategic Approaches. The Surface Approach results indicate that student self-perception regarding the adoption of this Approach was not a significant differentiating variable in respect of student academic success. In particular it appears to be the prevalence or not of the Strategic Approach that is most indicative of success or failure at this level of analysis.

These findings may suggest that the student essays were more sensitive than the RASI in acquiring information that helped to describe the pattern of success and failure at Nottingham. However, given the very small number of student essays analysed, more work will need to be conducted before a general principle can be described, regarding the data from the student essays and student Approaches to Study in engineering. Nevertheless, it is felt by the author that this type of work could be valuable in addressing some of the questions still left open after his research and suggestions in the discussions above.

8.5 Discussion of the Findings

Whilst it is accepted that interventions can range enormously in scope and depth, it has been reported that the author was not in the position to make large-scale interventions into the curriculum and rubric of the course. The intervention option most accessible was in gaining time to work with students directly. However, in doing so there was a need to examine the role of the individual within the system of teaching and learning so that the intervention might be targeted most effectively. Points within such a system of teaching and learning need to defined and constructed by applying the concepts available. Likewise, methods of obtaining feedback from the system are needed so that the effects of any intervention might be observed. The author examined these needs and constructs in chapter two the literature review, where a systemic model of student learning was proposed.

The model of student learning provided a map for exploring how, when and where interventions were to be delivered within the system. Recent work (Norton et al 1995) has supported the idea that in order to have any effect, interventions of this

kind must be designed as an integral part of such a system. Previous models have suggested a functional relationship between several concepts that were potentially open to modification, in particular, orientation to study, conceptions of learning and student Approaches to Study. However, some aspects of these models are open to interpretation within the context at Nottingham, particularly where specific elements lie within the model. A combination of evidence from the literature review and from factor analysis suggested a range of variables that were examined in this, and could be examined in future research.

Orientation, conception and Approach were addressed in the three learning to learn seminar objectives, and a method of profiling any change was sought. The workshops were designed with content and methods of presentation based on previous work (Gibbs et al 1979, Gibbs 1981, 1989, 1992) which is generally characterised by a desire to change in some way the conceptions students have regarding the learning with which they are involved. This makes it necessary for the interventions applied here to have at their core an aim to enable students with an exploration of their learning and the way learning relates to the broader learning system. The broader learning system is that described within the author's model. It can never be assumed that such a model is absolute, rather, it is a way of mapping out and conceptualising the determinants of learning in a way that can be communicated to academics and students alike.

Workshops, however well researched, designed or run, cannot make students change their conceptions of learning and thereafter their Approaches to Study. It was not therefore entirely surprising to find that the author's intervention seemed to have little effect on the Approaches to Study of the attending students. Many students, according to additional data acquired in reflective essays, did gain an understanding of the concepts associated with Approach to Study, but at a group level, the data obtained from the RASI did not reveal any beneficial changes in Approach. No direct evidence is available from this study as to why this should be, but based on previous research literature and the established relationship between the context of learning and Approach, it is likely that students are responding to their perception of the overall system rather than to the specific objectives of the author. Nevertheless, the workshops and this subsequent research are considered as being useful for two reasons: (i) the workshops did help fresh students on the Integrated Engineering degree to appreciate some of the options available to them in choosing how to study (ii) even though the participating students may not have adopted the options that the author hoped they would, a future search for why they did not could be used to inform both departmental changes and further research.

Suggestions have been made here as to why the intervention did not work, and these could now be evaluated in future research. However, given the systems model presented earlier it is more than likely that there are particular elements (such as the teaching context) that have the largest influence in terms of the relatively poor Approaches reported here. It is likely that following this research, the author will be involved in the development and validation of a new engineering based degree course at Nottingham. The evidence available here when compared to other studies (Clarke 1986, Newble and Clarke 1987, Newble and Hejka 1991, Gibbs 1992) would suggest that such a course should be very careful when considering the associated modes of teaching and assessment. Discussions locally have already suggested that a new course should be project based and have a higher proportion of continually assessed work than is available in the current course at Nottingham. Likewise, the desired outcomes from a new course could be evaluated against a framework such as the SOLO Taxonomy (Biggs and Collis 1982) so that a greater emphasis is placed on assessment by the teaching staff in respect to what level of understanding they wish to promote and are really intending to assess.

Given the correlations found in this research between Approach and assessment, it can be argued that the current assessment system is, for the majority of students, not promoting a Deep Approach to Study. Following the relationships between Approach and quality of outcome discussed in the literature review, it can be argued that students are passing courses at Nottingham at a level of understanding that is likely to correspond with the lower levels of the SOLO Taxonomy and Perry's stages of intellectual development. Further research is need to confirm this. Likewise, students' conceptions of learning could also be examined, on the assumption that many of the students reported here have conceptions that could be described as reproducing rather than transforming, and that the courses at Nottingham are, at present, doing little to provide an environment that would promote a positive change. According to the evidence available from comments within the student essays. Those students who do have a developed conception of learning, seem to be discouraged from taking a Deep Approach by the prevailing context. A transforming conception and a Deep Approach are not perceived to be required by the students. This counters the often heard argument associating poor performance and levels of student interest with problems inherent in the student rather than the context.

If these suggestions about the context at Nottingham are correct, it is hardly surprising that the author's interventions had little observable effect. It is a basic assumption within the systems model presented that such a system is always

attempting to reach equilibrium (Biggs 1993a, 1993b). Even though the intervention was targeted at three points in the system, this was not enough to overcome the inertia inherent within the system and it is assumed students succumbed to the state of the system in balancing Approach against what they perceived was required. This conclusion is based on previous findings from Biggs and Rihn (1984), Ramsden et al (1986, 1987) and Norton et al (1995). Only when the students had an inchoate conception of learning, orientation and Approach within a course that could be shown to encourage Deep Approaches were interventions effective (Biggs et al ibid, Norton et al ibid); 'they provide a means of achieving equilibrium in a system that was unstable for those students' (Biggs 1993b). Where the system did not promote a developed conception, orientation and Approach, the interventions were ineffective and even had the opposite to the desired effect (Ramsden et al 1986, 1987). A further conclusion to be drawn therefore is that until the course of study is designed within a favourable system, the interventions of the type reported here are unlikely to be effective. However, should the system be favourable, such interventions may have a significant positive effect on student learning, particularly for those students who find themselves dis-orientated, or who have inappropriately low conceptions of learning and poor Approaches to Study as presage factors. It is presumed that it is within conditions such as those, that Biggs and Rihn (1984), Martin and Ramsden (1987), Meyer et al (1990, 1993, 1994), Norton et al (1995) report positive effects when they describe interventions that 'alter the perception the student has of the course rather than the course itself' (Parsons and Meyer 1990). Within this notion of 'altering perception' are the constructs of belief, motive, intention and process (Meyer and Kaschula 1994), which, it can be argued, are synonymous with conception of learning, orientation and Approach as described within the literature review and constructed within the objectives of the author's intervention.

The reported successes in changing in students' learning behaviour as described above and in the literature review are generally based on work at the individual, or at least very small cohort level. The problems of intervening on a scale that copes with large numbers of students are legion. There is therefore an in-built inadequacy in terms of dealing with all students in the same way in respect to their learning behaviour. There may be some merit in pursuing now, a method of identifying and supporting those students most at risk of failing through mismanagement of their study, or misconceptions of what study is and what it requires. Gibbs (1981) alluded to this conclusion but there has been very little research since then, for example, into how group level interventions might help identify at risk students who can then be engaged at the individual level. Those studies that have managed this (Meyer, Cliff and Dunne 1994) report positive

results. There is no statistical evidence available from the present study that individual students have improved their learning through this kind of mechanism. However, there were students who, encouraged by and following the author's workshops, did present *themselves* for further consultation. There are also students whose essays did report a change in awareness if not process, following the author's intervention. Future work might therefore concentrate on the identification of students at risk of failing, followed by support at the individual level. It is still, following the research reported in this thesis, an 'unsupported presumption' that 'well intentioned group level interventions will allow the individual learner to perceive personal difficulties and their appropriate remedies' (Meyer et al ibid). However, even the implied assumption that remedies can succeed following the identification of personal difficulties would probably be reliant on the system itself being tuned for high quality outcomes. This seems unlikely in the case of the author's local system which adds further weight to the argument for changing the local context rather than and before the individual student.

8.6 Direction and Consequences for Future Research

Based on the research reported in this thesis there are some related directions in which future research might follow. These are discussed below

Modelling and Simulation

There is a tradition involved in teaching engineering which may need to be reassessed before any improvements are observed. As Eysenck and Piper (1987) suggest, there may be an epistemology of Engineering Education that enables many lecturers to dismiss the findings of research such as this as being unsound:

> *The way in which the student has to learn about, say physics or engineering, it is claimed, is peculiar to the subject, because the criteria by which good evidence is distinguished from bad and truth from falsehood is the very basis of the discipline. It is accepted that such is the case for all subjects. All, that is, except the one which refuses to stay in its discrete territory. when education brings its methods of analysis and applies its criteria of rigour to investigating how physics or engineering is taught, then it is asked to justify itself, not against its own paradigms of veracity, but rather against those of the subject matter taught.*

With respect to this, it is likely that there is some reticence or inertia within the Engineering Education system as a whole to adopt sound and well-grounded principles which have been formulated with the aim of improving the quality of student learning. The author's research was conducted from within an engineering context in the hope that any findings would be recognised and accepted by the department they are intended to inform. Whilst the author's research was concerned with his interventions and not the broadest perspective of Engineering Education itself, it can be argued that the outcomes of his research should now inform the aspects of engineering teaching and learning they are related to. For example much has already been discussed in this thesis regarding the nature of the course demands and how these are perceived by students. It seems reasonably clear that the demands as they stand locally are not encouraging high quality learning outcomes. The central problem for further research may not solely be in verifying this suggestion but also in getting such suggestions recognised by the culture from which they have emerged. In this respect it can be argued that some mechanism for bringing educational research closer to the culture is required. It has been suggested that analogies with engineering concepts and methodologies might be employed when appropriate. The model of student learning proposed in this thesis is analogous with closed-loop feedback based systems. In turn this has two distinct consequences.

Firstly the model could be developed so that is recognisable from an engineering perspective. Much of this work has already been done in the author's research. The next stage would be to propose and to test the model mathematically. If successful the model, in parametric form, becomes capable of simulation by altering variables and observing consequent outcomes. Effects of disruptives to the system might then be used to predict the effects of changes within the system such as the effects on students' Deep Approach, for example by changing the time and type of assessment (cf. Vos 1991). Such a proposition speculates on the successful development of a mathematical model. This is far from confirmed, but involving local engineering expertise may yield some possible solutions as well as bringing the systems model closer to home.

Likewise, the second consequence involves an engineering input, and is also related to the modelling and prediction of systematic events. Previous attempts at this kind of modelling are typically associated with developing computer based applications such as expert systems. Whilst not an expert system in its strictest sense, Entwistle, Tait and Speth (1994) have already devised and produced a computer-based diagnostic system that identifies students at risk of failing. This package known as 'Student View', relies on the RASI, and its subsequent analysis,

as the basis for a diagnosis being made and 'treatment' being prescribed. This type of system has one major flaw. It is inflexible in its interpretation of the RASI scores against differing contexts and as such will tend to consider all students in all disciplines as fundamentally similar. What is needed is a much more flexible system, one which recognises what student dispositions are most suited to a particular discipline *and* the context in which it is learned. These loci could then be used as datums against which students could be profiled. In this manner a series of criteria for passing students could be established, and those students significantly differing from the criteria would then be flagged as at risk of failing. This type of system would have to be more flexible and context sensitive than that produced by Entwistle et al (ibid). Output from such a system could also be used retrospectively to evaluate courses based on the assumption that a Deep Approach to Study will be associated with high quality courses (cf. Prosser et al 1990).

In an attempt to examine the possibility of developing such a flexible system, the author has recently consulted colleagues in respect to the computer applications known as neural-networks. These significantly extend the previous work on expert systems by enabling the neural-network, the computer program, to 'learn' from its environment, ie. the data supplied to it. In brief, a neural-network is an analytical program which can be 'trained' to recognise patterns within data sets. It is trained by being repeatedly shown one set of data in random order. The program effectively 'learns' to recognise inherent patterns within the data and to draw inference from these patterns. Ultimately the program will be capable of accepting new, unseen data, and then indicating probable outcomes based on the previous training runs.

Theoretically then, it is possible to programme such a network to accept data from the RASI or some other profile and to 'look for' links between this data, context data and academic or other outcomes on a retrospective basis. Tied into the local student tracking system, and over a period of time, the network would therefore 'learn' to distinguish and generalise profiles of students most likely to succeed or to fail. Thereafter the system could be used prospectively to identify students who would benefit from specified forms and content of learning intervention. Clearly there is a series of technological and psychological issues to be researched in the development of such a system. The author and a colleague have already begun to train a simple neural-network with data obtained during the research reported here. However, given that there is some concern regarding the utility of the RASI as discussed earlier, it is not yet clear whether the data used for this training run is adequate. Ideally such a neural-network as proposed here needs to be able to draw inference from a very broad range of data, not just the Approach variables

of the RASI. Information regarding the perceived state of the system is also needed; information about students conceptions and orientations might be needed as well as data describing the state of the course goals and assessment methods. This may be more data than can be conveniently collected, but there are neural-networks that are capable of the adaptive learning required to cope with a changing system (a capability known as *plasticity* (Coveny and Highfield 1995)).

Contextual Effects

As interesting as the above possibilities may be from an engineering perspective, there are a series of more fundamental research issues consequential to the research reported here. These are largely thought to be associated with the prevailing engineering learning context at Nottingham. The research reported in this thesis is inconclusive regarding the effects of context as opposed to time or the author's intervention. It is therefore argued that further research will need to be conducted before firm conclusions are drawn about the effects of the local context.

With respect to the author's research findings there are a series of variables that may be constraining student Approaches to Study. The extent to which the students' perception of their context at Nottingham has influenced their Approaches to Study was not part of this research. It can now be argued that some urgent local research is needed to establish to what extent perceptions of items such as teaching, workload and assessment are contributing to the deterioration of Approaches to Study that this research has identified. It is also reasonable to ask how context variables can be changed so as to increase the likelihood that students will adopt a Deep Approach to Study (Richardson 1995b). Within the case of engineering at Nottingham this may involve changing both the conceptions students have of learning and moreover, the conceptions tutors have of teaching engineering.

Evidence is available to the author from the student essays regarding the effect of the course dominating students' Approaches to Study. There is also evidence of students reporting a perceived benefit to the intervention without this being mirrored by the RASI profiles. There would appear to be a number of students who recognise a tension between a desired Approach and the Approaches promoted by the course demands. There may be single or covarying variables related to these effects which this research has not identified. Had it been possible, the author should have liked to have conducted interviews with students. These may

have helped to reveal why it is that some students seem to be in a paradoxical relationship between what they acknowledge high quality learning to be and the quality of learning they demonstrate. Given the model of teaching and learning the author subscribes to and the literature reviewed, it is suggested that these variables might be (i): either teaching based, student based, or both, and (ii): system dependent in that they can be shown to relate to all variables both within the immediate teaching and learning system and the broader systems of the institution and the community. This last point suggests that substantial shifts in student Approaches to Study will only be achieved through interventions which target several points in the system in a coherent and systematic way (cf. Gibbs 1992, Biggs 1993b). However, there is no guarantee that even comprehensive positive changes in the learning environment will result in all students pursuing their courses of study with enhanced intention. Research has already been conducted in to the effects of student perception on Approach to Study (cf. Parsons and Meyer 1990, Eley 1992, Tait 1992, Tang 1994) which has shown how individual students within a single cohort may perceive the same learning environment in different ways, and as a consequence, adopt different Approaches to Study.

It would be very interesting to have more evidence other than that described in this thesis regarding how individual students change their perception in respect of course demands, including mechanisms specifically designed to enhance learning such as the author's intervention. It has already been suggested that some evidence regarding why students respond in certain ways are tightly related to conception and orientation and that these may be exposed in interviews. At a broader research level, there is also a renewed interest in issues such as perceived locus of control (Van Overwalle 1989, Macan et al 1990, Britton et al 1991, Dart and Clarke 1991, Rossouw and Parsons 1994, Hattie and Purdie 1995). It has been suggested elsewhere (Rossouw et al ibid) that considerable further research could be undertaken into the possibilities of enhancing student learning through altering perception not just of Approaches to study, but also of locus and degree of control students exert over internal and external factors. This would seem to be congruent with the system model presented in this thesis, assuming that students relate to many elements of the system(s) and not just classroom based factors. This may indicate other elements that could be included in, (i): interventions aimed at changing how students perceive and otherwise react to the learning environment, and (ii): methods (either interview or inventory based) for evaluating how and why students relate to their learning environment in the ways that they do, and the reasons they attribute to academic success or failure.

In some respects this last point raises again the issues associated with methods of evaluating the Approaches to Study of students, in particular, the constructs of the Approaches relative to different disciplines. Whilst authors have commented on Approaches to Study within specific disciplines such as engineering (cf. Johanssen et al 1985, Sparkes 1989, Entwistle et al 1989, Ramsden 1992, Meyer and Sass 1993), very little of this work has questioned the underlying assumption that all Approaches to Study are applicable as defined in the literature to all subjects. There is a possibility as discussed in the literature review, that engineering may attract students who do not for example, always associate certain sub-scales of the ASI or the RASI with their intended main scales. Meyer (1995) has suggested that it could be possible to consider the context specific/appropriate nature of Approaches to Study within engineering, but the nature of quantitative research would demand very large data sets before any work in this area could be carried out. However, it is suggested by the author that such a programme of future research is appropriate and could now be pursued, particularly in the light of the factor analysis reported in chapter four and the discussion associated with hypothesis one in chapter five. It can also be argued that an initial start (at least) to such research would appropriately be made via interviewing students regarding their conception of learning and how this relates to studying at a specific course level. At the local level, this would depend on the ability (to some extent) to identify students who have a developed conception of learning, and a Deep Approach to Study, regardless of the constraints on their learning discussed earlier in this thesis. Alternatively students of the type above could be identified with other courses. For example, it was shown in the results from hypothesis two, how Computing Studies has a proportion of its students adopting Deep and Strategic Approaches to Study in relation to their assessment demands.

The importance of student perception of course contexts could be explored further along the lines indicated here. Whilst such work may reveal how classroom interventions can be designed to include elements most likely to impact on what students do, it is still maintained by the author that more fundamental research at the local level needs to be conducted into what teachers do and how this affects the quality of student learning (cf. Gibbs 1992, Gow and Kember 1993). This represents the section of the context most likely to yield benefits in student Approaches following changes in, for example, teaching, assessment and workload. In respect of this, discussions at the local level have already taken place regarding changes in course architecture and provision that might be made following the outcomes presented in this thesis. It is therefore suggested that further research should now be conducted in to how course architecture and provision in engineering at the local level can enhance qualitative outcomes. Whilst this seems

a somewhat broad and undefined call, it should be remembered that under the new regime of modules and semesters, it is entirely unclear how such an outcome can be achieved. It can be argued to be unlikely that many departments can afford or will be tempted to either commission new modules, to conduct the staff development, or to force changes in validation of assessment regulations that are needed to provide the climate where course demands encourage and reward high quality learning. Such changes may be unsupported within the system(s) already described. Further, it may not be until such systems, by whatever cause, enter into a state of dis-equilibrium and become instable that the need for change will be recognised (cf. Gibbs 1992). For these reasons, further research could now be undertaken into how beneficial course changes are appropriately developed within the local and wider Engineering Education contexts.

8.7 Conclusions

Some very specific findings have been reported here regarding the utility of the research instrument and the constructs of Approach to Study inherent in the RASI scales. In particular these findings have made a small contribution to the understanding of what the Strategic Approach to Study scale is measuring in terms of student activity, and the relationship of this activity to academic outcome. In this respect the Strategic Approach has been shown to be less concerned with intention or motivation and more concerned with skill. It is suggested that this scale needs further construct and conceptual clarification. Interpretations made using the RASI data suggest that, overall, high scores on this scale are to a small extent associated with academic success within the local context, more so than high scores on the Deep Approach scale. It is further suggested that there is a deterioration locally in Deep Approach with time and that these outcomes may indicate a deleterious set of course demands being present in the local context. Comments made by local students about their Approaches to Study and their relationship with the course and its assessment would seem to support this conclusion.

This research supports previous findings regarding the difficulties of forcing changes in students' Approaches to Study though group level interventions. Whilst the nature and the content of the intervention was broadly well received by the participating students, the results from the RASI data suggest that it had no effect on the Approach to Study or academic outcome of the participating students. This is not the same as saying that students were unchanged regarding their position to evaluate their relationships with the learning environment following the

intervention. Some students did report an increased awareness in this respect. The question regarding the integrity of the intervention is therefore unanswered because the state of the system the intervention resides in may militate against such an intervention having any effect at all at the group level. Likewise the methods of analysis applied are unable to offer substantial conclusive evidence regarding effects at the individual level.

These conclusions lead to a wider conclusion regarding the nature of improving the quality of student learning. As students enter into Higher Education they become part of, contribute to, and have a relationship with a system of teaching and learning. Intervention into only one part of the system erroneously presumes that the intervention will have a sufficiently disruptive effect so as to alter other system elements. Such an effect was not identified in this research. The practical benefits in conducting the research are therefore in determining where and how interventions in a broader sense might be targeted, and how, should the system support it, students might be encouraged to reflect on their experience of learning in support of a developed Approach to Study. It is suggested that, at the local level at least, urgent research and action is needed in establishing an engineering learning environment that offers holistic support to developed Approaches and high quality learning outcomes.

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Appendices

Appendix One

Questionnaire on Approaches to Learning and Studying

This questionnaire has been designed to assess your approaches to studying and is being given to you as part of a collaborative project between your department and the Centre for Research on Learning and Instruction at Edinburgh University. Please respond truthfully, so that the answers you give represent accurately your real ways of studying. Only then can the research produce valid conclusions and help departments to provide better study skills advice for students. Answer quickly but carefully.

A. Background

Name ..... **Age**..... **Sex** M / F

University..... **Faculty**..... **Year of study**.....

Main subject of study ..... **This course** .....

How do you think you compare with other students taking this course in terms of each of the following?

	Very well	*Well*	*Quite well*	*Not so well*	*Badly*
1. Entry qualifications ('A' Levels, Highers, etc.)	5	4	3	2	1
2. Previous knowledge assumed by lecturers	5	4	3	2	1
3. Study skills required (reading, essay writing, etc.)	5	4	3	2	1
4. Ability to organise and plan studying on your own	5	4	3	2	1

Where did you gain your entry qualifications?

School	*FE College*	*Access*	*Overseas*	*Other*
5	4	3	2	1

Did a significant proportion of pupils from your school go on to higher education?

Yes	*No*	*Not sure*
3	2	1

B. Reasons for entering higher education

Why did you decide to take the courses you are currently taking? Typical replies given by other students are shown below.
Circle the appropriate code number to indicate how strongly each of these reasons applied.

5 means strongly, 4=fairly strongly, 3=somewhat, 2=rather weakly, 1=very weakly or not at all.

1. The qualification at the end of the course should enable me to get a good job when I finish.	5	4	3	2	1
2. The course should help me develop knowledge and skills which would be useful later on.	5	4	3	2	1
3. It will give me another three or four years to decide what I really want to do later on.	5	4	3	2	1
4. I should be able to study the subject in depth, and find interesting and stimulating courses.	5	4	3	2	1
5. Having done well at school, it seemed to be the natural thing to go into higher education.	5	4	3	2	1
6. I wanted a chance to develop as a person, broaden my horizons, and face new challenges.	5	4	3	2	1
7. I suppose it was a mixture of other people's expectations and no obvious alternative.	5	4	3	2	1

C. Approaches to Studying Inventory

The next part of this questionnaire asks you to indicate your relative agreement or disagreement with comments about studying again that have been made by other students. The technique involves using rather a large number of such comments to distinguish what may be rather slight differences. You are asked to work through these items quickly, giving your *immediate* reaction to each one. Just circle the code number closest to your initial feeling about each comment, and move on to the next. Have a rest if it becomes boring, but please do not give casual answers without considering how closely the item describes your own approach. The codes are used to indicate the following meanings: they are not scores.

5 = agree (√) 4 = agree somewhat (√?) 2 = disagree somewhat (x?) 1 = disagree (x).
Try not to use 3 = unsure (??), unless you really have to, or if the item really cannot apply to you.

		√	√?	??	x?	x
1.	I usually set out to understand for myself the meaning of what we have to learn.	5	4	3	2	1
2.	I tend to read very little beyond what is actually required to pass the course.	5	4	3	2	1
3.	It's important for me to feel that I'm doing as well as I really can on the courses here.	5	4	3	2	1
4.	I rather drifted into higher education without really deciding it was what I wanted to do.	5	4	3	2	1
5.	So far, I seem to have a good grasp of the subjects I am studying.	5	4	3	2	1
6.	I generally put a lot of effort into trying to understand things which initially seem difficult.	5	4	3	2	1
7.	I try to find books which give me just what I need, so I don't have to work things out for myself.	5	4	3	2	1
8.	I enjoy competition: I find it stimulating.	5	4	3	2	1
9.	I think I'm on this course more to please other people than because I really wanted it myself.	5	4	3	2	1
10.	Generally, I find the set work easy to do.	5	4	3	2	1
11.	Often I find myself questioning things I hear in lectures or read in books.	5	4	3	2	1
12.	In lectures, I try to get down in my notes just as much as I can, so I'll be able to learn it later.	5	4	3	2	1
13.	It's important to me to get better marks than my friends, if I possibly can.	5	4	3	2	1
14.	When I look back, I sometimes wonder why I ever decided to come here.	5	4	3	2	1
15.	I don't have much difficulty in making sense of new information or ideas.	5	4	3	2	1
16.	When I'm reading an article or book, I try to find out for myself exactly what the author means.	5	4	3	2	1
17.	Often I have to read things without having a chance really to understand them.	5	4	3	2	1
18.	Although I'm a bit nervous before exams or tests, I suppose I really quite enjoy the challenge.	5	4	3	2	1
19.	I am finding it really difficult to motivate myself.	5	4	3	2	1
20.	I seem to be able to grasp things for myself pretty well on the whole.	5	4	3	2	1
21.	Often I follow up interesting ideas mentioned in class.	5	4	3	2	1
22.	There's not much point in me trying to think through the implications of what I've read.	5	4	3	2	1
23.	When I start an exam question or an assignment, I think first about the best order to tackle it.	5	4	3	2	1
24.	Often I find myself wondering whether the work I am doing here is really worthwhile.	5	4	3	2	1
25.	Regularly I find myself thinking about ideas from the course when I'm doing other things.	5	4	3	2	1
26.	I concentrate on learning just those bits of information I have to know to pass the course.	5	4	3	2	1
27.	I look carefully at tutors' comments on course work to see how to get higher marks next time.	5	4	3	2	1
28.	There's not much of the work here that I find interesting or relevant.	5	4	3	2	1
29.	I find that studying academic topics can be quite exciting at times.	5	4	3	2	1
30.	I suppose I need to be a bit more adventurous in trying out my own ideas.	5	4	3	2	1
31.	In course work or exams, I try to plan out exactly how I should tackle it before I start work.	5	4	3	2	1
32.	I'm not really interested in this course, but I have to take it for other reasons.	5	4	3	2	1

		√	√?	??	x?	x
33.	I tend to accept what I'm told by lecturers without really thinking whether I agree with what they say.	5	4	3	2	1
34.	I keep an eye open for what lecturers seem to think is important and concentrate more on that later on.	5	4	3	2	1
35.	Because I find a lot of it boring, I find it difficult to keep my mind on the work I have to do.	5	4	3	2	1
36.	I try to relate ideas I come across to those in other topics or other courses whenever possible.	5	4	3	2	1
37.	I find I have to concentrate on just memorising a good deal of what I have to learn.	5	4	3	2	1
38.	Some of the ideas I come across on the course I find really gripping.	5	4	3	2	1
39.	I manage to find conditions for studying which allow me to get on with my work easily.	5	4	3	2	1
40.	When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.	5	4	3	2	1
41.	Much of what I'm studying seems to be no more than unrelated bits and pieces.	5	4	3	2	1
42.	One way or another I manage to get hold of books or whatever I need for studying.	5	4	3	2	1
43.	In tackling problems, I try to work out first what underlying principles may be involved.	5	4	3	2	1
44.	Although I can remember facts and details, I often can't see any overall picture.	5	4	3	2	1
45.	I think I'm quite systematic and organised when it comes to revising for exams.	5	4	3	2	1
46.	Ideas in course books or articles often set me off on long chains of thought of my own.	5	4	3	2	1
47.	I often have trouble in making sense of the things on the course I have to remember.	5	4	3	2	1
48.	I'm fairly good at following up some of the reading suggested by lecturers or tutors.	5	4	3	2	1
49.	I look at the evidence carefully and then try to reach my own conclusion about things I'm studying.	5	4	3	2	1
50.	The pressure of work often gets me down and makes me feel really miserable.	5	4	3	2	1
51.	I organise my study time carefully to make the best use of it.	5	4	3	2	1
52.	I check the work I've done thoroughly to make sure I can justify the reasoning and it makes sense.	5	4	3	2	1
53.	Sometimes I worry about whether I'll ever be able to cope with this course properly.	5	4	3	2	1
54.	I'm pretty good at getting down to work whenever I need to.	5	4	3	2	1
55.	When I'm reading, I examine the details carefully to see how they fit in with what's being said.	5	4	3	2	1
56.	I often seem to panic if I get behind with my work.	5	4	3	2	1
57.	I generally make good use of my time during the day.	5	4	3	2	1
58.	It's important for me to be able to follow the argument, or to see the reason behind something.	5	4	3	2	1
59	Often I lie awake worrying about work I think I won't be able to do.	5	4	3	2	1
60.	I work steadily throughout the term, rather than leaving everything until the last minute.	5	4	3	2	1

How sure are you that you have chosen to study the right course?

Very sure	Quite sure	Unsure	Very unsure
4	3	2	1

How well do you think you have been doing on this course so far? *Please rate yourself objectively :-*

Very well		Quite Well		About average		Not so well		Rather badly
9	8	7	6	5	4	3	2	1

Relative to the rest of the class, how well do you think you'll have done by the end of the year?

Be in the top third	Be in the middle third	Be in the lowest third
3	2	1

Please go straight on to Section D

D. Preferences for different courses and types of teaching

Here we are interested in your preferences for different types of lecturers, assessment, courses and books. Please respond by ringing the appropriate code number as before.

	√	√?	??	x?	x
I generally prefer lecturers who					
1. - show us how what we're learning relates to the outside world.	5	4	3	2	1
2. - tell us exactly what to put down in our notes.	5	4	3	2	1
3. - show us what they themselves think about a subject.	5	4	3	2	1
4. - entertain us even if the content isn't particularly good.	5	4	3	2	1
I generally prefer types of assessment which					
5. - give me an opportunity to show I've thought about the course material for myself.	5	4	3	2	1
6. - can be completed using the material in our lecture notes directly.	5	4	3	2	1
7. - make it clear how much effort we're expected to put into the assignment.	5	4	3	2	1
8. - provide opportunities to follow a number of different lines.	5	4	3	2	1
I generally prefer courses where					
9. - we're able to follow our own interests quite a lot.	5	4	3	2	1
10. - it's made very clear just which books we have to read.	5	4	3	2	1
11. - it's clear how important the various topics are for the exams.	5	4	3	2	1
12. - we're encouraged to read around the subject a lot.	5	4	3	2	1
I generally prefer books which					
13. - provide full explanations which go beyond the lectures.	5	4	3	2	1
14. - challenge me to think more about the topics for myself.	5	4	3	2	1
15. - provide definite information which I can easily learn.	5	4	3	2	1
16. - go over the same material that is presented in lectures.	5	4	3	2	1

Finally, if there are any comments you would like to make about any difficulties you have had, or about aspects of studying we have not covered, please use the space below to make them.

Deep Approach

Intention to understand

1. I usually set out to understand for myself the meaning of what we have to learn.
6. I generally put a lot of effort into trying to understand things which initially seem difficult.
11. Often I find myself questioning things I hear in lectures of read in books
16. When I'm reading an article or book, I try to find out for myself exactly what the author means.

Active interest

21. Often I follow up interesting ideas mentioned in class.
25. Regularly I find myself thinking about ideas from the course when I'm doing other things.
29. I find that studying academic topics can be quite exciting at times.
38. Some of the ideas I come across on the course I find really gripping.

Relating ideas

36. I try to relate ideas I come across to those in other topics or other courses whenever possible.
40. When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.
43. In tackling problems, I try to work out first what underlying principles may be involved.
46. Ideas in course books or articles often set me off on long chains of thought of my own.

Use of evidence

49. I look at the evidence carefully and then try to reach my own conclusion about things I'm studying.
52. I check the work I've done thoroughly to make sure I can justify the reasoning and it makes sense.
55. When I'm reading, I examine the details carefully to see how they fit in with what's being said.
58. It's important for me to be able to follow the argument, or to see the reason behind something.

Surface Approach

Intention to reproduce

2. I tend to read very little beyond what is actually required to pass the course.
7. I try to find books which give me just what I need, so I don't have to work things out for myself.
12. In lectures, I try to get down in my notes just as much as I can, so I'll be able to learn it later.
17. Often I have to read things without having a chance really to understand them.

Passive learning

22. There's not much point in me trying to think through the implications of what I've read.
26. I concentrate on learning just those bits of information I have to know to pass the course.
30. I suppose I need to be a bit more adventurous in trying out my own ideas.
33. I tend to accept what I'm told by lecturers without really thinking whether I agree with what they say.

Unrelated memorising

37. I find I have to concentrate on just memorising a good deal of what I have to learn.
41. Much of what I'm studying seems to be no more than unrelated bits and pieces.
44. Although I can remember facts and details, I often can't see any overall picture.
47. I often have trouble in making sense of the things on the course I have to remember.

Fear of failure

50. The pressure of work often gets me down and makes me feel really miserable.
53. Sometimes I worry about whether I'll ever be able to cope with this course properly.
56. I often seem to panic if I get behind with my work.
59. Often I lie awake worrying about work I think I won't be able to do.

Strategic Approach

Intention to excel

3. It's important for me to feel that I'm doing as well as I really can on the courses here.
8. I enjoy competition: I find it stimulating.
13. It's important to me to get better marks than my friends, if I possibly can.
18. Although I'm a bit nervous before exams or tests, I suppose I really quite enjoy the challenge.

Alertness to assessment demands

23. When I start an exam question or an assignment, I think first about the best order to tackle it.
27. I look carefully at tutors' comments on course work to see how to get higher marks next time.
31. In course work or exams, I try to plan out exactly how I should tackle it before I start work.
34. I keep an eye open for what lecturers seem to think is important and concentrate more on that later on.

Study organisation

39. I manage to find conditions for studying which allow me to get on with my work easily.
42. One way or another I manage to get hold of books or whatever I need for studying.
45. I think I'm quite systematic and organised when it comes to revising for exams.
48. I'm fairly good at following up some of the reading suggested by lecturers or tutors.

Time management

51. I organise my study time carefully to make the best use of it.
54. I'm pretty good at getting down to work whenever I need to.
57. I generally make good use of my time during the day.
60. I work steadily throughout the term, rather than leaving everything until the last minute.

Apathetic Approach

Lack of direction

4. I rather drifted into higher education without really deciding it was really what I wanted to do.
9. I think I'm on this course more to please other people than because I really wanted it myself.
14. When I look back, I sometimes wonder why I ever decided to come here.
19. I am finding it really difficult to motivate myself.

Lack of interest

24. Often I find myself wondering whether the work I am doing here is really worthwhile.
28. There's not much of the work here that I find interesting or relevant.
32. I'm not really interested in this course, but I have to take it for other reasons.
35. Because I find a lot of it boring, I find it difficult to keep my mind on the work I have to do.

Academic Aptitude

Academic self-confidence

5. So far, I seem to have a good grasp of the subjects I am studying.
10. Generally, I find the set work easy to do.
15. I don't have much difficulty in making sense of new information or ideas.
20. I seem to be able to grasp things for myself pretty well on the whole.

Appendix Two

The Nottingham Trent University
Faculty of Engineering and Computing
Department of Mechanical Engineering

INTRODUCTION:

This scheme of work describes and reports on a series of eight seminars that have been tried in the Department of Mechanical Engineering.

A programme of study is provided along with lesson plans, handouts and some examples of over-head projection slides.

Many of the ideas and sequences are based on, or are directly taken from the work of others, particularly Graham Gibbs (1981). I have modified some of the material to suit my own needs and I would encourage anyone wishing to use the material here to do the same.

Overall it was my aim to run seminars with the intention of improving the study strategies of students, particularly those struggling to come to terms with a new learning culture. My evaluations of the seminars I ran are included to give the reader a flavour of the way the seminars were conducted and received. What follows is a set of proven material that the majority of my students and I have found useful.

How effective this material is in improving learning is open to conjecture. At their best I believe these seminars raise awareness about some of the issues affecting the quality of student learning, and that this self-awareness will have a positive, long term effect on the orientations students have to their studies.

Ian Solomonides
November 1993

LEARNING STRATEGIES FOR STUDENTS: SCHEME OF WORK

AIMS:

To facilitate the development of students as effective learners within an education context. This is seen as a result of promoting:

- o appropriate educational orientations of students,
- o appropriate concepts of learning and,
- o appropriate approaches to study.

OBJECTIVES:

The objectives are tightly linked to the three aims above:

To promote appropriate educational orientation by enabling students to become more aware of the values and attitudes they may have in relation to higher education, and to recognise appropriate priorities and intentions.

To promote appropriate concepts of learning by making explicit by creating an understanding of what effective learning is.

To promote appropriate approaches to study by describing and explaining these different approaches, so as to help the student to adopt preferable approaches wherever applicable, and to see the implications of doing so.

RATIONALE:

Students tend to arrive into higher education with varying motivations for being here, and little or no explicit understanding of what effective learning is. Some may have the view that learning is about being *taught* procedural information which is then remembered and regurgitated. This is compounded by the belief by some students that exams are "memory tests", and indeed the setting of tests and assessments that rely on *only* memory recall.

This is a low-order, shallow concept of learning, it cannot develop true understanding as distinct from knowledge or skills. Nor does it promote self-sufficiency in learning and students will tend to see tutors as purveyors of information and dispensers of reward. There are obvious implications here for modular systems and the implied need for more independent learning.

Students who rely heavily on tutors and concentrate their efforts on remembering information for exams, can be described as taking a *surface approach* to their

studies. Those who are intrinsically interested in the subject material, who intend to understand the material and examine the logic of arguments can be described as taking a *deep approach* to their studies. There is a further approach described as strategic or which sees the student striving to achieve high grades by using whatever means are necessary. The link between approach and outcome is shown in the diagram below.

APPROACH	SURFACE	DEEP	STRATEGIC
MOTIVATION	EXTRINSIC. COMPLETION OF THE COURSE. FEAR OF FAILURE.	INTRINSIC. INTEREST IN SUBJECT MATTER. VOCATIONAL RELEVANCE.	ACHIEVING. GETTING HIGH GRADES. COMPETING WITH OTHERS.
INTENTION	TO FULFIL ASSESSMENT BY REPRODUCTION.	TO REACH PERSONAL UNDERSTANDING.	TO SUCCEED BY WHATEVER MEANS NECESSARY.
PROCESS	ISOLATED FOCUS, MEMORISATION OF FACTS & IDEAS. NARROW FOCUS ON THE SYLLABUS.	EXAMINES IDEAS & EVIDENCE. FOLLOWS UP THEIR OWN INTERESTS.	USES ANY METHOD THAT WILL PRODUCE GOOD GRADES. WELL ORGANISED STUDY METHODS.
OUTCOME	DESPITE CONCERN TO PASS THEY DO BADLY. LITTLE UNDERSTANDING. SOME DEVELOP SUBSTANTIAL FACTUAL KNOWLEDGE.	DEEP LEVEL UNDERSTANDING. INTEGRATES FACT AND PRINCIPLE. USES EVIDENCE TO DEVELOP ARGUMENTS. TEND TO DO WELL.	VARIABLE LEVEL UNDERSTANDING DEPENDING ON THE COURSE REQUIREMENTS & METHODS OF ASSESSMENT. TEND TO DO WELL.
ORIENTATION	REPRODUCING	MEANING	ACHIEVING

Figure One: Approaches, their outcomes and general orientation to study.

Traditional study skills of the "survival" type on note taking et cetera are rarely taken up in the long term by students, and indeed *may even be damaging* as students use the skills to carry on studying more efficiently in a surface, reproducing manner. It is more likely that enabling students to become

consciously aware of what they do as learners will have a more profound effect. This scheme is aimed at making students aware of their approaches and the implications of adopting them. It should however be remembered that the students are only one variable in the learning equation, and that other factors beyond their control such as being overloaded may force a surface approach.

THE LEARNING TO LEARN OUTLINE SCHEME:

A series of interactive workshops over the first two semesters organised by a tutor. Total contact per student approximately 7 - 8 hours. Each session about 60 minutes. Trial group size approximately 20. Full group size between 80 and 120.

The **LEARNING OUTCOMES** are an understanding of the learning process and the preferential deep or strategic approaches; an understanding of organisation and time management; an inclination to think critically and analytically.

The **SYLLABUS** includes: experiences of learning, approach to study, communication of meaning, organisation of time and space, hierarchical levels of learning, motivation and intent, study skills.

LEARNING TO LEARN: PROGRAMME OF STUDY

This is a sequential description of the workshop content. For convenience it is divided up into single workshop/seminar units.

UNIT ONE: Reflecting on past experiences of learning.

Objectives: Students will reflect on their past experiences of learning and this will then inform thinking about the type of learning they are about to experience on the course.

Students spend time as individuals thinking about positive and negative learning they have experienced. These are then discussed in pairs and generalised out in groups of four. Each group produces a list of conditions that support satisfactory learning and things that create unsatisfactory learning. These are then discussed in a plenary session where the process versus the outcome of learning is likely to be a talking point and may lead to examination of motivation and style. The students are prompted to think about how efficient learning is a precursor of success at both undergraduate and professional levels.

UNIT TWO: Learning Approach.

Objectives: Students will come to realise that they approach learning and studying in qualitatively differing ways, and these have distinctive outcomes.

Following the application of the 16 item Approach to Study Inventory, it will be possible to identify key questions, the response to which can give a preliminary indication of approach. The scores are discussed in relation to the output scales and what they mean in terms of motivation, approach and orientation, and further, the academic consequences of adopting given approaches.

UNIT TWO OPTION: Descriptions of learning.

Objectives: Students will become aware of the five stages of learning, come to realise that each stage is *qualitatively* different from the previous one and that the stages are hierarchical and related to approach.

The five stages are learning as: an increase of knowledge, memorising, acquiring facts or procedures to be used, making sense, and understanding reality. Qualitatively different learning outcomes are discussed and analogies drawn between the descriptions and previous exercises, including the approach outcomes. Use Habeshaw's (1988) "First Class Answer" exercise which re-writes an essay question according to how first class, second

class, and third class students would interpret it.

UNIT THREE: Displaying Quality in Learning

Objectives: To highlight and exemplify some of the indicators of high quality answers and explanations. To explore some of the intentions students may have when submitting as piece of work.

It is not until you are asked to display understanding or knowledge about a subject - until you are asked to explain, that the quality of your learning can be viewed by an audience. What are written explanations for? Who are they for? Who is your audience?

UNIT FOUR: Memory Techniques and Learning.

Objectives: Students will view a commercial available video on learning and be encouraged to extract any information that is of use or relevance to them.

There is a great deal of 'advice' available on the market in respect to study skills and how to be an 'effective learner'. Some of this is valid, while some offers unrealistic advice. Here the students have an opportunity to see one of the better packages and to then learn from it and to offer their constructive criticisms as appropriate.

UNIT FIVE: Organisation and Time Management.

Objectives: Students will become aware of their own attitudes and strategies related to organisation. They will compare alternatives and be encouraged to make improvement as necessary.

By comparing their own strategies of organisation with their own, students should be able to identify room for improvement and to see the benefits of doing so. The advice is not prescriptive, but because views and alternatives will be publicised it is likely that the individual students will identify those strategies most appealing to them. The main idea is that organisation and how other students go about working is not often discussed in the open, and yet some of the best options are likely to come from students within the group, particularly those that are already achieving.

UNIT SIX: Understanding learning and learning for understanding.

Objectives: Students will view the purpose of learning from a personal perspective. Students will come to realise that the purpose of learning is the construction of meaning,

and that the purpose of communication is the communication of meaning. (see Habeshaw et al 1987)

Students work in pairs. One of the pair is shown an image and told to "learn" it with or without the aid of notes. The observers then "teach" the image to the other pair member without the notes. The resulting images are displayed and discussed. Students are asked to describe their strategies as teachers and learners and to evaluate the images for being good representations or not. Encouraging the identification of implications for learning in general, and the applications to their studying should set up powerful analogies for the development of meaning, the communication of meaning and how suitable outcomes are assessed.

UNIT SEVEN: Self-discipline and Self-evaluation

Objectives: Students will systematically reflect on their roles as students/learners and generate ideas for improvement. They will also be introduced to the assessment for this unit.

Students should be reaching the stage by now of being able to recognise their own strengths and weaknesses. This session offers a mechanism for making more overt some of the issues they need to consider to become more effective learners. This is directly linked to the assignment where students are asked to reflect on their position as learners and to comment on the link between the way they learn and the quality of learning achieved

UNIT EIGHT: Tutorials

Objectives: To orientate students towards the type of qualities expected in the assignment.

The assignment is very open and could cause anxiety in some because of the lack of structure. This is an opportunity to encourage and support students in making personal statements and legitimately being able to comment on the affecting factors on their learning. Tutor will be available for a question and answer session within the usual timetable.

OPTIONAL UNIT: Reflection

Objectives: To promote reflection by students about the way in which they interact with their chosen course of study.

Encourage students to answer the question, 'In your experience, what does it take to be successful on your course?' Brainstorm for answers in the form of a list of skills, beliefs or attitudes and explore some of the emerging issues.

OPTIONAL UNIT: Reflection II

Objectives: To identify action needed to address some of the issues identified in the previous unit.

Having identified a list of skills, students are encouraged to rate answers on a scale of 1-5 depending on how important they believe the skills to be. They are then invited to rate their own abilities in those skills areas, offering students a comparison between what they believe to be important and their actual capabilities.

REFLECTION ON LEARNING/GROUP COMMUNICATIONS

LESSON PLAN: One: Reflection on past learning experiences.
AIMS: To promote students' thinking about their learning experiences.
OBJECTIVES: Students will reflect on their past experiences of learning. This will be used to prompt their thinking about the type of learning they will experience on the course they are now starting. Some descriptions of learning will be offered.
MATERIALS: see Gibbs (1981) p.11.

CONTENT	ACTIVITY	TEACHING POINTS
Individual reflection on past learning experiences.	Students asked to think of eg's of good and bad learning and to make notes.	10 mins. Emphasise that learning does not have to be formal schooling. Why was it good, why was it bad?
Paired reflection of learning experiences.	Students relate their learning anecdotes to each other.	10 mins. Prompt explanation of why the experiences were good or bad. What are the main similarities? In what ways did they thrive or suffer? Be specific.
Identification of common themes.	In groups of four students identify the common themes. List under two columns: 'things that lead to satisfactory learning and unsatisfactory learning.	10 mins. What are the characteristics of good and bad learning? Groups need to elect a chair to feedback.
Plenary.	Each group of four report back to the class and describe the points they have identified.	15 mins+. Each group reads one item. Prompt for suggestions as to how the identified items are affecting learning in this institution now.

NOTES: During the plenary session it is likely that some key themes will emerge such as the motivation of learners and the need to communicate. I would advise that tutors

avail themselves to some information related to intrinsic/extrinsic motivation and to the idea of a mis-match between teaching and learning styles, eg as described by holism/serialism.

EVALUATION: Objectives were realised. The session works well probably because of the opportunity for the students to talk together. Some of them have difficulty in thinking of good and bad experiences, but are soon prompted once they have the opportunity to talk to someone else. The facilitator should be aware of this and have his own examples of good/bad if needed. Once the students are in discussion it appears that they maintain in depth and extended conversations about varying aspects of learning. At these times there is little for the facilitator to do except coax discussion if there is none taking place. However, one should be aware of interrupting what might be self-sustaining conversations.

The facilitator's role becomes more important in plenary as the points identified are discussed. I have had no difficulty in getting the students to discuss the points, but to start, they have sometimes required an input from me... perhaps moving the conversation from one that places blame, to one that discusses the students' own role.

Common themes that seem to arise are: reward and reward structures which can be developed quite easily into discussions about intrinsic and extrinsic motivation; communication and the possibility of a mis-match between student and tutor... this can be developed into a discussion about teaching and learning styles and how discussing with others can help to establish concepts; the need to ask questions if needed; the idea that understanding something is an ultimate goal, and that understanding is often easier than memorising; the identification of poor learning environments and how to deal with them.

Overall this is an exciting and enjoyable session in which students get to discuss issues that are common to them all and which may go a long way to explaining poor previous performance. They have the opportunity to introduce themselves to each other and to break down some barriers to communication. The session is perhaps most valuable as a promoter of reflection on the processes and outcomes of learning.

APPROACH TO LEARNING: DEEP/SURFACE/STRATEGIC

LESSON PLAN: Two: identification of learning approach and its implications.

AIMS: To highlight the effect of studying and learning with varying qualitative intent.

OBJECTIVES: Students will identify their own profile and its implications. They will realise that approach is changeable and is influenced by both internal and external factors. They will be encouraged to continue to reflect on their approach.

MATERIALS: The Approach to Study Inventory, and the shortened ASI for scoring and discussion in class. OHP showing the consequences of taking each approach. Handout with the shortened ASI and information on the consequences of approach.

CONTENT	ACTIVITY	TEACHING POINTS
Shortened ASI	Completing the ASI	10 minutes. Students complete and score their own inventory.
Discussion	Discuss the scores and what they mean in relation to approach to study.	Rest of the session. Use the OHP showing consequences to guide students through the implications.

NOTES: The limitations of the shortened ASI should be recognised. It is not a substitute for the full questionnaire, but is useful as a teaching tool. The students need to bear in mind a specific element when they are answering the questionnaire so there are problems with identifying the approach as being uniform to the entire course. It is important for students to realise that the approach is not a fixed aspect of personality and is a reaction to a given learning event. It is important to have some familiarity with the concepts of: Rote Learning, Improvidence, Globetrotting, Operation and Comprehension learning. For an explanation of the shortened ASI see Gibbs (1992).

EVALUATION: A note of warning here, some students, if they display a high surface score may label themselves as a permanent surface learner. This is obviously problematic and should be avoided. It must be pointed out that the approach is only a reaction to a

given learning situation and not a fixed aspect of the personality. It is probably "better" to use the short ASIs so that students work in pairs, one completing as if they are going to do very well, the other as if they are going to do badly. This would then give a discussion point and provide statements for examination.

The last session using this plan was probably the best of the three. The activities were reduced so that the short ASI was not filled in and used only as a handout. I was able to describe the approaches to study using the outcome table and a diagram showing teaching and learning interacting at a point called the "learning environment". Describing students' perceptions of this environment then supported the idea of approach.

In conclusion, the session should be redesigned, so that there are fewer concepts introduced to allow a fuller discussion around the short ASI and the implications therein.

STUDENT DISPLAY OF QUALITY IN LEARNING

LESSON PLAN: Three: What intentions do students have when displaying what they know?

AIMS: To highlight some of the important indicators of high quality answers and explanations.

OBJECTIVES: To establish a checklist of intentions when submitting work for formal assessment.

MATERIALS: A short written answer from Gibbs (1981)

CONTENT	ACTIVITY	TEACHING POINTS
Reading the passage	Students read through the passage and jot down any comments they may have to which is the best answer.	15 mins working individually. Prompt students to ask what the writers were trying to do. Do they have different understandings of what learning in general is?
Pooling comments	Compare the comments and describe what each of you was trying to do.	10 mins working in fours. Were the students trying to do the same thing?
Plenary	Each group to comment on the answers. Tutor to prompt to the previous sessions that established concepts of learning and their implications and consequences.	To lead into a general discussion about the display of understanding and high quality responses to tasks.

NOTES: It is not until you are asked to display understanding or knowledge about a subject - until you are asked to explain, that the quality of your learning can be viewed by an audience. What are written explanations for? Who are they for? Who is your audience?

I find it useful to get students to think about the kinds of comments they would like to see on their own scripts. The fact that they have made comment is indicative of their inherent ability to evaluate what they write before they hand it in.

EVALUATION: The contrasting answers work well in stimulating discussion amongst the students in respect to which is the better and why. Most were able to appreciate, if not initially identify, the qualities inherent in both answers. The link was then established between the answers (ie. the learning outcomes) and the nature of quality in approach to study. By encouraging the students to think about concepts of learning the answers typify, they were able to see the practical outcomes of adopting one approach or another. Because the students themselves had assessed the quality of the questions, they were able to appreciate how their own responses and explanations may be viewed by tutors. Explanations can and do vary enormously in their conceptual quality. By offering students a theoretical description of this (Sanders' Taxonomy of Questions) alongside practical examples, they came to appreciate the difference between explanations that rely only on the memory, and those that elicit higher order qualities such as evaluation. At this point it seemed quite useful to prompt students to think about who their explanations are for and to always check for what type of explanation is being required of them. A very useful session overall.

THE ACCELERATED LEARNING VIDEO

LESSON PLAN: Four: Memory techniques and learning

AIMS: To encourage students to view a commercial package on 'learning' and to extract any information that is personally relevant to them.

OBJECTIVES: Students will identify personally useful information and offer any criticism due in respect to the information being presented in the video.

MATERIALS: VHS Video 'Accelerate Your Learning', Accelerated Learning Systems Ltd, Aston Clinton, Bucks.

CONTENT	ACTIVITY	TEACHING POINTS
Show video.	Encourage students to watch and to interact with reasonable criticism.	Start on time - the video is exactly 40 minutes.
End of session plenary.	Elicit any comments the students are prepared to make.	Some of the info in the video relies on memory techniques. The validity of some of these is questionable and students can be encourage to criticise the info given.

NOTES: I am using a commercially available video here and this lesson plan as it stands relies on the use of that video. There are several of these types available on the market from various sources. For example try TES, Ravenswood Road, Bristol, or The Oxford Centre for Staff Development. The video offers some suggestions for the mechanics that support effective learning. Students might be encouraged to consider how they adopt any of the suggestions for their own use. This would also give some interesting feedback about the video itself.

EVALUATION: The best outcome from this session was without doubt the critique some of the students were able to present in relation to the video. However, this does not imply that the video is useless, indeed, there is a great deal of valid and persuasive information

in it and students commented on that too. The ability of some of the students to constructively criticise is satisfying to me, as it is one of the qualities the workshops aim to develop. It also indicates that at their best, the students are developing an awareness and understanding of what effective learning is and the mechanics that support it. Encouraging students to do this, to report back how they learn, is an essential part of their development. This is promoting meta-cognitive awareness and is getting students to order and to construct explanations that go beyond memorisation.

ORGANISING YOUR LEARNING

LESSON PLAN: Five: well organised students do better. Why?
AIMS: To identify the important factors affecting organisation.
OBJECTIVES: To get students discussing the concept of organisation. To identify at a personal level what is important for efficient organisation.
MATERIALS: A checklist of statements made about organisation Gibbs (1981), copy of "Schedule for passing the test of time".

CONTENT	ACTIVITY	TEACHING POINTS
Checklist.	Read the list of statements and tick those that apply to you.	5 minutes. Alter any statements to make them apply better to you if nec... perhaps changing them from the negative to the positive. Note down any reservations or differences you may have.
Working in pairs.	Compare responses.	10 minutes. Have they responded the same for the same reasons? Why have the responded differently?
Working in fours.	Discussion of outcomes.	15-20 minutes. See where you agree or disagree. Take one statement at a time and ask if it is important. If it is, how do the members overcome the problem? Note the interesting or important points.
Plenary	Groups report back the statement that they found particularly important.	10 minutes. Telling the others what ideas emerged.

NOTES: The ability to organise time and space is a fundamental characteristic of the effective learner. However, presenting students with 'lists' of how to do this is unlikely to achieve any positive effect as students will tend to find this threatening. It is better to identify best practice from within the group, allowing issues to be discussed and questioned as they arise.

EVALUATION: There were three distinct responses to this session. One group tended to use the session as a forum to discuss their "worst" and "best" tutors, another were quite reticent in discussing anything, but the third were highly interactive and judging by their responses got a great deal out of the discussions. I am convinced that these varying responses are not a product of the material and are rooted in the history of the groups and their experiences. In future it would be useful if all the groups have the same room in which to work and are generally brought closer together relative to the time and space conditions in which the workshops are presented.

Students recognise many of the statements and they make useful discussion points. It is important though to get students actually noting some down, and not allowing them to say "all of them are relevant". When encouraged to be selective and critical, the session works better... likewise the group is encouraged to discuss points raised by their peers.

The main themes arising from these workshops are that students generally see "getting started" and "doing enough work" as the greatest problems. Some very useful conversations built around these themes developed, but a future practitioner may wish to develop some material to support these themes. In the same way, the article on "passing the test of time" raises issues of time management. I would however avoid giving prescriptive advice about time management. Leave this until a later session, and even then avoid giving direct instruction. The students in my groups were quite able to accept time management as being 99% self discipline!

UNDERSTANDING LEARNING/PERCEPTION AND COMMUNICATION

LESSON PLAN: Six: Understanding learning and the importance of perception and communication.

AIMS: To get students to realise that the purpose of learning is the construction of meaning.

OBJECTIVES: Students will communicate a prescribed message to each other and the outcomes of this transaction evaluated. It is expected that they will identify the difference between effective and ineffective communication, the need for meaning to be explicit and precise, and the way in which received information is evaluated.

MATERIALS: An OHP of the hidden image. See Habeshaw and Gibbs (1987 p.35.)

CONTENT	ACTIVITY	TEACHING POINTS
Students examine an image (OHP)	One of a pair of students concentrates on the image and is encouraged to do anything they like except talk.	5 minutes. Seat them back to back so that only one of the pair can see the image. Tell them they are expected to "learn" the image and that they will then "teach" it to the partner who has not seen the image.
Students "teach" the image to their partner	The receiver of the original image attempts to get the partner to draw the desired image. They draw what they are told and may not ask questions.	5-10 minutes. The students facing the image must put away any notes and get the partner to draw the image. Talk quietly.
Display the drawings	Display so that the drawings can be seen and discussed.	

Plenary	Discuss strategies adopted as learners and teachers. Evaluate the drawings to identify good representations.	Rest of the session. Encourage discussion around issues of: learning and teaching strategy, successful representations, learning in general, study, and their work as engineers (see notes below).

NOTES: The success of this session will depend upon the identification of appropriate issues and the prompting of discussion around them. While the students are "teaching" the image it is a good idea to walk around them and attempt to identify the strategies they are using. Discussion can be centred around: **Strategies** - as learners some may have perceived the image as a horse and communicated this, some may have tried hard to see the image and then succeeded, some will have tried to memorise the shapes. As a consequence there will be differing teaching strategies. The conclusion is that if you are actively trying to find meaning or make sense of information learning can be effortless, but if the information is meaningless it is very difficult to learn anything. Gibbs (1992) writes:

> *The image can be successfully drawn only if: (1) the "instructor" attempts to perceive it as a meaningful picture... if an attempt is made to memorise the image... the task is very nearly impossible. (2) The "instructor" conveys the meaning of the image to the drawer as the central organising principle to guide the drawing. Even if the image has been perceived as a horse, if the instruction goes "there is a black dot at the top right hand corner with two spikes at its top" and so in, then the drawing task is almost impossible.*

Representation - it is likely that the student will judge the better drawings as being those that look like horses rather than an array of dots. The conclusion being that you are judged on the extent of your learning by the overall meaning you convey rather than by the accumulation of detail.

Communication - concentrating on the communication of meaning is more successful than communicating fragments of information. It is preferable to initially get across the overall meaning at the outset and then to fill in the details.

Applications to study - can be elicited from students, but concentrate on examples that require them to establish meaning rather than an expansive memory, eg, notes that capture the meaning of a lecture rather than a record of the entire content, or extracting

key ideas in reports.

The context - this exercise should be put into context either before or after the activities. The context can be exemplified by discussing issues of perception of a given task or artefact depending upon one's viewpoint or role. The Integrated Engineer will view the production of an artefact in very different ways to that of the Industrial Designer, or the Production Engineer. However, these are aspects of design and manufacture that must be congruous in order to be successful and satisfy a brief. This relies heavily on the ability to: perceive, or attempt to perceive information in differing ways; to be able to communicate in a variety of ways to a range of people issue that they themselves may only perceive in one way; and, to convey overall meaning to the user, without the acceptance of whom, the product will fail.

EVALUATION: The presentation of the teaching/learning sequence tends to be successful with all willing to participate. While the situation is amusing some participants remain sceptical and comments like "I came to learn engineering not how to be a teacher", might be heard. It may be appropriate therefore to put the exercise into context first. Regardless of when the session is put into context, it is important to have all the concepts you aim to establish to hand... they are somewhat difficult to explain, so rehearsing the ideas is advisable.

The transition from the production of drawings to plenary needs to be handled carefully. It is too easy to get into a hypothetical conversation about the difference between forms of understanding, without first eliciting realistic examples from the students. However this itself requires careful coaxing and I advise having a stock of examples to hand, eg, the instance of reading text without understanding and the implications for communication by asking, "how many of you have been reading, got to the end of the chapter and realised you've taken none of it in?". This "real" situation might then elicit some opinion as to suitable strategies for enabling communication for meaning.

Some students who act as the teachers, may not see the image as a representation of a horse, and consequently the drawings will all be of an irregular sequence of shapes. In this instance there is no comparison available to be made between drawings of horses and drawings of shapes. In this case it may be possible to reveal the image to all the students after the drawings have been displayed, and at least some of the students will identify the horse shape and begin to discuss the alternative outcome. To avoid a situation where the students are forced to imagine a drawing of a horse and rider, it may be useful to have an "example from a previous session". I have now modified my OHPs so that I have an overlay to show the horse outline in the original image and an OHP that has two examples of outcomes on it.

SELF-DISCIPLINE AND SELF-EVALUATION

LESSON PLAN: Seven: Your own character in relation to learning.

AIMS: To get students to systematically reflect on their current position as learners and to generate a list of needs and action plan.

OBJECTIVES: Students will collectively identify the roles in which they currently are involved. They will reflect on these roles using specified prompts. This will form the basis of an individual plan for future action.

MATERIALS: A pro-forma on which to identify the task demands. A list of possible roles and tasks (optional). See O'Neil and Pennington (1992)

CONTENT	ACTIVITY	TEACHING POINTS
Introduction	Students read through the handout. Tutor offers any further information.	Make sure the points are understood. Prompt for comment.
Pro-forma	Describe the pro-forma	Draw attention in particular to the task and roles column.
Generation of task and role descriptions	To identify the roles that students take in the course of their work and to identify the tasks they have to perform.	Describe what roles and tasks mean. Use a pyramid session to develop a full list.
Filling in the SWAN pro-forma	Students take the roles and tasks most relevant to them and begin to write under the prompt headings.	Draw attention back to the handout describing the heading criteria.
Future instruction	To have completed the needs part of the pro-forma by the next session and to have begun to identify an action plan.	The next session will be tutorial. Set aside time for students to talk over their emerging plans.

NOTES: This is an important session and will need the commitment of all the students. It will be difficult to follow up for those that do not attend. It may therefore be useful to

distribute the handout before the session. It may be useful to have a ready prepared list of roles that students may take during the course. For example:

Researcher	Note-taker	Attender
Reader	Analyst	Goal setter
Reviser	Peer	Writer
Critic	Reviewer	Problem solver
Organiser	Time manager	Information processor
Listener	Planner	Activist

EVALUATION: Having presented the list, the students tended to be more responsive to the task; they were able to discuss the headings and to decide which were the most personally relevant. Others were quite happy to add to the list any of their own terms for the roles and tasks they are involved with. Some found the process I wanted them to engage in difficult to understand, but this was quickly overcome by working through an example of filling in the pro-forma.

Once satisfied that the students did indeed understand the task they were dismissed. I wanted them to complete the pro-forma at home or in their own time and to return the following week for tutorials. This gave the students the opportunity to complete their reflections in private without fear of cant. Overall the session worked well and objectives were achieved.

TUTORIALS

LESSON PLAN: Eight: Assignment tutorials.

AIMS: To orientate students towards the type of qualities expected in the assignment.

OBJECTIVES: Students will recognise the parameters within which they may respond to the question set. Students will recognise an audience for their writing and realise that the question is canvassing for personal views informed and supported by empirical evidence.

MATERIALS: Students must have with them their assignment handout 'Self-discipline and self-evaluation', and the completed pro-forma from the previous session.

There is no lesson plan as such for this session in that I cannot prescribe a particular format or possibly predict the outcomes of a tutorial, except of course that there will be unexpected ones.

My own tutorials revolve around the students and I discussing the question set in relation to the marking criteria and the pro-forma they complete. It is important to establish early on that I am not expecting an iterative essay and rather, would expect a high level of personal input, indeed the essay cannot be written in any other way. This may seem a little threatening in that the assignment is open and the less confident need greater guidance.

REFLECTION ON PROGRESS I & II

LESSON PLAN: Option: Reflecting on progress so far

AIMS: To promote reflection and consideration of strategies and skills needed for success.

OBJECTIVES: Students will generate a list of strategies and skills needed for success and identify the ones most relevant to them. They will consider how effective/ineffective they are in relation to these skills and strategies.

MATERIALS: Board/flip chart. Prepared handout. A list of strategies and skills may be useful in the unlikely event of students not generating enough.

CONTENT	ACTIVITY	TEACHING POINTS
Brainstorming	Ask students to answer the question 'In your experience what do you need to be successful on your course?'	Write suggestions on board
Discussion	Prompt students to talk around the skills they have identified	Concentrate on getting examples of these skills in action
Identification of personal relevant skills	Use handout as described	Make sure students complete the handout before leaving

NOTES: It is quite easy for students to become disillusioned if they identify a series of strategies and skills they feel incapable of adopting. Point out that the aim of the exercise goes beyond areas for action and includes the intention to get students to be reflective. This reflection is one of the routes to improvement and it is an essential feature of the effective learner.

EVALUATION: I like this exercise; it promotes a great deal of discussion providing students have had enough experience of the course. I used this one half way through the second semester when students could begin to identify the differences in teaching between the two, had experienced the end of fist semester exams, and were becoming aware of the

variety of skills they use. Some care is needed in allowing a balance between students complaining about their poor teachers or conditions and the identification of what is needed to deal with the learning environment, whatever it is presenting.

Common themes emerging in response the question are:

Patience Humour Stamina Commitment Submission to others' ideas Motivation Honesty Organisation Time Listening Note-taking Research Peer support Will power Schedules Reading Self-belief Sense of value Pragmatism Tenacity Reflection Analysis Contexts

EVALUATIONS

The relative success of this kind of scheme is very difficult to evaluate. What, for example, are the criteria against which the success of the students can be measured? Higher education in this country, particularly in the numerate subjects tends to be assessment led. This means that staff may expect the benefits of this scheme to be manifest in exam results. I think this is too simplistic and that at its best, the evaluation of improvement might be through decreased attrition rates. These evaluations might be supplemented by subjective opinions of lecturers in respect to the quality of learning the students are achieving, but this of course requires the staff involved to reference from a congruent understanding of what quality is.

What follows here are the reports from two evaluation sessions run during and following the Learning Strategies scheme. They both report an overall benefit as perceived by the students. It is my opinion that the true benefits of a scheme like this may not be particularly obvious to students. Likewise, perhaps the benefit will not be realised until later in the course or even after graduating.

STUDENT FEEDBACK: LEARNING TO LEARN WORKSHOPS

Background: A series of four workshops have been delivered to first year Integrated Engineering undergraduates. This extra-curricula evaluation session was then run to identify the strengths and weaknesses of the workshop formats and to attempt to set an agenda for the following four workshops. Seventeen students were present.

Format: Using pyramid group discussion the students described their experiences of their learning within the workshops.

Outcomes: Some of the comments made by students are found later. The workshops were seen by students as, at their best useful, and at their worst interesting. However my personal feelings about this are that this level of interest is unique to this group and in this sense my sample may be "self-selecting". However, some of the comments arising in the plenary suggest that some of the students have moved from being initially sceptical about the workshops to now fully integrated and constructive members of the group. Moreover, they are beginning to see the personal relevance of the content. Some of the main points of issue have now emerged as:

- The differing responses of the groups and why this should be.
- The ability or not to evoke student interest and value.
- The ability or not to put the workshops into context very early on.
- The balance between making the process of learning explicit and offering "hard" advice.

The emerging agenda for the next four workshops is built around more practical advice, although the consensus of the group is that this should not be prescriptive and would be appropriately delivered by the same teaching method. It involves issues of:

- Concentration and learning from a given source.
- Motivation when working independently.
- Organising time (self discipline).
- Identifying task demands.

SOME COMMENTS MADE BY STUDENTS

About the workshops as a whole:

"Encourage critical reflection and offer a forum for debate."

"Gives confidence and makes you think about how to learn and different ways of learning."

"They have helped put aside worries about workload."

"Realisation of learning strategies and how they can improve/change my approach. Helps motivation."

"Discussing problems openly with other members helps to liberate problems."

"I enjoy the workshops as I can relate my individual problems, understand my weaknesses and discover solutions."

"Maybe an initial confusion with regard for its function."

"Hard to relate optimum learning strategies to self."

"The realisation of faults that have to be confronted can initially seem daunting."

"Bad classroom." (seven times)

About the teaching in the workshops:

"Although some of the teaching has been difficult to get to grips with, I have understood the process after the lesson has ended."

"Novel ideas, intriguing presentation, good atmosphere; (what is the) possibility of the workshops integrating with other subjects ie thermodynamics?"

"Good teaching, group learning, promotes thought."

"Relaxed giving a friendly atmosphere."

"The informal approach is ideal to express/discuss opinions/ideas, but individuals must participate."

"Teaching tends to be self realization. We as individuals participate, where as in some classers concentration disappears because of lack of participation."

"Thorough and on a level, ie (we are) spoken to on the same level. Able to discuss points as a group."

"Relates to students at an independent level via the journals."

"Don't feel a positive direction for the workshop, not enough structure."

"Not really knowing what we are learning about, but it feels confidence boosting."

"Some of the teaching has been difficult to understand."

About their learning experiences and themselves as learners:

"Helps students realise that the problems they have are not unique to themselves."

"My learning method has changed a little without knowing why initially, but having read items I understand my previous and current strategies and now able to work on them."

"The group has learnt from each other."

"Made me think more about time management."

"Could have done with this four years ago."

"Understanding the learning techniques and developing your own learning techniques."

"There has been no real weaknesses as yet, but I feel that if the effort is made (with the information provided) a full realisation of my own and other people's strategies can be understood. The personal "chat" helped reassure me."

"Haven't really applied the methods."

Student statements:

The students were also asked to highlight the main points of interest and to prepare a statement about the workshops in general.

"We feel that a realisation of learning strategies may, if acted upon improve the learning abilities of the individual and the group. The teaching method is very relaxed and enables students to open up more readily. The change in learning methods enables the individual to understand his current or previous strategies and identify the problems and rectify them."

"The strengths of this course are now being able to reflect on all learning experiences, being able to see a whole picture rather than individual aspects which may be confusing. The course is good humoured and offers a relaxed atmosphere in which we are able to express our views without worrying about the consequences. The atmosphere possibly doesn't appeal to everyone. Some advice on revision techniques next term would be useful."

"Group discussion build confidence and hold motivation, likewise the teaching methods tend to be guidance so individual participation and this holds interest. We enjoy learning about the possibilities in improving our learning abilities. More time could be allocated to the subject, the surroundings are not ideal and sometimes the noise level is disruptive."

Evaluation Report: A Formal Evaluation of the Learning Strategies Course.

Background: As reported in previous papers, the first year cohort of the Integrated Engineering degree have been exposed to a series of eight 'learning to learn' workshops. In order to gain qualitative information regarding the effectiveness of these workshops a representative group of students exposed to them was selected and their views elicited. Nominal Group Technique was the method used for evaluation as described by O'Neil (Effective Learning and Teaching in Higher Education, Module 12, p.22, 1992, CVCP). Essentially this is a method of getting participants to generate a series of answers to a specific question, which are then discussed and a consensus reached via voting in order to rank the answers in order of importance.

Outcomes: Mike O'Neil from the Education Faculty at The Nottingham Trent University served as leader for the group. The group consisted of ten students randomly selected from the cohort of sixty exposed to the Learning Strategies element. The question asked of them was: 'What practical benefits do you perceive the learning strategies course has had on your studies in Integrated Engineering?' In response to this a 'master list' of answers was generated and the congruent answers merged to give:

- Makes you think and be more reflective (be more introspective).
- Gives you an overview of your own method of working.
- Shows new ideas/ways of working.
- Aids motivation, for example, makes me stop and think how idle I am.
- Practical applications are of use for understanding.
- Aids satisfaction having understood something.
- Relates studies to self-learning.
- Emphasises the difference between memorising work as opposed to understanding it.
- Appreciation of other's methods of working.
- Use ideas in everyday work.
- There are better methods of working than just note-taking.
- Changed the way I made explanations.
- Time-management and target setting has helped with motivation.
- Lecturers have a responsibility to help us learn as well as ourselves.
- There are easier ways to learn than just reading text books.
- You can integrate information.
- Reflect on previous learning experiences.
- Made me realise my responsibility for learning/understanding a subject.
- Awareness of different ways of teaching as well as learning.
- Allowing yourself to be unorthodox in finding/collecting information.

- Can learn in a variety of ways depending on the subject being taught.
- Allows/aids the combination of different subjects and understanding.
- Justifying your own answers to questions.
- Understanding questions set.
- Promotes your own critical awareness.
- Improves communication.
- Realising your own personal characteristics and improvement.
- Self confidence.

A group consensus as to the relative importance of these items was then canvassed for. This was done by asking each student to rank five responses in order of importance, and to award each five to one point/s in descending order. The results were then calculated by tallying the points awarded. The ranking was as follows:

1) Emphasises the difference between memorising work as opposed to understanding it. (32 points)
2) Makes you think and be more reflective (be more introspective). (26 points)
3) Shows new ideas/ways of learning. (15 points)
4) Promotes your own critical awareness. (14 points)
5) Aids motivation, for example, makes me stop and think how idle I am. (8 points)

This order was felt to be realistic by the group. Some time was spent discussing the outcomes and students tended to infer that while there was some tangible improvement, any changes in approach were not particularly overt. In terms of the scheme of work for this element and the desired aims and objectives, it would appear that these outcomes and the stated objectives have a strong correlation. It can only be concluded therefore that at their best, the Learning Strategies workshops do indeed evoke a more responsive attitude to learning on the part of the student.

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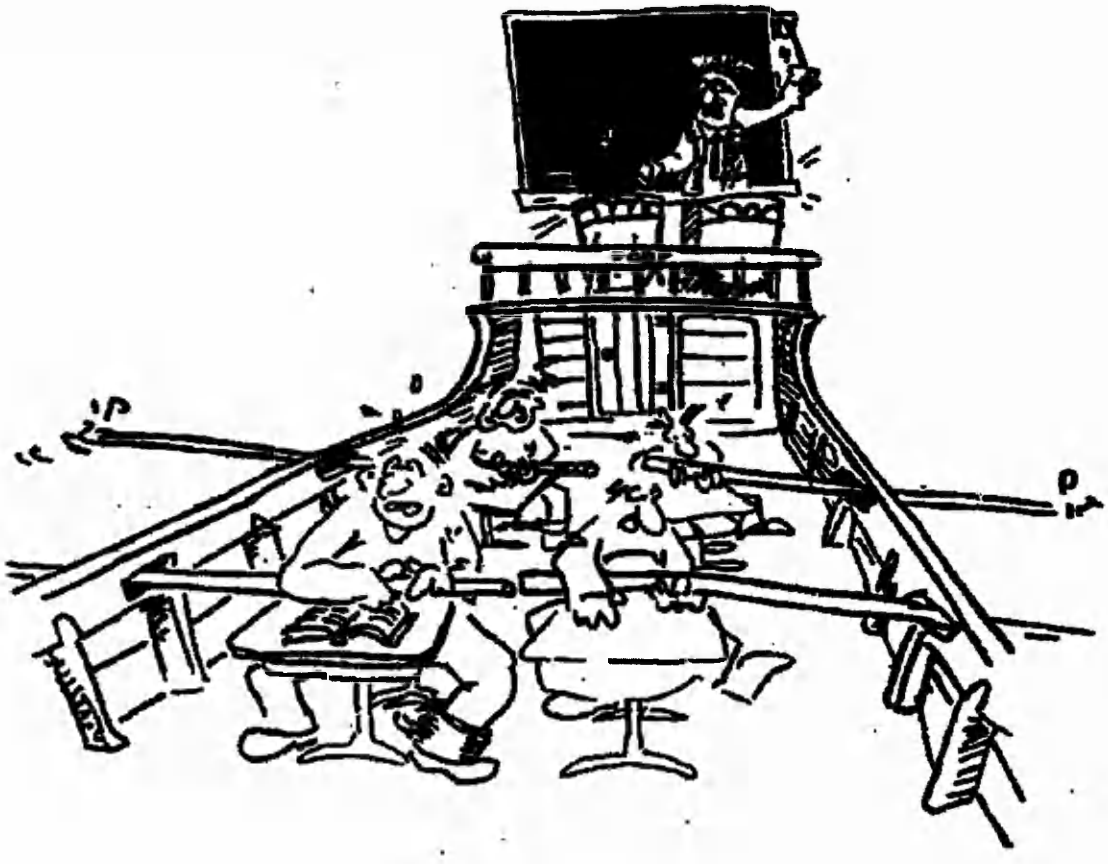
HANDOUTS

These are some examples of supporting handouts for the workshops. They are not exhaustive and further materials may be needed. I encourage you to make your own materials or to modify these to suit your own needs. The more dynamic, and exciting you can be with presentations and materials, the better the sessions will be.

The materials can be used as is felt to be appropriate. No particular sequence is implied by the order presented here. Those handouts that relate directly to particular seminars can be easily identified.

Learning



Learning to Learn.
Some notes about this element: Handout 1

I believe students have two things they need to learn in higher education:

1) the subject matter, or it's ***content***;
2) the ***process*** of learning.

Learning in higher education is very different to being taught in secondary education.

Observe the effect the course, tutors, practicals, seminars etc have on your learning and the attitudes that affect that learning.

I cannot, and will not ***tell*** you how to learn.

Telling you how to learn implies that there is one best way; one set of skills that will enable you to succeed. In reality it is not known what necessary ***skills*** are. What is known is what the necessary ***approach*** is.

Without first knowing what learning is there is little point in being given or being told about 'study skills'.

I will, if you want, give you study skills advice on a one-to-one basis.

Developing as a learner is a continual process which you must become aware of and take responsibility for. Nobody can make you learn.

Reflecting on the process and outcomes of study is ***the way*** to make progress; passively following advice will not improve learning.

The capacity for learning is developed when you understand how to learn, the mechanisms and processes that lead to success.

Trying to ***memorize*** stuff like mathematical formula can be very dull and it may be better to attempt to understand something.

Being ***anxious*** about learning will limit what you learn.

Learning what ***you*** want to learn is easier than learning what others want you to learn.

Discussing what you learn seems to help.

from Gibbs G (1981)

Learning to Learn
Successful Learning: Handout 2

There are certain skills, strategies, attitudes and behaviours that distinguish successful learners from those that are not so successful. You will have already identified some of these for yourself in the workshop session. Generally however we can identify certain variables that are incorporated by 'the successful learner':

> motivation ... the successful student has an inner drive the makes him or her want to do well. He or she accepts responsibility for learning and therefore knows that doing well is a result of his or her own efforts. He or she succeeded because of wanting to, because of trying his or her best, and ultimately luck had nothing to do with it.
>
> understanding ... the successful student makes an effort to understand the ideas presented. On realising he or she doesn't know enough about a topic to understand it, then he or she gets help, either from the tutor, other students, or more reading.
>
> metacognition ... a long word used to describe how students can be aware of what learning itself is. Successful learners have a sophisticated conception of what learning is. Here are some examples; which do you think are the 'better' viewpoints?

Skilled learners are more in control of their learning, experience greater ownership of it, and hence generate motivation. They are also more likely to process subject matter in a more active and varied way. Developing learning can be done by training, and by reflection on learning integrated into courses and tasks. This is what the learning strategies course is about ... how to become the true owner of your learning and then use it to full advantage as an undergraduate.

Learning to Learn
Understanding Learning, Perception and Communication: Handout 3

People see learning as being variable in quality. In this sense, some people think that learning is the memorisation of facts, and others feel it is the **construction of meaning, or understanding**. Your perception of information you are attempting to learn, and how that information is communicated can also vary. The view one takes can have a massive impact on the way information is perceived and communicated and ultimately influence success and failure. For example:

> Consider the example of a design, manufacturing and marketing process in which you have a starring role as the Mechanical Engineer. In this scenario issues of perception of a given task or artefact become critical depending upon one's viewpoint or role. The Mechanical Engineer will view the production of an artefact in very different ways to that of the Industrial Designer, or the Production Engineer. However, these are aspects of design and manufacture that must be congruous in order to be successful and satisfy a brief. This relies heavily on the ability to: perceive, or attempt to perceive information in differing ways; to be able to communicate in a variety of ways to a range of people issues that they themselves may only perceive in one way; and, to convey overall meaning to the user, without the acceptance of whom, the product will fail.

So, the **purpose of communication** is the communication of meaning, but people perceive communications in very different ways. Gibbs (1981) says that in relation to studying and success as an undergraduate, it is important to realise that the purpose of learning is the construction of meaning and that reward is given for **communicating meaning successfully** in the same way as we identified in the 'horse and rider' workshop. The accumulation of a series of unconnected facts is not only hard work, but cannot give the understanding examiners are looking for.

Even if the 'instructors' in the horse and rider workshop identified the image, their instruction will have effectively failed if they then attempted to 'teach' the image as a series of unrelated shapes. The drawings will only have been truly successful if the instructors were able to guide the learners with some **central organising principle**, for example: "There is a series of black shapes that make up the image of a horse and rider".

In Conclusion
Effective communication relies on the ability to communicate within a conceptual framework or organising principle common to tutor and student. The purpose of communication is the communication of meaning. Remembering is qualitatively inferior to understanding and communication should therefore promote understanding rather than memorisation.

Learning to Learn
First Year Common Semester: Handout 4

Orientation to Study

There are certain skills, strategies, attitudes and behaviours that distinguish successful learners from the not so successful. This success is not always directly proportional to effort in that the dis-orientated student can spend many hours in hard but mis-guided study. In other words, lots of effort for little **understanding**. Some students may display learning 'pathologies' where for example, they may make vacuous analogies, be over ready to generalise from insufficient evidence, or make hasty personal judgements. Others may fail to build an overall map of the topic they are studying; to fail to see the separate parts fitting together and the way in which a particular topic fits the overall theme.

The way in which students, that is you, **orientate** yourself towards a course is largely a product of perceived beliefs about what learning is. You can be sure some of your beliefs and perceptions are inaccurate and out of date. These **perceptions** are fuelled by a rich mixture of the way you have been taught in the past, how you will be taught now, and your own beliefs about what learning an engineering subject involves. We need to examine some of these perceptions and beliefs to help remove any mis-understandings

about effective study and how best to go about it. Five typical perceptions of learning are presented below (from Gibbs 1992).

There may be five stages in the development of students' understanding which are listed here along with the kinds of things students who have these conceptions say:

1. *Learning as an increase in knowledge. The student will often see learning as something done to them by teachers rather than as something they do to or for themselves.*
   "To gain some knowledge is learning... We obviously want to learn more. I want to learn as much as possible."

2. *Learning as memorising. The student has an active role in memorising, but the information being memorised is not transformed in any way.*
   "Learning is about getting it into your head. You've just got to keep writing it out and eventually it will go in."

3. *Learning as acquiring facts or procedures which are to be used. What you learn is seen to include skills, algorithms, formulae which you apply etc which you will need in order to do things at a later date, but there is no transformation of what is learnt by the learner.*
   "Well it's about learning the thing so you can do it again like when you're asked to in an exam."

4. *Learning as making sense. The student makes an active attempt to abstract meaning in the process of learning. This may only involve academic tasks.*
   "Learning is about trying to understand things so you can see what is going on. You've got to be able to explain things, not just remember them."

5. *Learning as understanding reality. Learning enables you to perceive the world differently. This has also been termed personally meaningful learning.*
   "When you really have learnt something you kind of see things you couldn't see before. Everything changes."

As you can see there is some variation in quality here. Some people see learning as the assimilation of facts while others see it as the development of meaning or understanding. The view one takes can have a massive impact on the quality of learning achieved and ultimately influence success or failure.

Not much learning takes place without actually doing something. Learning takes place at its best when information can be related to real-life settings, that is be put in context. Use your past experiences and your reading to inform your understanding and to see where theories and principles are applied. This is a very **active** process and distinct from the passive role the majority of students adopt. For example, an imitation of learning takes place as students get by quite well by identifying the most important parts of the subject, getting a short term grip on them, regurgitating them coherently and then forgetting them. You can be sure that this is how most people gain qualifications such as 'A' levels. This strategy will not suffice here and now. Fortunately strategies of

learning can and do change. It is very important to dispel any intention to operate at a **surface** level and to move toward a **deep** and **meaning** orientation and strategy.

So what is needed now?
An **active** deep involvement in the material you are attempting to learn is very useful. An effort needs to be made to understand the ideas presented. Note that this is qualitatively different to remembering information given to you. This information will also come from a variety of sources, from tutors, from experience, the workplace and (mainly) from books. Another essential element of success is the ability to **integrate** the information. Do not fall into the trap of isolating different pieces of knowledge or separating the theory from the practice. You must use one to inform the other.

Skilled learners are more in control of their learning, experience greater ownership of it and hence generate motivation. They are also likely to reflect on the way in which they process information so as to check the effectiveness of their strategies. This process of **metacognition** means being aware of what learning itself is and managing your own learning processes. It means being alert to task demands and constructively analysing and **evaluating** the outcomes. It means the ability to monitor your learning and to feedback information about the quality of your learning to yourself following study or learning tasks.

Evaluate how you learn against the **learning outcomes** you achieve. In this way you will take control of your own success. The important thing is to consider the way in which you learn and to take responsibility for you own learning. To be most effective consider:

An Active Approach:
Interact with the material you are learning.
Do not be a passive recipient.
Go out and get the information you need.

Ownership:
You are the owner of the material you are learning.
Success and failure can be controlled by you.

A Critical Disposition:
You should question things you see and hear.
Be slightly sceptical to find out why things are as they are.

You can improve your learning by understanding more about your choices and strategies you use as an undergraduate. The Learning Strategies course will introduce you to these and help you orientate yourself for meaningful and successful learning. In less than eight hours I can help you become better learners.

Learning to Learn
Learning Strategies for Students: Handout 5

Note taking and making

Students take and make notes for a variety of reasons. Effective note taking is a boon while ineffective note taking is at its best a distraction from the information source. The majority of students take verbatim notes, creating a great deal of work and detracting from their ability to concentrate on the information source.

In standard notes, 90% of the student's time is wasted as he or she writes down redundant words, re-reads those words and attempts to sift the essential information out of the scrawl that often results. There is no need to write grammatically correct notes. Your brain is perfectly capable of using just **key words** to trigger information recall. Key words tend to be nouns and verbs.

It is important to **actively** take notes rather than **passively** copy everything down. Active note taking will:

Encode the information
Impose personal organisation on the information
Allow you to include personal associations and inferences
Bring attention to what is important
Bring attention to what is written

Most notes are not made with the intention of being able to recall them at a later date. Surely it would be useful to be able to construct notes that have longevity and can be remembered at a much later date. Notes in neat lines are not easily remembered, our brains simply do not work in a linear fashion and are much more comfortable making associations and clustering bits of information together. This is where **Mind Maps** may help. These can be used in any situation that requires information to be either remembered or recalled. Mind maps will have certain essential characteristics:

Key Words and Phrases so that the bulk is reduced and imagery is increased. This also forces you to extract the salient meaning from information.
Association with strong visual images wherever possible.
Clustering so that information is ordered around sub-centres; again with key words or phrases.
Visual Impact because visual images are much better recalled than words.

Whenever something is **outstanding** in some kind of way it is better remembered. Mind maps should be so as well as involving your brain **actively**. The greater the originality of your notes, the more interest you will have in them, the more interest you have, the greater the motivation, the greater the motivation, the better the understanding, and the better the understanding, the better the recall. Russell (1990) writes:

Paradoxically one of the greatest advantages of mind maps is that they are seldom needed again. The very act of constructing a map is so effective at fixing ideas in the memory that very often a whole map can be recalled without ever going back to it at all. A mind map is so strongly visual and uses so many of the natural functions of memory that frequently it can be simply read off the 'mind's eye'.

It is time to destroy the myth that says the more you study the more you forget. That is a very simplistic belief based on a misunderstanding of the facts. There are strategies that evoke long term memory. Mind mapping, alongside a desire to grapple with the material is one of them.

Bibliography

Buzan T (1989) *Use Your Head* BBC Books pp.77-103
Russell P (1990) *The Brain Book* Routledge pp.171-186

It is essential to experiment with learning maps.

The first time you try anything it feels strange and may even take a little longer.

That's true of riding a bike or driving. First it seems odd – gradually it becomes familiar and natural.

So persevere – it's worth it.

from: Rose & Goll (1992) *Accelerate Your Learning* ALS, Aylesbury

Schedule for passing the test of time

Andrew Northedge on the most vital skill to learn at college – managing your study time

I WAS in a student coffee bar during my first week at university soaking in the atmosphere when a lad from Oldham, of conspicuously cool and languid manner, announced calmly that he intended to get a first in classics. He would work 25 hours a week, study five hours a day on weekdays and leave the weekends free. That would be sufficient.

I was vaguely committed to endless hours of work. I imagined that at some point I would spend weeks of intensive study. The vice-chancellor had told us in his address to freshers to look at the person on either side and note that in all probability one of us would not be around the following year. The message struck home. I would turn myself into a paragon of academic virtue. I could see that the classicist in the coffee bar had got it all wrong, or was bluffing.

Three years later he sailed to his first whilst other friends struggled to very modest achievements. As I discovered when sharing his lodgings, he worked more or less to the plan he had outlined. He slept late in the mornings, only stirring himself if there was a lecture to attend. He played cards with the rest of us after lunch. Then he moved to his desk and stayed there till around seven. The evenings he spent more wildly than most — hence the late mornings.

Nevertheless, when I came to look back I realised he had studied more than anyone else I knew. Through sticking assiduously to a modest but well-defined, realistic plan, he had achieved a great deal. He had enjoyed work much more, too.

He argued that it was not possible to work productively at intensive intellectual tasks for more than a few hours at a time. I aimed to do much more. But I was badly distracted. By the time it was apparent that stretches like my best had slipped away, I felt so guilty that I blotted studies out of my mind, comforting myself with the thought of all the days which lay ahead.

I was too inexperienced at looking after my own affairs to realise I was already falling one of the major tests of studenthood, the organisation of time. I thought that success in studying was to do with how brilliantly clever and original you were; I had yet to discover that one of the central challenges of adult life is time management.

At school the work timetable was defined for us and teachers made sure we fitted all that was required into the school year. At university I was at sea. Time came in great undifferentiated swathes. What to do with it all? With 168 hours in a week — or 105, allowing nine a day for sleeping and eating — how many was it reasonable to spend on study? Individuals vary and different subjects make different demands. Nevertheless with a target you can plan your studies, not just stumble ahead in hope.

Sticking to a modest but well-defined plan, he achieved a great deal

The sketchiest of weekly timetables, setting aside 40 hours to cover all study, is an invaluable aid in defining time. Then you can divide it into segments and use it strategically, rather than let it dribble away.

Defining what to do is harder. Take the booklists. How many books are students expected to read? How long should a book take? It took me so long to read just a few pages that I felt defeated when I looked ahead. Should I take notes? How many? What would I need them for?

I would sit in the library for a whole day, dipping into one book after another, often with glazed eyes. What was my purpose? How would I know when I had achieved it? By comparison I went to lectures gratefully — at least I knew when they started and finished. Although my lecture notes weren't up to much, I could tell myself I had accomplished something, which would bring down my anxiety level.

Much later I discovered I could learn a great deal from close reading of selected sections; that taking notes could sometimes be very satisfying and at other times was not necessary. The trick was to take control; to decide what I wanted to find out — something specific — and then work at it until I had taken in enough to think about for the time being.

Dividing big jobs into smaller sub-tasks helps to bring work under control, allows you to set targets and check your progress. There is so much pressure to be ambitious — to go for the long dissertation, to read the huge tomes. Yet achievement arises out of quite modest activities undertaken on a small scale. The trouble with the big tasks is that you keep putting them off. Their scope and shape is unclear and we all flee from uncertainty. The more you can define your work as small, discrete, concrete tasks, the more control you have over it.

Organising tasks into the time available can itself be divided into strategy and application. It is useful to think of yourself as "investing" time. Some tasks require intense concentration and need to be done at a prime time of day, when you are at your best and have time to spare. Others can be fitted in when you are tired, or as "warm-up" activities at the start of a session. Some, such as essay writing, may best be spread over several days. Some need to be done straight away.

There are few reliable guidelines. Essentially you have to keep circling round a self-monitoring loop: plan an approach to a task, try it out, reflect afterwards on your success in achieving what you intended and then revise your strategy.

Once you start to think strategically, you begin to take control of your studies rather than letting them swamp you.

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The Nottingham Trent University
Learning to Learn: Handout 6

Reviewing your effectiveness

Consider the following activity:

> You are provided with a set of statements about performance based on the discussion. Pick six characteristics off the board and write them down in the characteristics column.
>
> In the left hand column rate the characteristics you list according to the scale: 1 = Not important 2 = Limited importance 3 = Average importance 4 = Very important 5 = Essential.
>
> In the right hand column rate your own abilities in this area based on the scale: 1 = Very Poor 2 = Poor 3 = Satisfactory 4 = Good 5 = Very good.

IDEAL	CHARACTERISTIC	ACTUAL

How did you do? How do you know that you are as effective or ineffective as you think you are? Will you be able to find out?

The Nottingham Trent University
Learning to Learn: Handout 7

Assignment

The essay title is:

> Describe the Approach(es) to Study you are taking to your engineering learning. Justify your description and evaluate the implications of taking the approach(es) you do.

The aim of this assessment is to promote self-reflection on the part of the students as a mechanism for improvement and a move toward metacognition. Students cannot successfully complete this assignment without including a high proportion of personal anecdotal evidence. In other words they must reflect on their learning environment and their relationship to it.

Students will comment on their own essays and award themselves a mark prior to handing them in. This is included as part of the reflection and self-development process. In order to do this a pro-forma will be supplied with headings to prompt appropriate comment.

Assessment marking criteria and conventions:

In marking the assignment the assessor will be looking for the following qualities:

Does the student understand the consequences of approaching their studies in different ways? Is he or she reflective and self-aware? What does he or she take responsibility for? Can he or she offer examples and a context into which the theories fit?

Marks will be allocated using the following structure:

70% and above: Very well organised, clear structure, logical analytical treatment. A full answer with supportive detail and referencing, evidence and examples that show an understanding if the concepts and ideas. Willingness to show an extension of thought and to take intellectual risks in argument.

60 to 69%: Well organised with logical structure. A complete answer, but one that has less of the personal input that a first class answer shows. A full and 'safe' answer.

50 to 59%: A basic understanding of concepts and ideas. Acceptable structure, but lacking in thorough argument conclusion. Limited personal input and evidence. Some minor problems in clarity and conciseness of expression.

40 to 49%: Little supportive detail, evidence and examples. Lack of coherent structure with no justified conclusions. No willingness to use personal experience. A basic 'list' of information.

Below 39%: Below the pass level in respect to the above criteria.

The assignment is best typed. A pro-forma is supplied for your evaluation of your assignment. The essay is incomplete without it. State the essay title at the beginning of your work, and make sure you have an introduction, a developing argument(s) and a conclusion. Provide a bibliography if you refer to published work, the way to do this has been exemplified in the hand-outs you have received.

Essay Pro-Forma

Use this pro-forma to evaluate your own essay. With reference to the marking criteria and to the descriptions below, evaluate which category your essay fits into, justify your evaluation and award yourself an overall mark out of 100. Your willingness to do this will be taken into account when the final mark is awarded. Constructive and honest reflection is called for.

Name ..... Tutor Name .....
Course .....

Your report could be evaluated using the following criteria:

PRESTRUCTURAL	Ignorance with no correct or relevant elements.
UNISTRUCTURAL	One correct or relevant element is present.
MULTISTRUCTURAL	Several relevant elements are present but are often independent of each other and in a basic list form.
RELATIONAL	The relevant elements are integrated into a structure and students produce an argument rather than a list.
EXTENDED ABSTRACT	As relational but the whole is generalised into a related domain of knowledge. The student therefore realises that behind the question there are a series of related issues and implications. A balanced evaluation is given. (Gibbs 1992)

Evaluate the category your essay fits into. Justify your evaluation, describe what you could have done better and award yourself a mark. Identify any missing elements. Use the space below for your comments:

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Tutor Comments

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